



## Science and Technology Committee

Oral evidence: [The science budget](#), HC 340

Tuesday 8 September 2015

Ordered by the House of Commons to be published on 8 September 2015.

Written evidence from witnesses:

- [National Physical Laboratory](#)
- [Innovate UK](#)
- [Higher Education Funding Council for England \(HEFCE\)](#)

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Members present: Nicola Blackwood (Chair); Victoria Borwick; Jim Dowd; Chris Green; Liz McInnes; Dr Tania Mathias; Carol Monaghan; Graham Stringer; Derek Thomas; Matt Warman; Daniel Zeichner

Questions 70-140

Witnesses: **Dr Ruth McKernan CBE**, Chief Executive, Innovate UK, and **Martyn Sené**, Deputy Director and Operations Director, National Physical Laboratory, gave evidence.

**Q70 Chair:** Can I welcome everybody to the second session of oral evidence in our science spending inquiry? Can I please ask everybody to turn their mobile phones either off or to silent? Even though this is a science and technology session, we would rather not be disrupted. For those of you who are not glued to our Twitter feed, the key issues that have arisen so far for us in this inquiry are the value of the ring fence; the need for resource to follow capital; and the balance between research and innovation. We have already received over 400 pages of written evidence. I am hoping that both of you can help us to examine the intersection between research and industry today.

Perhaps you can begin by giving us an overview of your two organisations, Innovate UK and the NPL, particularly the place where you sit in our innovation ecosystem, and how that has developed over the last five years. Dr McKernan, in your written evidence you wrote: “The roles and remits of the Research Councils and Innovate UK are clear. Research Councils invest in the UK’s leading edge research, whereas Innovate UK drives business led innovation and R&D.” Do you think that is a fair summary?

**Dr McKernan:** Yes; I wrote that.

**Q71 Chair:** Can we move on, or is there more to say?

**Dr McKernan:** I would like to take a few moments to expand a bit, if that is all right with you, Chair. There are a couple of important points about Innovate UK. We are the Government's innovation agency. We fund business; research funds academia. The majority of our money goes to micro and small businesses, and that is matched funding. It is matched by industry. For every £1 we spend, we crowd in funding from the private sector. It is important to say that because of state aid rules nobody gets a 100% grant, so we crowd in funding. Since Innovate UK was started eight years ago we have spent £1.5 billion of Government money, which has brought in another £1.5 billion of private investment and created 35,000 jobs. The economic analysis shows that for every £1 spent we have created £6, on average, in GVA, and that is seven jobs for every company we have supported over that time, so we are business-focused. We are all about economic growth, driving productivity and ensuring that the spectacular research that is done is driven through into companies and products and growing the economy for the future.

**Q72 Chair:** Mr Sené, the National Physical Laboratory is our national measurement institute, as I understand it, and it sits between scientific research and real-world application. Can you explain exactly how you operate with the kind of funding challenges that you have been experiencing?

**Martyn Sené:** To say a little about the organisation, as you said, we are the national measurement institute. As a national lab, we are about creating and then utilising enduring capabilities: skills, experience, knowledge and also physical facilities. We are mission driven. The two purposes are, first, to ensure that we can all have confidence in the measurements on which our economy and quality of life rest and, in many cases, our very lives depend. The second purpose is aligned very closely with that of Innovate UK: to drive science into tangible economic growth or improvements in our quality of life. We are a mission-driven organisation. Some 60% of our funding comes from BIS; 40% comes either from competitively won grants or from delivering services directly to industry or Government. We sit at that intersection. We have a mixed funding model, and we are a delivery organisation.

There are three really important features about what we do. First, the science we have must be excellent, because challenging measurement science has to be absolutely world class. Secondly, we have to act internationally. The international measurement system probably has a good claim to be the largest co-ordinated scientific activity on the globe, but although it is co-ordinated, every one of the 100 national measurement institutes is battling on behalf of its nation, so it is competitive. The third is about collaboration. We sit horizontally across all activities in the UK, so we need to collaborate with business, with 2,500 businesses a year—academia, 75 universities a year—and we work with most Government Departments.

**Q73 Chair:** Your evidence says that you raise in the region of £29 million a year from leveraged funding. Is that right?

**Martyn Sené:** That is right.

**Q74 Chair:** Over the last 10 years, you have had a funding cut in real terms of about 30%. Is that right?

*Martyn Sené:* That is correct.

**Q75 Chair:** We heard from the Science Minister in our last session. He believed that a focus on inputs like the ring fence or the amount of funding that was invested was false and we must focus on outputs. The issue I have with your evidence is that you can point to the amount you have to leverage and the cuts you have had, but you then point to the efficient delivery of your institute, and you can demonstrate that internationally you have the same publication and citation profile as the PTB, which I think is your German equivalent.

*Martyn Sené:* Yes.

**Q76 Chair:** The Minister might say that he can demonstrate that even in that challenging environment you remain competitive because you are excellent. How would you answer that claim by the Minister?

*Martyn Sené:* I think the Minister would have a good point. Indeed, we have managed to retain our international reputation and position through both leveraging the money and driving efficiency in the organisation, but there is a time constant for the input that generates the capability or for exploiting it to do that. There is also a competitive drive from nations that do not have 100 years of history in a national measurement institute as we have, and they are coming up very fast on the rails. Among our competitors, the US has had an 80% increase in the funding of their national measurement institute in the same period of time. I visited Asia last month. The increase in funding for national measurement institutes in Asian countries is astonishing. We can over a period of time continue to deliver by efficiency and leveraging, but we will not remain internationally competitive if this is a long-term policy.

**Q77 Chair:** Dr McKernan, following on from the point you made about the balance between innovation funding and research funding, you said that essentially we have the balance wrong and we invest far too much in early stage research and far too little in innovation and that, if we were in the business sector, we would increase investment as research became increasingly close to market stage, and we are doing the reverse in terms of our science and innovation budget. How does our balance compare with competitor nations, because that is not in your evidence?

*Dr McKernan:* I want to make sure I clarify one thing. I did not say, and I do not believe, that we invest too little in research. I said that we have to ensure the money we spend on research is paralleled with spend on innovation, so that we do not short-change the taxpayer by doing the research and not moving it into commercialisation. There are two sources for the data I was talking about. One talks about creating a product; in the amount of money you spend on the concept at the early stages, £1 at that end requires £10 to be spent on translation and £100 on commercialisation.

The journey from the concept to commercialisation is a well-understood nine steps, which are called technology-readiness levels. For the research councils, in the early stages of research pretty much all of that investment is in stages 1 to 3. Established businesses largely put their investment in stages 7 to 9. That leaves a gap in the middle, which is the highest risk and the most vulnerable part of the process—the translational gap; the valley of death, as it is sometimes called. It is imperative that we use public money to help ideas get from the research space through that valley of death into commercialisation. That was what I was talking about.

My background is 25 years in the biomedical sector. I know that when you are creating a medicine the amount of money you spend in the research environment is really small. For one product, the path it follows is roughly £1 in the early stages of research; £10 in the middle with clinical trials; and, in terms of commercialisation, manufacturing and production, it is 100-fold. If we are looking to create a product from the work we do in research, we spend a very large amount in the early stages and a fraction of that amount in the translation. That has been highlighted in the past in several Government reports. It is true today, and I do not think the problem has been solved.

You asked about the international comparison. There is a really good document—the international benchmarking report—written by Tera Allas, an economist from BIS. We do not fare well compared with our peers in other countries. We use many of the same types of tools, such as the technology and innovation centres, which in the UK we would regard as catapult centres. When they were launched in 2010 by the Prime Minister, they were constructed to bring together in one place the concept of commercialisation. They are physical manifestations in a sector, in a particular area, to build that connectivity and help us pull across the valley of death, and create businesses that will underpin economic growth and productivity in the UK. Does that answer your question?

**Q78 Chair:** Sort of. I am not quite sure I have the answer to how we compare with other nations in terms of our balance between research and innovation spend. It is not so much our total R and D spend but the balance between the two. We spend £2.7 billion with our UK research councils, £3.9 billion with HEFCE and £340 million with innovation councils. It is just the simple proportions.

