House of Commons

Environment, Food and Rural Affairs Committee

Oral evidence: Work of Defra: Health and Harmony, HC 870

Wednesday 18 April 2018

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Watch the meeting

Members present: Neil Parish (Chair); John Grogan; Dr Caroline Johnson; Angela Smith.

Questions 87 - 192

Witnesses

I: Dr Ben Caldecott, Senior Associate Fellow, Bright Blue; Angela Francis, Chief Economist, Green Alliance; Michael Taylor, Economics Research Fellow, Policy Exchange.

II: Tim Bennett, Chairman, Centre for Innovation Excellence in Livestock; Fraser Black, Chief Executive Officer, Crop Health and Protection; Professor Simon Blackmore, Head of Robotic Agriculture, Harper Adams University; Tom Hind, Chief Strategy Officer, Agriculture and Horticulture Development Board.

Examination of Witnesses

Witnesses: Dr Ben Caldecott, Angela Francis and Michael Taylor.

Q87 **Chair:** Thank you very much. Starting with Angela, if you would like to introduce yourselves, please, we will work across the panel and then we will go straight into the session.

Angela Francis: I am Angela Francis. I am chief economist at Green Alliance.

Dr Caldecott: I am Ben Caldecott. I am a senior associate fellow at a think tank called Bright Blue.

Michael Taylor: I am Michael Taylor, economics research fellow at the think tank Policy Exchange.

Q88 **Chair:** I will start off with the first question, which is quite a straightforward one but possibly needs a reasonable answer. What will happen if Defra and Government remove direct payments from farmers? It is a nice simple question. Who wants to start? Michael, you look like you might like to start.

Michael Taylor: Yes, sure. Various things will occur with the removal of direct payments. One would hope that land prices and rents for farmland might fall, given that they are currently embedded in the direct payments process. In terms of agricultural output, there may not be a huge effect. There may be some farms that are supported by subsidies at the moment and will no longer be viable without the direct payments, although that depends on what alternative arrangements are put in place. Without these direct payments, there is an opportunity for the farming sector to increase its innovation, to improve productivity and efficiency. These direct payments have been a very blunt and very poor way of supporting the industry. They support the wealthier farmers—those with the largest landholdings—and are incredibly blunt and indiscriminate in their effect. Any other system will almost certainly be an improvement on direct payments. Removing them will be a positive for the farming sector.

Q89 **Chair:** Your argument would be that, if you remove them, you need to replace them with something, though, do you not? Do you just want to remove them? They would definitely reduce rents, probably more than the value of land. I am not convinced that £10,000 or £15,000 an acre is built on the value of the basic farm payment, but the basic farm payments are recognised in the rents. Are you of an opinion that we should just take away the direct payments and let them get on with it? What is your opinion?

Michael Taylor: No. Subsidies should be redirected, as the Defra consultation document sets out. We would agree with that direction of travel, in that they should be moved towards using public money for the provision of public goods, supporting air and water quality, the natural environment, biodiversity, et cetera, rather than supporting any particular form of production in farming or providing widespread income support to the whole range of farmers. In terms of providing support for the farmers most adversely affected by any change to the system—for example, livestock farmers in upland areas—we certainly would not object to ongoing support for them, although you would hope that, over time, as the alternative methods of support in terms of public goods came into play, that could provide an income stream for those farms and retain their viability.

Q90 **Chair:** Naturally I have a lot of livestock farmers in my constituency, especially in the sheep and beef sector, who perhaps rely too heavily on the basic farm payment. It is interesting; for those who are on the hill, we could look at types of hill payments. For those who have come off the hill into lowland farming, or not quite lowland but in livestock and grass, that is going to be quite a challenge.

Angela Francis: Yes, that is absolutely right. Whatever replaces direct payments has to be relevant for all farmers. It cannot just be something that is about public goods in the uplands, which we can associate with landscape and the kinds of public good we think about when Michael Gove is waxing lyrical about how we are going to change the system. It has to be relevant also to lowland arable farmers. At Green Alliance, we are talking about how those public goods come from changing our farming system. Farming differently can deliver carbon sequestration, better habitats, biodiversity and soil quality. That is relevant to all farming, not just upland livestock farming.