**Dr McKernan:** I do not have in my head how we compare on innovation spend, but I will get that information and send it to you. I know that in terms of GDP and research spend we are low and other countries are aiming higher.

**Q79 Chair:** That is very helpful. I understand that Innovate UK was supposed to be taking part as a BIS-funded body in a review by the consultancy firm McKinsey. Have you participated in that review? Have you had meetings with representatives from McKinsey? How have you been consulted?

**Dr McKernan:** I did take part in the review and met McKinsey for an hour. They asked me a lot of detailed questions about spend. If I am honest, I was a little disappointed with the conversation. Having spent 25 years in business and looked strategically at how efficiencies can be made, how money can be saved and how we could consolidate to do things more effectively, I was prepared to have a conversation about my thoughts on how

we could make Government money go further. That was not quite the conversation we had. They really wanted to know the details of the percentage of admin spend. I was left feeling that we were trying to build a strategy from cost upwards rather than from where the greatest need and priorities for spend should be, and implementing cost afterwards.

**Q80 Chair:** What did you end up thinking was the purpose of the review?

**Dr McKernan:** I felt that the purpose of the review was to scrutinise costs across BIS.

**Q81 Chair:** Did you think it was going to achieve that?

**Dr McKernan:** I had a one-hour discussion. It is hard for me to say what other information they were gathering.

**Q82 Dr Mathias:** Obviously, in Twickenham, we consider NPL to be an absolute centre of excellence. I want to pick up what you said about other countries, in particular Asia. Are there particular areas of NPL's work where Asia might be competitive and you feel threatened? I always thought that nobody could touch your level of accuracy.

**Martyn Sené:** I think a national measurement institute has a horizontal infrastructure role, so our measurement capability goes across the whole of the economy and all aspects of the activity in the country. Countries are investing with a mind to their particular challenges and businesses. For instance, in NPL, our focus is driven by the UK's challenges and businesses, so Government policy, such as the eight great technologies plus two, is shaping the forward look, and our engagement with business shapes our forward look. That was what I also saw in Asia. I was in Korea, Thailand and Singapore. They are being driven to invest most heavily in the areas where they see they can bring the greatest benefit for their nation. They are investing very large sums of money, and increasing sums of money. In some areas their capability, on very crude measures of the accuracy with which they can measure, is challenging NPL and is raising their influence and profile internationally and benefiting and bringing competitiveness to their businesses.

**Q83 Dr Mathias:** On the applied work, is there also a threat from other countries? I have seen some medical innovations that you have done. Is that threatened?

**Martyn Sené:** Yes. We are utilising our capability for the benefit of the UK broadly. Some of that we do by bringing innovative new techniques to bear, and the underlying capability in the funding that goes with that. The more of that we have, the more we have to exploit and deliver benefit to UK industry. Last week, I visited one of the labs in NPL and had demonstrated to me a fantastic new system that enables you effectively to recreate GPS in a room this size, but with incredible accuracy. That is going to be demonstrated on the shop floor of Airbus next year. A US competitor would not demonstrate such a facility on the shop floor of Airbus; they would demonstrate it on the shop floor of Boeing and would

bring those benefits to US industry. What we do and the applications we have are there to bring benefit to our industry.

**Q84 Matt Warman:** This is a how-long-is-a-piece-of-string question. Is it possible even to think about how much we as a country should be spending on research and innovation? The temptation is to say more, but is there an optimal level, and where do you think we are in relation to that? Are we getting the right balance between public and private investment? Do we have any evidence that public investment really does drive increased private investment?

*Dr McKernan:* I agree that we are not in a position to say exactly what the right amount is. I am confident that it should not be a penny less than it is today because, if you are looking at inputs, international standards show that we are below, at 1.8% of GDP. We are very efficient, so our output and impact is very strong for the amount of money we spend.

There is very good evidence that if we spend public money on translation—I can give you examples—it benefits business and the UK and will provide us with sustainable economic growth. One of our recent programmes is called the catalyst programme. This provides very early stage funding to start-up companies or small businesses in the biomedical, agri-tech or energy sectors. The longest running one is the biomedical catalyst, which has been going for three years. I will give you a couple of examples. A company called Summit had £2 million in funding from us, and we partnered with the MRC to do that. They had not been able to get funding for a project to try to come up with a treatment for Duchenne muscular dystrophy. The reason why they had not been able to get funding was that it was a very creative way of treating the disease by changing the way the genes were turned on and off, and that is not traditionally how drugs work. Having got £2 million in funding from Innovate UK and the MRC, they very quickly got £44 million of investment after they had proven that their idea was feasible. It has now gone to the public market and their drug is in phase 2. When I spoke to the company they said they would not have been able to do that were it not for the public funding they had from us and the follow-on private funding. That is one of 100 examples of new businesses or programmes that have been started with very early stage private and matched public investment.

**Q85 Matt Warman:** Do you feel you are able accurately to predict in a meaningful way the outcome of the money you are spending? My fear is that the nature of spending public money is that you become too cautious and do not take what a business would regard as a rational risk because spread across a portfolio it would get a return. Is that an unreasonable concern?

*Dr McKernan:* I would look at it slightly differently. These are companies and programmes that the private markets will not invest in. They are too early and too risky. Even at the moment when there is quite a lot of investment money around—it goes in cycles, and we are now in a bit of a good one—these are very risky projects, where public money is the right way to do them. In the way we spend public money on fundamental blue skies research, we should spend public money on high-risk programmes to de-risk them and make them investable. I think that is where we should spend our money most wisely.

**Q86 Chair:** You mentioned that you were disappointed in your conversation with McKinsey because you were hoping for a discussion about how the Government could make their money go further. You have just said that we are terribly efficient in the way we spend our money. How can the Government make their money go further?

**Dr McKernan:** Since I joined four months ago we have come up with a five-point plan for Innovate UK, and I would like to see us do that. Very quickly, the five points are, first, scaling businesses; so far we fund very early stage projects, but I would like us to help businesses scaled as medium size. We should measure the growth of medium-size businesses. They pay the tax and provide the jobs. The second point is that we have to look at regional investment and how we can grow businesses around the UK and make the clusters that are good globally competitive. I have already talked about pulling research into business. There is also networking our catapult centres, so they are as efficient as possible. I think it would help us, at a time when there is money in the private markets, to look at where there are opportunities to leverage additional private money. We already do matched funding, but is there a way we could get yet further funding from investment sources to help us grow those businesses and scale them? That is not an area we have focused on so far. We do really well with the funding we have. Both Innovate UK and the research councils are very efficient, but we are innovative; that is what we do, and we should not stop trying to make the money go as far as possible.

**Q87 Carol Monaghan:** We are hearing a lot about the ring-fencing of the science budget. How effective has that ring-fencing been at protecting both scientific research and innovation?

**Dr McKernan:** First, innovation is not in the ring fence, though research is. I think that has been very valuable. If there had been changes in the machinery of government, protecting science in a ring fence would be a good thing to do. More important is the message it sends to other parts of the world, which is that the UK really cares about research and science. We are heading for a knowledge-based economy and preparing for the future, and it provides a strong message that this is what we are good at. Without a ring fence, now would be entirely the wrong time to change that message and the way people view the UK, because we are going to need to spend money on research and innovation now more than ever. If the UK takes its foot off the gas or if we pause or stand still in any sector when the rest of the world is trying to catch up and spend more—you spoke about countries in the far east—other parts of the world will walk past us. We may have to make hard choices and decide where we give away an advantage and where we compete, but now is absolutely not the right time to reduce spending and reduce the ring fence. If you are going to ring-fence research, we need a similar mechanism by which innovation and translating that into business should also be protected.

**Martyn Sené:** I heartily agree with both points, particularly the second one. If the ring fence is the boundary at which the signals, the policy and the funding long term for scientific research stop, that is a serious mistake. If you are to reap the benefits of economic growth and tangible improvements in quality of life from that, you need the other activities. The infrastructures, such as the catapults and NPL, and the interventions,

such as those made by Innovate UK, need long-term sustainable policy and funding behind them; otherwise, you have an F1 engine and no transmission.

**Q88 Carol Monaghan:** There is also the argument for extending that ring fence to applied research and innovation. How robust are the arguments for extending the ring fence, and what impact do you think that could have?

**Dr McKernan:** Both areas need to be protected. It is not a good idea to consolidate them into one. We run a peer review process for all of the grants we give small businesses; likewise, the research councils run a peer review process, but what comes up as quality in science is not exactly the same thing as the indicators you need to provide a good business going forward. You are really looking at two different types of skill and two different types of what quality looks like. If we condensed them, we would end up consolidating innovation back into research. For that reason, I think it is better to keep it in two separate buckets, bearing in mind that research is funding academics, which is a different process with different parameters; we are funding business, and it is a different set of skills.

**Q89 Carol Monaghan:** You were talking about the difficulty between the initial idea and research and the actual marketing of it, and the missing funding in the middle. Often academics have great ideas, but they do not know how to market the product. Is that an area that should be considered?

**Dr McKernan:** This came up in the Dowling report, which had some excellent recommendations in it. Dowling noted that people particularly skilled in academic research might not have exactly the same skill set you need to start a business. We try to help anybody who wants to start a company, particularly on a science and technology basis. When we give grants we always give the option for mentorship and direction to the Business Growth Service to provide additional skills, but there is still a relatively small percentage of academics who want to take a commercial line. Many academics are very happy being academics. Thank goodness they are, because they are very good at it. Let's make sure we have entrepreneurs and business people who are good at being business-minded. They need to speak together and there is some crossover, but we definitely need to fund both streams.

**Q90 Chris Green:** Capital and resource spending are managed as separate pots of money. This can lead to the under-utilisation of our research facilities. To what extent does the separation of capital and resource money hinder innovation?

**Martyn Sené:** When I talked about NPL in opening, I said that the purpose of a national lab was to create an enduring capability and then use it for a purpose. That enduring capability is skills, knowledge, experience and physical equipment. They are all part of an enduring capability. The cash profile is different, but they need to be managed coherently. What is really important for organisations in innovation spend, particularly when you are creating an enduring capability, of which the catapults and NPL are examples, is the flexibility to be able to manage those things as a coherent whole and ensure that the



funding is coherent and aligned. If the funding has to be separated into those different pots, it needs to be aligned; otherwise, you end up wasting money because you have skills and experience or physical capital that you cannot utilise.

**Q91 Chris Green:** Does there need to be a substantial shift in the current culture, or is this a smaller step? How can we change it to improve the situation we have at the moment?

**Dr McKernan:** I think this was discussed in the previous session as well. It is described as “batteries not included” when it is desirable to start something that is a physical infrastructure, but what is required is the long-term funding to make sure that is consistently available. It is very important for attracting inward investment and business partnerships in the UK. As an example, I could give you two elements of the high-value manufacturing catapults: the National Biologic Centre and the National Formulation Centre. Both of these are centres we are expecting to launch and grow. There are many large global companies that would want to be part of the National Formulation Centre and put their research in the UK. At the moment, we do not have a long-term commitment for funding, so we cannot hire people and build that. There is growing frustration in some of our major global partners that we could do more to get inward investment and help the economics of the UK if we were able to make long-term commitments to funding some of these really strong interdisciplinary research-business partnerships.

**Q92 Chris Green:** If the public sector had a bit less of a risk-averse attitude and a bit more of an entrepreneurial attitude perhaps the money could be managed better and that would draw in more money as well.

**Dr McKernan:** I do not think it is a matter of risk aversion but of confidently saying that the funding will be there to establish a centre and encourage people to come. At the moment, we are in abeyance until we get through the comprehensive spending review, and we understand how tough the decisions we have to make will need to be. There are many people, not just our own public sector employees and scientists but also private sector businesses, as we saw in a letter today in the *Financial Times*, wanting to know what will happen, so that they can make their investments in the UK and continue to grow the work they do here. It is important.

**Q93 Jim Dowd:** I want to look at the share of expenditure on innovation. My first question was to be whether the balance was right in terms of relative public expenditure between research and innovation, but in your response to the Chair’s opening questions I think you made it plain that you do not believe it is. You went on to outline the problems in the commercial sector of investing in very risky and unpredictable research. Surely, therefore, it is perfectly obvious that the best use of public funds is to put investment where it would not otherwise be, and so the balance between public expenditure on research rather than innovation will always be tilted that way.

**Dr McKernan:** I am not sure I quite understood. You are saying that the balance should be tilted towards research rather than innovation.

**Q94 Jim Dowd:** Yes, inevitably so.

**Dr McKernan:** I hoped that I had got the point over that when you go from concept to commercialisation, established businesses invest heavily at the commercialisation end. They do not invest much in the translational part because their responsibility is primarily to their shareholders. It is the public funding and pulling research into small businesses, or partnerships with big business, so that they are absolutely at the cutting edge, which gives them a competitive edge and, therefore, provides them with growth, productivity and shareholder return. The private sector puts its money at the commercialisation end, scaling downwards, whereas we invest publicly at the research end and not very much in translation and commercialisation. If we invest solely in research—this is where we have been, and is the very reason why the catapult centres and Innovate UK exist—the risk is that we are so good at it that we provide quality information for the rest of the world to benefit from, license the IP and build companies in other parts of the world, and not in the UK.

**Q95 Jim Dowd:** I do not think anybody is suggesting that we do only one; it is a question of where the balance lies between the two and whether the commercial imperative will make public expenditure less necessary. Is it straightforward to define, identify and track the so-called innovation budget?

**Dr McKernan:** Do you mean across all Government Departments?

**Jim Dowd:** Yes.

**Dr McKernan:** That is a very pertinent question. I have been in the role for only four months. I believe that Innovate UK has the biggest innovation budget. We work very closely with Government Departments, many of whom have their own innovation budgets. I may not yet have uncovered all the sources of innovation that there are, but it is to be welcomed that every Department has its eye on innovation. One thing we have been doing—I believe there is the opportunity to do more—is the SBRI programme where Government Departments identify their gaps, perhaps in procurement, where innovation could solve a problem for them and make them more efficient. We can help identify small businesses that can fill that gap. There are some great examples where we have done that. We work with every Department—MOD, the Office for Life Sciences, DECC and DCMS—and partner very carefully with them to identify their challenges. We run competitions. When we get applicants we peer review them; we find the best programmes for them to support, and then we manage the funding for them and make sure the money is spent appropriately. There are many sources of innovation, and we are happy to work with whoever wants to innovate. We will do what we can to help.

**Q96 Jim Dowd:** I recognise your relatively brief spell so far in your current post, but I hope that means you are four months closer to a solution than you were. In your experience, how has the innovation budget changed, if indeed it has, and how does it need to change further?

**Dr McKernan:** The innovation budget took a big step forward when Innovate UK, formerly the Technology Strategy Board, was created, because it provided a definite source where people could go, knowing that it was the agency responsible for co-ordinating innovation in the UK and for funding and growing business in the innovative space. I think that was a major step in the UK.

The next major step was the invention of the catapult centres. That brought us much more in line with other countries in Europe: France, Denmark and the Fraunhofers in Germany. They all have technology and innovation centres, and they fund those richly. The concept is an important one, because the core funding comes in a direct grant from us. That should be one third; there should be a third from industry; and the catapult centres should be able to win the middle third in a competitive bid in a collaborative research and development pool. That allows established businesses to work with the SMEs in the research arms. We could have 10 or 15 companies or researchers in that challenge programme trying to answer that question. The formation of the catapults was a big step forward.

To the Government's credit, we have added catapults with a regular drumbeat. The medicines technology catapult announced a couple of months ago by the Chancellor is a great step forward. We need to think about how we spend money wisely and make sure that when we start new catapults we do it as efficiently as possible. The high-value manufacturing catapult, which is a network of seven centres, was pre-existing centres that became more business-focused. They are the most established, and they now get the majority of their funding from business. They are very successful. It helps to ground industry in the UK and attract inward investment. As we create new ones, let's think first whether there is an existing entity that could become more business-focused with lower cost, and whether we need it to fill a gap that is not already covered somewhere else. In the future I would like to see more catapults carefully managed and networked together, working very closely with established businesses, SMEs and the research base.