Your main question about what is going to happen when direct payments are removed is a very difficult one to answer. Economists have this phrase, "ceteris paribus", which means all other things remain equal, and we could not be further from that. Everything is going to change. We are going to have a change of farm payments, a change of trading arrangements, technology and new competition coming into the market. It is going to be a real melee of different factors that farmers will have to respond to. They have been readying themselves for a change in the farming system for some time. As long as they know what direction we are going in, and how farming policy and trade policy will support them to get there, they are ready for that change. It is probably overdue.

Q91 **Angela Smith:** I take your point about a new system having to apply to all sectors, but the fact remains that upland livestock farmers find it a lot more difficult to sustain profitability than lowland farmers do. It is a fact. This surely is not just about public money and public goods. There is also a key issue of profitability for upland farmers; there really is. I represent an upland farming area and there is a serious issue there.

Angela Francis: That is absolutely right. It is about understanding how direct payments have caused lots of perverse behaviour in the industry. They support profitable farming and unprofitable farming alike. We have lots of farming where the farming itself is making a loss and the farming is kept in business by direct payments. We have had landholding; we have had fewer people leaving the industry and fewer possibilities for new entrants to come in. There are lots of things. As to what is sustainable and commercially viable to produce in the UK, we will have to ask ourselves some serious questions about what we should be doing.

That is going to be quite a big change, particularly for some upland farms that have not been profitable. What does that look like in a new world? It is around what has already been happening. It is about diversification and making the farming we have profitable, not just productive: farming for margin, not just for product. That is a cultural change, which will be improved by the removal of direct payments, because it turns farmers back into what they should be, which is businesspeople. How do they get the most money from the land? That is from farming.

Q92 **Chair:** Take upland sheep farmers and beef farmers, and not just on the uplands. If you look at the economic figures, you will find that it is not just the very inefficient that would struggle without a basic farm payment; it is probably only the top quarter that would be profitable. That is the challenge. I am not saying they should not have a challenge, but how do we move on from where we are? You do not want to see a complete exodus of the family farm. That will not do the environment any good, and it certainly will not do food production any good.

Dr Caldecott: It is a very exciting period of change and reform. Given the scale of the challenges and the changes that are going to happen, we must not take money out of the rural economy. One thing we said in our report that came out in November was that, during that period, the amount of money going into the rural economy through CAP should not be reduced. It is important that that is used to generate two vibrant markets that can help deliver all the ecosystem services that we want, but can deliver high-quality produce as well: one market in terms of commissioning ecosystem services and a market for produce and services.

We have also said it is important that there should be some form of means-tested livelihood support, because some farmers in some parts of the country will need that support, and it is right that it should be there. We have not looked in detail at what that would look like.

Q93 **Chair:** In your view, that would be like a sort of income support, would it?

Dr Caldecott: We have not looked in detail at what that could look like, but there is a need for that to be determined and fleshed out. It could be through the existing benefit system. It could be something separate, but there needs to be space for that in addition to these two markets.

Q94 **Chair:** I am not against the reform, because it is probably long overdue in some respects, but the trouble is that we still need to produce food at a reasonable price. It is not just the high-end market. Much of what I see the Secretary of State and the Government talking about concerns the high-end market for food, but 90% to 95% of the food goes through the general retail sector and people like to buy it at a reasonable price. No Government will want to see food prices shoot up. Have you considered what may or may not happen to food prices?

Dr Caldecott: Given the scale of the reforms and the things that need to be introduced, it is not crystal clear what is going to happen to food prices and levels of production. The priority should be getting a system that replaces direct payments and is aligned with ecosystem services. If we have a situation where that scheme is introduced, food prices are going up, self-sufficiency is going down and policy-makers think that is a problem, we should have a system in place that is dynamic, flexible and can respond to that priority. It is not necessarily the case that we will go down that route, but we need a system that is responsive to that.

Q95 **Chair:** The second question is linked to New Zealand. I have been to New Zealand. When they did away with subsidy, they also had quite a low level of regulation. I remember talking to farmers in New Zealand and they said, "We can farm partly because of our climate, our size and our scale, as long as we are not too regulated". I see quite the opposite here. If we are not at all careful, we will do away with direct support for farmers and there will still be a lot of regulation.