**Q97 Chair:** To follow on from Jim Dowd's point, I have this fantastically confusing organogram from Professor Dowling's report.

**Dr McKernan:** I recognise it.

**Q98 Chair:** Her key point was that the landscape of innovation and research funding is incredibly confusing for researchers, businesses and politicians alike and needs to be simplified. I think she called it "hiding the wiring". How are you working to achieve that? Please help us to achieve this outcome, if for no other reason than that we do not have to look at this any more.

**Dr McKernan:** I couldn't agree with you more.

**Martyn Sené:** One of the most important things that we need to do as a country is understand coherently that diagram, and where its strengths lie, and make sure it is connecting, communicating and collaborating well. There is an enormous wealth of expertise, some of it infrastructure, some of it in the academic sector and some in NPL, other national labs and now the suite of catapults. That is an enormous asset to the UK,

sitting in the space between academia and businesses creating things and putting them out commercially. It is an untapped resource that the UK needs to understand and co-ordinate to make sure it is not duplicating. The kind of interaction and co-ordination Innovate UK is doing needs to be spread wider. There need to be mechanisms and ways of getting our heads round where the capability is and how we can best use it. There is a fantastic asset sitting out there.

**Q99 Chair:** Sweat the assets; do not just create more.

*Martyn Sené:* Yes.

*Dr McKernan:* That diagram is a shocker and it is something that my leadership team has been working on for the past few weeks. We have responded to the Dowling report. We absolutely agree that simplification is really important. Much of our work is looking at that and asking how we can make it simpler for the person who wants to start a business and wants to know where to go to get funding, help and support to grow their company. We have that pinned up, and we are working on it.

**Q100 Chair:** Will you let us know how you get on?

*Dr McKernan:* I would love to.

*Martyn Sené:* I think it is about making connections. Connections between different parts of that landscape are where you generate value. NPL has a new operating model and partnership with BIS and two universities to try to increase the enormous connectivity we already have, so that we are able to make a great deal of difference in skills, as well as in our underpinning of measurement infrastructure. It is a whole host of things. It is about connecting. That incredible asset needs to be connected as best it can be.

**Q101 Liz McInnes:** I agree with the Chair that the whole funding process can be quite difficult to get your head round. I think you have partially answered some of the questions I was going to ask. I wanted to ask you about the role of the catapult centres. The feeling I get from your responses is that there is a bit of a disconnect between the research side of things and commercialisation and translation in the middle. Do you think that catapults are the best answer to fill that gap and improve innovation by businesses? That is certainly the feeling I am getting.

*Dr McKernan:* There are two key tools we can use, and that itself is a simplification. We can provide grants to micro and small businesses in areas where they cannot get loans, equity or investment. That is one part of it. The second part of it is exactly what you said; it is the catapults where we can connect established businesses with SMEs and the research. The example I would use is the automotive sector. I was fortunate enough to go to the meeting of the Automotive Council held just a couple of months ago. The automotive industry in the UK is very productive. Its productivity numbers stand very good comparison with the rest of the world. They have worked out how to do it. The big companies invest a lot in the high-value manufacturing catapults. We help them design lighter structures; I am going to a low-carbon vehicle event tomorrow. We funded some of

the innovative small companies that are generating the technologies that will fuel, or help make more economical, the cars of the future. It is also linked with early research, developing where graphene can fit in and what kind of new ceramics, surfaces and things would be relevant for the automotive sector. Because they are joined up, they do not spend money on things that go down a dead end. It allows them to be more productive. They speak well together. As to other sectors in the UK being able to operate in a similar fashion, I realise that is not simple, because the supply chain is well established in the automotive sector, much less so for other sectors, but we know what good looks like and what to aim for. The catapults are at the heart of that. They can take the role of helping sectors to become more thoughtful in planning and using new technology to reduce costs and increase productivity.

**Martyn Sené:** One of the other things catapults do for an organisation like us, which has a role that goes across the whole of the economy and society, is to give us a portal into making significant impacts in a sector. We are working with the more mature catapults, particularly the high-value manufacturing ones, to make sure that our measurement—metrology—expertise is being harnessed by them in such a way that we can connect with a particular sector better, rather than having to connect with a whole host of individual relationships. We are helping them to develop their quality system, because that is our expertise, and their geographical location also enables us to connect with individual regions where there are specialities and special clusters of industry. For an organisation like ours, with a mission that has to be across the whole of the economy, having a sectoral focus like that is really valuable for us to deliver greater impact.

**Q102 Liz McInnes:** You said that you know what good looks like. I realise you have been in post for only four months, but have you come across any areas where there is a disconnect between research and the end product? Do you have any thoughts as to how we can improve that central point? Is it just about catapults, or are there other ways we can deal with it?

**Dr McKernan:** It is quite a difficult question to answer, because where there is a disconnect it is because we do not quite know where the research will lead us and what the answer to the commercial challenge should be. For example, if you look in the energy sector there are lots of different ways of harnessing and storing energy. We do not know which of those is going to be the solution to the green energy requirements of the future. They are not always well connected, but that is because the science is not well connected and the solution is not yet obvious. It is not for want of trying; it is the very nature of research and translation. You have to try some things that are not going to work, and we have to be prepared to take some risks and try some things. It may be that we invented some catapults too early, or we picked the wrong things. It is incumbent on us to make sure that we monitor and evaluate and make sure the money is wisely spent. If it is not, we should change what we do and how we do it. That is the best way to get the most impact from Government funding. I do not think it is for want of trying. There are still gaps in our knowledge.

**Q103 Derek Thomas:** I represent West Cornwall and the Isles of Scilly, which is a beautiful and very rural part of the world, but there is an enormous appetite among small businesses to

develop areas of research and development, particularly on the Isles of Scilly, to look at what we can do within the renewable sector, for example. The very nature of the area is that there are very small businesses looking to expand and attract investment. Do you think that small businesses in particular are sufficiently well placed to secure the financial support they need? What arrangements are in place to make it easier for them to access the funding, support and investment they need?

**Dr McKernan:** All of the grant funding we provide is competitive. We have grant vehicles that are always open and that people can apply for. If they are successful in a peer-reviewed competition, they will be offered mentorship and given additional guidance and support. We have also tried to make sure that we grow businesses in an area where there is a particularly strong skill. We run something that we call a launch pad. It does not really matter what we call it. We can always do more for businesses. The vehicle I am referring to—the smart awards—is our most over-subscribed. Only 20% of the applications that are fundable are actually funded, because that is the limit of our funding. It may be that in your constituency there has been very strong application for those. I can confidently say that there are companies in all of your constituencies that have been successful in getting Innovate UK grant funding. I checked that before I came along today. There are definitely companies in your constituency that have been successful.

**Q104 Derek Thomas:** You are saying that more can be done, particularly in the early stages when a company has an idea or wants to develop a particular area of research, to enable it to take the first step to access funding.

**Dr McKernan:** Yes. This is an area where again simplification would be good because there are many entities, all of which want to help a small growing business. There are many entities that want to do that. For a small business, how do you know where to go? It would be better to consolidate and simplify so they only need to remember one thing. I believe they should remember Innovate UK, and if they come to us we will help them and direct them.

**Q105 Graham Stringer:** A few answers ago you said there should be more investment in regional innovation and research. How do you achieve that?

**Dr McKernan:** This is something we are looking at. The first thing we have done is understand already where Innovate UK funds go. We have mapped where all of our funds have been won since the inception of the Technology Strategy Board. It is surprisingly evenly distributed by head of population. If you look per head of population, the most successful area is the north-east. We have big investments in catapults in the north-east, yet it has a relatively low density of population. There is a lot of investment in the south-east, but it is also the most densely populated area.

The next piece of work we have to do is to understand what different regions are strong in and make them globally competitive. We have just started on a piece of work called smart specialisation. As I have been in post, I have been going round the country—I have been to all parts of the UK—to understand what it looks like from every region's perspective. Some parts of the country really know what they are strong at. The midlands know what they are strong at. Other parts of the country are not quite as clear and they are spreading

themselves more broadly. I think the next piece of work is to work with regions to help them understand where their strengths truly are and then help fund, in a competitive way, programmes that will allow them to grow.

We do not have a lot of money at the moment for regional growth, but other bodies have funding for regional growth. I would be very happy to work with different parts of the UK to share how we can grow and support companies in different places. I think it would be good to make some hard choices, because if we give everybody a small amount of money to work in lots of different areas we are not going to be internationally competitive in any of them.

**Martyn Sené:** To give an example, in the last few years we have done a very successful experiment and we are now looking to do it in other areas. We partnered with the University of Huddersfield to put a small group of people from NPL on site in the university to provide services directly to the high-value manufacturing cluster in that area. They also acted as a portal to the other activity at our main site in Teddington. That has grown enormously. It has been supported by the LEP and it has been very successful. When we plot the companies that interact with that centre and get benefit from it they are clustered in Huddersfield. They spread out further, but it demonstrates that, even in a small country, having a presence and being able to talk locally makes a big difference. We are now seeking to replicate that with one of our university partners, Strathclyde, in Scotland, bringing in the University of Edinburgh as well. We have been talking to Cambridge about putting something similar on the west Cambridge site. We have discovered that even a small physical presence can connect people to a major centre.

**Chair:** Fantastic. Unfortunately, we do not have as much time as we would like. This is fascinating. I suspect that we could discuss it all day. I would like to thank both of you for your written evidence on behalf of your organisations, but also for taking all of our questions, answering them in a very insightful way and helping us with our inquiry. We may come back to you with questions over the next few weeks if the written and oral evidence that we take makes us think that it could be helpful. I hope that will be all right. I know that we will want to see you at other times in other inquiries in the next few years. Thank you both very much.

### Examination of Witnesses

Witnesses: **David Sweeney**, Director (Research, Education and Knowledge Exchange), Higher Education Funding Council for England, **Professor Rick Rylance**, Executive Group Chair, Research Councils UK, and **Professor Philip Nelson**, Executive Group Chair-elect, Research Councils UK, gave evidence.

**Q106 Chair:** May I welcome the second panel to our science spending inquiry? Thank you very much for taking the time to come here today, and for your patience in sitting through the first panel's evidence. I hope you found all of that interesting. As you heard, we are all trying to get our heads round the spending landscape, to get a sense of how Government could improve and simplify it, and how we can spend that money in a more efficient and effective way. I am haunted by this piece of paper. If I am haunted by it, imagine how businesses and

researchers feel. It might be helpful if the research councils and then HEFCE could start by giving us a very brief sense of where you sit in that landscape.

**Professor Rylance:** I am Rick Rylance, the current chair of Research Councils UK's executive group. I am also CEO of the Arts and Humanities Research Council. As you recall, there are seven different research councils.

As to where we sit, we are one half of the dual support system, which means we fund largely on a project basis. People make applications to us; we make decisions about whether to fund them, and off they go with their project. The other part, for which David is responsible, is the quality of research—QR—component, which is an unhypothecated periodic allowance through universities. We are project based. The two parts match up quite well. You will be aware that the UK is an international research leader. I am not sure how many things we have in the UK to be really proud of, but research is one of them. We are contributing to that on the basis of maintaining core disciplines. We are funding projects of worth, distinction and achievement, and surveying the landscape to look for strategic investment as technology and research parameters change.

**Q107 Chair:** David Sweeney, Professor Rylance has slightly stolen your thunder with the block grant comment. Would you like to add anything?

**David Sweeney:** We fund universities, as Rick said. Universities are at the heart of the research effort in the country. Over 90% of our highly-cited, world-leading publications have university authorship, and we have universities in all parts of the country with diverse missions tackling global and local problems.

We fund on a performance basis, as Rick said. The core funding for research is the base on which project and private funding is built. Universities tell us—Universities UK has put this in its response—that our funding is used to attract the best staff to work in our universities; to support interdisciplinary work; to fund partnerships with universities but also with business, very much supporting the work that Innovate UK does; to move into new areas of research before they are identified for grant funding; and to provide the infrastructure—the buildings and equipment—that run research. It is not just research that is one of our jewels in this country; our universities are. We are delighted to fund university institutions to unlock their work for the benefit of the nation and the world.

**Q108 Chair:** I am the Member of Parliament for Oxford; I have Oxford University and also Oxford Brookes University, so I echo your sentiments. Can I start with the basics and make the assumption that you are unanimously in favour of the continuation of the dual support system? Or not?

**David Sweeney:** We are a world leader in research. What is distinctive about UK research is that both the funding for universities as institutions and the project funding are performance driven. Although we always look to do better, the dual support system has over the last 20 years brought us to a place I think we should all be proud of.

**Professor Rylance:** Unequivocally.



**Q109 Chair:** Excellent. I would like to move on to the letter which the Secretary of State for BIS sent to HEFCE regarding an additional reduction of £150 million, and focus particularly on the request to prioritise STEM research, high-cost subjects and widening participation in small and specialist institutions. How are you going to achieve that?

**David Sweeney:** We have announced how we are going to achieve that. That £150 million is a 9% cut in our teaching funding. None of the ring-fenced research funding is affected by it; it is teaching funding, but, as you will see, we use teaching funding to support research, because research and teaching are integrally linked in our universities. The same people do both; you cannot separate them. The most immediate effect of this cut is that, where universities take more STEM students, we are unable to provide additional top-up funding to cover the extra cost in teaching STEM subjects. Universities will have to teach STEM subjects for less money in the immediate future, but everybody will have to bear the consequences of a 9% cut. Although we can attempt to protect things, we cannot make 9% go away. It is teaching funding, but in order to handle the transitional effects of changes in our research budget, following our performance exercise—the research excellence framework—we had allocated £52 million of transitional funding to cover research matters. Unfortunately, we had to withdraw that. We are unable to fund the extra money we put into PhD students, where there is the biggest gap in funding for universities, but we have been able to continue to fund the STEM protection because the Government have found additional capital money, which we can use to ameliorate the effects of the loss of transitional funding. There is a hit on the research budget because we fund research and teaching together.

**Q110 Chair:** Could you clarify that? There is a paragraph here which says, “In order to support this I will, on an exceptional basis, provide additional financial flexibility to ensure it can achieve this. Due to the one-off exceptional nature...my officials will work with you.” Is that for the £52 million?

**David Sweeney:** That is £28 million of the £52 million to be provided through exceptional one-off capital funding, which makes a tremendous difference. We realise that these are very difficult times, and the Government have been working with us to do what we can to mitigate the effects of the cuts.

**Q111 Chair:** We heard from the Science Minister in our first session. One of the comments he made in July was that the research councils’ horizon scanning and strategic thinking function “has been at times a bit deficient”. What do you think prompted him to say that? How do you interpret it? Do you think he is right?

**Professor Rylance:** Phil will kick off on that one.

**Professor Nelson:** I am Philip Nelson, chief executive of the Engineering and Physical Sciences Research Council. I think the answer to the question is that the research councils individually do a tremendous job in their own horizon scanning, within their remits. I know for sure that my own council takes that role very seriously and spends a lot of time and effort making sure that we are abreast of new developments. We have quite a

sophisticated structure of strategic advisory teams from the academic base, the user base, industry and Government all contributing. I am sure the other research councils are the same in that regard. The Minister was perhaps referring to how we collectively look at cross-council activities. We are already working on that process so that we can refine it and make it better and address the point that the Minister made. While we are not complacent, it would be wrong to suggest that we are not good at that, because I think we are.

**Q112 Chair:** We also heard from Sir Paul Nurse who commented on the fact that the balance of research council funding had been largely constant for a significant number of years. He did not say that necessarily it should change but that perhaps there needed to be a bit more strategic thinking, and implied that that was perhaps behind the Nurse review. What do you think about that?

**Professor Nelson:** I think that is the source of the anxiety. To reiterate, we already do an awful lot of work across councils that is highly effective. For example, we have very strong cross-council funded programmes in energy, the digital economy and so on. These are very successful programmes. The perception has developed that perhaps we are not as strong at interdisciplinary research as we might be. That is sometimes misplaced, but we are working on better systems for ensuring that we can properly address and tackle effectively the work of the future, which will very often fall between disciplines, from what is already a very strong science base. While there is no complacency, I think these things can be overplayed.

**Q113 Chair:** What do you fear from the Nurse review?

**Professor Nelson:** I do not think we fear anything from the Nurse review. We welcomed the Nurse review. We have not heard from him yet. I think he has some recommendations about how we might work better together collectively. That would be an exciting prospect. I am taking over from Professor Rylance in October. I am very excited by that. It is a fantastic opportunity to build on the remarkable strength of the UK science base and take us forward over the next 10 years in a way that will be really exciting. I am not at all fearful of what Paul Nurse has to say. I have huge respect for Paul Nurse, and I am sure he will be making some very sensible suggestions to us about the way we might work better together.

**Professor Rylance:** Phil is absolutely right. When you look at a group of disciplines within a council they are extremely good at seeing the cutting edge and where the emerging things are, because this is what researchers are looking at day in, day out. Where I think there is a problem, and it goes back to your bowl of spaghetti-type diagram, is in how you make the links between the different agencies involved in funding. That will involve not just the research councils but other parts of it—charities, Innovate UK and also bits of Government—and how you see the emerging general issues. What I would hope for from Paul Nurse's review is active deliberation about that issue—how we try to convene a national conversation about joining up these different things.

**Q114 Daniel Zeichner:** I would like to continue the discussion on funding. There are huge pressures on public spending. If you are asked what you need, almost everybody will say, “More.” We have had flat levels of funding for a few years, with costs rising, which means effectively cuts. The board of the Science and Technology Facilities Council has calculated that a 10% increase in funding over the next five years would be needed just to maintain current activity. I note that the written evidence from the Babraham research institute, which is close to my constituency in Cambridge, warns that if there is not an increase in funding and it continues flat-lining, it will not be possible to maintain existing levels of scientific enterprise, innovation and output, and it is likely that world-leading scientists will leave the UK. That is quite a strong point. What are your feelings about that?

**Professor Rylance:** I think there is truth in that. Over the past Administration, there have been five years of flat cash. Figures vary, but there has been a real-terms cut of something around 12%. The Campaign for Science and Engineering—CASE—reckons it is more than that, because the cost of running big facilities or paying high-salaried people is greater than normal inflation. You cannot absorb that for ever. It is a simple, straightforward truth. We are coping as well as we can and keeping things going as well as we can, and all the indicators are that we are achieving that in terms of international respect for the kind of work we produce, the inward investment and all of those measures, including the stimulus of wider economic growth. But there will come a tipping point where you cannot sustain it, where those deeply impressive citation measures internationally are living on the achievements and investments of the past and where the future is in jeopardy. I do not think the STFC is alone in this; it runs across all seven research councils, and indeed the university community as well. We recognise that we are in tight times, but there is a jeopardy here. It is not going to happen tomorrow and it probably is not going to happen next year, but it is not too far away.

**David Sweeney:** We are determined to make our money go as far as we can. I have mixed views about that diagram that so horrifies you, because some elements of it are additional sources of funding that were not previously available. It is a good thing, and we are determined to go after new sources of funding where that can be achieved, notably from Europe. We are also determined to use what we have to leverage greater private investment, because one of the problems in this country is private R and D investment. We can make progress there, but we are the lowest public spender on research in the G8; we are at the lowest point in our investment per GDP over the last 20 years. It is very difficult. We have to go with what the Government can afford, but we want to do the most we can to work with private and other public funders. The charities have also done a great job for this country.

**Q115 Chair:** Some very challenging questions were thrown back at us by Dr McKernan. How can Government funding be made to go further?

**Professor Nelson:** I absolutely concur with what my colleagues have said. During the last Parliament we were very grateful for the settlement we had, given the background. We know that times are still tight, but over that period an awful lot of work has been done to maximise the leverage we get from private funding. We do that remarkably successfully. My own research council brings in private investment of getting on for £300 million a year, which goes into our universities and is co-invested with our own inputs. We have

done an awful lot in that regard. We look for co-funding with other charities and bodies as well. That works very well. We work with CRUK, the Wellcome Trust and so on. We are doing an awful lot to make the public spending go as far as it can. Let's look at the positive side of this. There is a fantastic opportunity for this country in the next five years that we must not waste. I absolutely understand the fiscal background, but we need to get back on to a curve that is perhaps gently rising at some stage—I appreciate it will take time—to reap the benefits of the investments that we have had. The real warnings around the citation indices are absolutely right. We are looking at citation indices that are probably the result of funding decisions made 10 or 15 years ago. My nervousness is that problems could be being stored up at the moment that have not surfaced yet but, looking at the positive side, there is a great opportunity.

**David Sweeney:** Being very specific, we are second in the world for inward investment from companies. Multinational companies want to partner with our world-leading universities, and we want to do everything possible to create an environment where that can happen. We are supporting our university institutions to build those partnerships, and we are offering some matched public funding where private partners are willing to invest substantial amounts of money. We have some great stories in our universities of industrial partnerships. That is a very positive way forward, but it requires universities to have the headroom for that investment.

**Professor Rylance:** The indicator David did not mention is that in the UK we get back more for each pound spent than anywhere else in the world, so we are already extraordinarily efficient and productive. The data about the proportion of GDP which is spent, both private and public, are quite alarming.

**Q116 Chair:** We have had this in written evidence. The question is whether we are as efficient as we can be or whether there is more efficiency to be achieved and, if there is, where those innovations are to be found.

**Professor Nelson:** An awful lot has been done. Rick has made the point that if you look at output per pound we are undoubtedly the best in the world. In terms of how we convert public spending into scientific output, it is pretty irrefutable that we are immensely efficient already. I look at the opportunity and the number of people in the research excellence framework exercise that HEFCE runs. There were about 10,000 full-time equivalent engineers and scientists who would qualify as world class or internationally excellent, with three and four-star-standard outputs. We can fund only about half of them at any one time. We could get still more from that science base, and it has a proven economic impact.

We have looked at the results of the research excellence framework. For example, over the period 1993 to 2013 the EPSRC—my own council—spent about £7.8 billion on publicly funded research. We can look at £80 billion of economic activity associated with that. It is about 10 to one. If we could get more input we could get more output to help propel this economy. We need a science-based economy, and it is absolutely critical that we get it right.

**Q117 Graham Stringer:** You do not agree with one of our most distinguished scientists, Lord Rutherford, who said that because he had very little money he had to think.

*Professor Nelson:* Of course, there is an element of truth in that. I have often heard it said that our scientists, given the facilities they have, compared with what is available in the United States, still do remarkably high quality work as a consequence. I go back to the point that we are fantastically efficient at converting taxpayers' money into scientific output. There are limits to that argument, especially in the modern age. If you are to have a well-equipped science base, you need the facilities and equipment to be able to keep pace with international developments, as other countries invest significantly in strengthening their research base. You have already heard the numbers in terms of fractions of GDP and so forth; we are way behind other countries. I take the point, but in the modern era we need proper facilities that are well funded and for which the batteries are included, to use a somewhat hackneyed phrase, and all those put together sensibly. I understand what you say, but I do not buy the argument in its entirety.

**Q118 Graham Stringer:** Is the balance right between the funds flowing through HEFCE and the research councils?

*Professor Nelson:* I would say yes.

*Professor Rylance:* I would say yes as well.

**Q119 Graham Stringer:** We live in the best of all possible worlds.

*David Sweeney:* Universities UK has said, as the collective group of universities, that it considers that to be the case. What do we know? We know that the research councils are unable to fund grants of the very highest quality that they think have potential for great research breakthrough, so we know that the research councils could do very well with greater investment. We also know that, as I mentioned earlier, we are not managing to leverage as much money as we could from other sources because the funding that flows to universities through HEFCE is constrained. We know that we are underfunding doctoral students quite significantly. We know the shortfalls on both sides of dual support. I think it is a very difficult decision to say that it is absolutely more critical that we should spend more money on grants in one particular area, or on doctoral students, or that we should leverage that inward investment from multinationals. We have got to a strong place with the balance we have now. It is right we should debate whether some variation in that balance is required, but there seems to be consensus that we are roughly in the right place, and nobody has produced evidence that we are in the wrong place. We would appreciate that evidence, because we are trying to invest every pound for the best return. If we could invest it differently we would do so.

**Q120 Graham Stringer:** How is the balance determined? Is it determined by BIS, or is it in effect determined by history, inasmuch as it has always been that balance?

**David Sweeney:** It is determined in the spending review by the Government.

**Q121 Graham Stringer:** Yes, but in that determination do you think the largest factor is the historical spend levels?

**David Sweeney:** We are in a very strong position, so a significant perturbation to that balance would be a risk, but you have to ask colleagues in government to comment on how they take that decision.

**Professor Rylance:** I would say more or less the same as David—it is a decision for Ministers, but clearly they are governed by historic precedent. One thing you can say about historic precedent is that one interpretation of it is that it could be right.

**Graham Stringer:** On the other hand—

**Professor Rylance:** The balance could be as good as you are going to get it, and the cost of disturbing it radically, and certainly suddenly, could be quite considerable.

**David Sweeney:** Universities have multiple sources of funding and they have tailored their activity to match those sources of funding. To an extent the research units have optimised what they do to meet what is available.

**Q122 Graham Stringer:** You sound like two Dr Panglosses; you really do live in the best of all possible worlds. How would you go about studying and examining the balance? What analysis or research would you do to find out whether the balance is right so you could advise Government on what it should be?

**David Sweeney:** BIS has done work. The recent economic insight report talked about the returns from research. There was a report earlier on by Tera Allas, a senior economist, that looked at the returns. To an extent you have to do experiments to judge. That is quite difficult when you are in a long-term stable funding arrangement, but we have unleashed our best economists to look at the returns and it is for Government to evaluate their responses. I do not think we are Panglossian. We are determined to do things better and we struggle to find better ways to do it. We are having a good set of outcomes, and you would not expect us to be negative about the glorious position of our universities, research institutes and the international statistics.

**Q123 Chair:** Can I ask you about one more funding pot: the HEIF? This has been mentioned to me by the Russell Group as an important funding source. What is your view about another bubble on my organogram? What is your view about its value to the innovation or research landscape?

**David Sweeney:** For some reason, it is the fund that is most looked at. The Witty report a couple of years ago suggested that it should be doubled in size. The Dowling review has also endorsed its importance, so there is agreement. It is about unlocking the research strength in universities for business and society, so it is encouraging universities to have

the infrastructure in place. When we say that academics are not terribly entrepreneurial—some of them are not, although quite a lot of them are—we have to put alongside them people who are entrepreneurial, who make those introductions to business and ensure that some time can be bought out of teaching for those academics to do the entrepreneurial things. HEIF is unique, because it is for universities to unlock innovation, whereas Innovate UK funding is business driven. It makes perfect sense, surely, to have some incentives driven by the needs of business, which Innovate UK does, and some incentives driven by getting universities to do the very best with the work they do. It would seem that universities value it very much because we have had universal support for it. I think we get a phenomenal return. The economists have been hard at work on that scheme over a period of more than 10 years. I can understand why people are supportive of it and why they keep telling you they are supportive of it, because it is in a space—university-business relations—that is reviewed time after time after time.

**Q124 Chair:** Is it ring-fenced for that spending? Is it always used for innovation?

**David Sweeney:** It is. It is the only HEFCE funding that is hypothecated. Although our research funding is used for research, because there is a tremendous shortfall, we do not tell them they have to use it for research. HEIF funding has to be used for knowledge exchange and innovation, and we ask them to report annually on how they have spent it and to produce strategies every four years. We give them the money only if they both produce a return on that investment and their strategy aligns with national objectives. For a relatively small pot of money—roughly 10% of the HEFCE research budget—it receives a lot of strategic attention.

**Professor Nelson:** In my former life I was a pro vice-chancellor for research and enterprise. That particular funding stream was transformational in the UK. It moved the universities a long way towards equipping themselves to be able properly to exploit their intellectual property. It has been absolutely crucial. It is a relatively small amount of money, but hugely instrumental in helping us transform the landscape. If you look at the statistics, you will see that much more entrepreneurial activity has come out of UK universities since that funding stream was introduced, in about 2000 if I remember correctly. I think it is very important.

**Q125 Carol Monaghan:** As a former physics teacher, I do not agree with Rutherford. That is a dangerous thing to say. We can be creative up to a point, but then the wall is hit. That is really what is being said. I would like to go a little more into the idea of batteries not being included and the balance between capital and resource expenditure. We already have an indication of the level of capital expenditure for the coming years. What do you think would need to be the resource funding to make full use of that capital investment and, first of all, the science infrastructure?

**Professor Nelson:** It is a complex question. Across all councils, we are concerned about this, so we all have our own issues depending on the infrastructure in which we are involved. It is a common problem. We could certainly get back to you in writing with the sort of sums we think we would need to ensure the capital investments currently coming through the system, and we are hugely grateful for them. It is an excellent move on the part of Government to allocate over £6 billion to capital in the next three or four years. It

is important that we do that. The answer is that we are concerned. I am sure we can get the numbers, but probably the right answer is that we do not have them at our fingertips at the moment.

**Professor Rylance:** Given that these investments are very strongly forward-looking and very adventurous, it is about getting the maximum return from building the buildings and putting the facility in place. We need to make a calculation about what it can deliver maximally and what would then follow. Like the Crick Centre, very often they are coming from different funding sources, so it is not a straightforward calculation. Nor would you necessarily assume that it is all going to come from public sources, because there would be commercial and charitable investments as well. Quite a bit of work has to be done on trying to think about how over, say, a five-year timescale you will get the best and the most from these things.

When you think about capital investments, it is naturally tempting to think of the new, the best, the forward-looking and all that stuff, but there is a bricks and mortar question about maintenance, replenishment and so on. As we think about the way in which we are going to invest capital in those sorts of things, we have to make sure the guttering is all right, the computers are fit for purpose and the windows do not leak—all that sort of stuff as well.

**Q126 Carol Monaghan:** Do you think that should be considered whenever we are looking at funding?

**Professor Rylance:** In that calculation, you are always making decisions about immediate priorities. If there are, for example, additional funding streams if you invest in a new facility, the temptation will be to steer your money in that direction. That is probably right, but you must not forget the more mundane, pedestrian and unphotogenic bit of it.

**David Sweeney:** We did an analysis more than 10 years ago as to why UK science and research was not as strong as it could be. A lot of independent work done on that clearly identified that we had not invested enough in infrastructure over the period before that. The Government responded, as did private funders, and we had a period of substantial investment in infrastructure, which, along with a number of other factors, led to the improvement in the quality of UK research. We are very stretched on capital expenditure and on the balance between excellent new research facilities and the core infrastructure that enables universities all over the country to keep going, not just on the global research challenges but the local challenges as well. That is one of the things we argue about with Government. We are not Panglossian on that.

**Q127 Jim Dowd:** Can I pursue with the second panel the questions I put to the first, largely on the question of the share of expenditure on innovation? To what extent do your organisations take into account innovation to build upon basic research? Is it a significant consideration when you are making allocations?

**Professor Nelson:** We do an awful lot. I am speaking as chief executive of Engineering and Physical Sciences, which has a very strong remit in that area. We want to ensure that we keep up with science developments that lead to technology developments, and vice



versa; technology drives science as well. We always encourage our applicants for grants to think about the impact their work might have. That happens every time. They have to think through their impact. Some of that impact can be in the foreseeable future, within three, four or five years; some of it is difficult to foretell because it is basic science that may have a longer-term impact. When we looked at our REF impact case studies we saw that the impacts varied almost uniformly between 20 years and nought years. The time to impact was plus or minus 10, so there is a huge range of possibilities within the remit of our portfolio. It has been absolutely central to our mission for some time that we encourage our researchers to think this through. We encourage them to work with industry and business to develop collaborations, and that is a very effective way of moving technologies from the science base into practical application. We do an awful lot of that with strategic partners. We encourage them with new technologies to spin out new companies. In particular, we work closely with Innovate UK to try to help that process. It is absolutely central to the mission. I have spoken for EPSRC. I am sure the same is true across all research councils. We are deeply conscious of the need to get the process right, and we work very closely with Innovate UK in trying to do so.

**David Sweeney:** In our case, we established the infrastructure fund HEIF, which we have just talked about, more than 10 years ago, but the critical step in the last five years, to which my colleagues have referred, is telling universities that the performance-driven funding they get for their core research would be based not just on an assessment of academic excellence but on the impact that research had had in society. Both my colleagues referred to that. That sends the message very clearly to universities that, if they want an optimal financial return, they have to involve themselves critically in innovation—not that they can do it themselves but they can work with partners to help unlock that knowledge. However you look at the statistics, there has just been a phenomenal response not only from universities but from their business partners. It is at the heart of what we do and it is at the heart of our most recent changes, and the way forward is to understand even better, because of the work we have now done, how we get impact and innovation from core research to spend our money more efficiently.

**Q128 Jim Dowd:** Is the budget big enough at the moment to maximise that impact?

**David Sweeney:** There is a constraint on university budgets to do the work all the time, so of course there is a constraint. There is also a constraint on the ability of businesses to take up the research. We could put quite a bit more money into universities working with business effectively. There is certainly an enthusiasm from the universities to do that. I think there is enthusiasm from universities all over the country. This is not something that only Oxford does, although Oxford does it brilliantly. It is something Oxford Brookes does, and virtually every university understands the problems of companies and the cultural sector in its own area and is determined to make sure its research supports that.

**Professor Rylance:** I think this is a win, win, win situation. It is a win because it gets universities into their communities more effectively; it is a win because of the dividend in terms of growth, impact and other forms of benefit; and it is a win because it improves the research. One thing that is happening in research is that more and more of it is collaborative. It is collaborative between different institutions, both private and public; it is collaborative internationally; and it is collaborative between disciplines, in

interdisciplinary endeavour. There really has been a transformation over the last five, six or seven years. It has been hard won, but the impact agenda has really made a difference. You can see this generationally within researchers. It is the young who have embraced this, and they will carry it forward. I think it is one of the things we ought to be quite proud of.

**Q129 Jim Dowd:** In your estimation, has that development occurred because of the advantages it has brought in terms of the quality of research or the increasingly tightening financial circumstances in which institutions find themselves?

*Professor Rylance:* I think the latter has stimulated it, but clearly tightening circumstances can in the end discourage as much as they can encourage. The real issue is how, as we think about the future, we get a balance of engagement between the universities and the research cohort and those outside. You hear stories about places which have queues of researchers outside their door, growing daily, and eager to work with them but they do not have the capacity to do it. If we are to think smarter about how to make more of this, it is about trying to invest in those collaborations.

*David Sweeney:* There are benefits not just for research in universities but for teaching students in universities because you are engaging more of them with local employers and business activity. The benefit to universities is not just a simple one. However, this question is normally posed in the context of whether we should shift money from one to the other. It seems to me we are so successful in the research we do, but there is so much we cannot do, that that is the wrong question to answer. We have to invest better in research because we can generate a tremendous return on it, and alongside that we have to invest in ensuring there is an impact from that research.

**Q130 Jim Dowd:** If the innovation budget was brought within the ring fence, do you think it would result in an alteration of the balance between research and innovation?

*David Sweeney:* The problem with the innovation budget is that it is a budget. About 75% of our budget for innovation is within the ring fence. The budget for business-focused innovation is different in character, as Ruth described earlier, from the funding for research in universities. I am not sure that something totemic about the ring fence is the right way of looking at it. You have to analyse how you get best value for different pots of money.

**Q131 Matt Warman:** With increased collaboration in mind, given the levels at which different research councils are funded, are we getting that right? Does it take into consideration the fact that you are often funding big assets where there are different pressures?

*Professor Rylance:* That is a version of the earlier question about the historic precedents for doing these things.

**Q132 Matt Warman:** I am thinking about between research councils as well.

**Professor Rylance:** But in a sense the disposition of those relative to each other is historically derived to a certain extent. I do not know of a single research council which would not say it was grossly underfunded for one reason or another, meaning you could do a heck of a lot more than you do at present. Phil talked earlier about evidence of the quality of the applications we get. To repeat what I said earlier, the worry is that, if you start shifting too suddenly or too drastically, you will rob Peter to pay Paul and you run the risk of causing more damage than any possible good you can do. That may sound Panglossian, but it is a serious anxiety about perturbing the system.

**David Sweeney:** We should be clear that, if you perturb the system, you are going to close down university departments and academics in some numbers are going to lose their jobs. Research takes place over a pretty long period. You take big decisions like that with incredible difficulty, for all sorts of very obvious reasons. We went through a very difficult period with STEM funding where university science departments were shutting, partly because not enough students were going and because of shortage of funding. Collectively, the nation has turned that around by changes in schools and by universities doing outreach, and we have a much more stable environment for university science departments. During that period, we lost capacity that now we miss, and we do not want to put the future at risk by doing that again.

**Q133 Matt Warman:** In an idyllic future where funding increased rather than decreased, are you saying collectively that you would maintain the relative funding of the different research councils, or are there some where you might wish to increase it compared with others?

**Professor Nelson:** As I tried to explain earlier, the future is full of possibilities and a lot of them will be between research councils. The issue is how much you put into individual research councils versus what we do collectively. That is an interesting question to answer. My colleague has already made the point that a series of Ministers has seen the balance of research council funding and not interfered too much with it, frankly for fear of undoing good work.

**Professor Rylance:** Even though council x gets this and council y gets that, what that does not count is the amount of money that is pooled between two or more councils to produce particular kinds of work. If you think of an area like design, which is growing in importance, my council does a bit of that, Phil's council does it, and so on. It is a common enterprise and that is not clear in terms of the budgetary allocations on a unitary basis.

**Q134 Chair:** David Sweeney, we asked Dr McKernan about the McKinsey review of BIS-funded bodies. We understand that HEFCE has also taken part in it. I wondered whether you had participated in the review, and what that participation had been.

**David Sweeney:** I did not. My chief executive met representatives from McKinsey and gave them information about what we did.

**Q135 Chair:** Have you had a report back from that meeting?

*David Sweeney:* I am not aware that we have had any significant report back from that meeting.

**Q136 Chair:** Have you discussed it with your chief executive?

*David Sweeney:* Yes.

**Q137 Chair:** What was his view?

*David Sweeney:* Her actually—Professor Madeleine Atkins.

**Chair:** My apologies.

*David Sweeney:* We are awaiting the outcome. We have given information but not received significant feedback.

**Q138 Chair:** Do you think that the level of consultation is sensible? Did you think the questions were sensible? What do you think is the purpose of the review?

*David Sweeney:* I am not sure that I can comment fully on the purpose of the review. The questions we were asked were generally sensible. They allowed us to make the case for what we did and explain why we did it, but I am not sure I can say more than that because I was not present at the meeting.

**Q139 Chair:** I know that the research councils have participated as well. I am not sure whether it has been at RCUK level. Are you able to comment?

*Professor Rylance:* The person who spoke to them was the executive director, Hilary Reynolds. They were mainly seeking information about operational costs and how the seven different councils articulate together and share costs—that kind of area. That is my understanding of it.

**Q140 Chair:** Thank you very much. This brings us to the end of the oral evidence session today. Are there any last points or comments that you want to make?

*Professor Nelson:* I just reiterate that we have a fantastic opportunity in this country, and we must not waste it.

**Chair:** Thank you. I think all of us on the Committee share your view that we have outstanding universities and research in the UK, at the risk of sounding Panglossian—the word of the day. I would like to thank you for coming to give evidence. It is very helpful for us as we go forward into the spending review, which will be crucial to the future of science and innovation in the UK. I hope that you will take any future questions we might have and write back to us as we go forward. I am sure that we will also want to ask you to

come and give evidence at different points in the future as the spending review unfurls.  
Thank you very much. That brings this session to an end.