Free marketeers say, "Farmers should manage without subsidy." That is fine if you are going to free their hands up, but we are not. We are going to do quite the reverse. I want to see how you feel the New Zealand model might fit. In some ways, it does not fit in today's environment, given how green our policies on the environment need to be. They all cost money if you are not at all careful. I do not want everybody to have their hands tied behind their backs, to be given no support and then to be told, "You must work to the marketplace." That is an easy question to answer, Angela.

Angela Francis: If we get this right, payments for public goods should improve farming productivity. There are things that we can do, as has been shown, such as increasing wildflower margins at the side of a farm. Up to 8% of the land could be given over to those margins, to increase the yield from the crop by up to 25%, even including the fact that you have taken 8% out of production. You can do these things, because the benefits of natural predators and pollinators mean that you get more yield out of that farming area.

The Committee on Climate Change has also identified that you could achieve carbon abatements from farming in ways that save cost to the farming, so energy efficiency and reduction of use of fertiliser. There are win-wins where you can provide for the environment, provide public goods and improve yield.

To your New Zealand example, it is a very important one. We can look at the productivity story in New Zealand. I would say the light hand of regulation, at the point at which the subsidies were taken away, has developed an industry in New Zealand that is exactly what we want to avoid in the UK. What has happened is a very, very good productivity story. Policy Exchange quoted a 67% increase in productivity; we also quoted that figure in our report. But at that time you also had very serious environmental damage. Initially, 5% of farmers went out of business. They were not commercial. Some of that marginal land stopped becoming farmed, and that is understandable. There was a productivity increase because the more productive farms stayed in business.

Then, because they were not being supported, they intensified their farming production, and that led to a 30% increase in nitrates in the rivers. It led to e-coli in some water courses in the farming areas that had previously been swimmable and part of recreational use in New Zealand. It has been really devastating for the natural environment. Biodiversity was already challenged in New Zealand. They have very serious issues with invasive species. Add to that the fragmentation and intensification of agriculture, and New Zealand now has the highest species loss in the world. That is not where we want to get to.

Once they realised those problems were happening in New Zealand, they tried to bring in a biodiversity Bill. They had invented an industry that was at odds with the environment, which was lobbying to say, "Our environmental model does not work with environmental protection", exactly as you said, Chair. They have not been able to pass a biodiversity protection Act in New Zealand.

In the UK, we want to create an industry that is built on high standards and environmental quality. This is a challenge the world will have to face, and the UK is the prime place to do this. We have fantastic agri-environment expertise. I think you are talking to a tech panel later on. We have fantastic agri-tech expertise. If the UK, with its science expertise and its farming industry, cannot solve some of these problems, we are really going to struggle.

Chair: Our biggest challenge will be maintaining the support from the Treasury, because the Treasury will be saying, "Right, let us get rid of all that support." This is what I am fearful of. Naturally, and quite rightly, we will then need to have regulation. We do not want more nitrates; we want fewer nitrates in our water. We accept all those things but, like I said, it is about getting the balance right.

Q96 **Angela Smith:** On that point, I must admit I increasingly struggle with slogans such as intensification, because they are a rather lazy way of making an argument that oversimplifies the dilemmas that are ahead of us. It is not possible, it seems to me, to apply the same solution to all farming environments or to all farms. Having wildflower margins all the way around a field may be right in some circumstances, but not in every circumstance. Do you recognise, Angela, that the picture is very complex, and it will be difficult to come up with a system that puts public money in, in return for public goods, but which is detailed enough to apply accurately to every single farming environment, while at the same time maintaining basic ethical and environmental principles? I want to explore with you whether you think it is important to recognise that every single farm has different ecological needs and farming needs.

Angela Francis: Yes, absolutely. As we have decided we are going to move towards this public goods system, we now need to work out how to apply it. How do we reward outcomes? How do we reward improvements in public goods, biodiversity, carbon and flood prevention? How do we do that in a way that is regionalised, which prioritises what is important in those areas and is designed around what is possible for a farming system? There are going to be different thresholds. LEAF and other systems have different standards, depending on what is possible within a farming system. I am not the person who can tell you what the different examples are at all, but we absolutely recognise that it is not going to be a blanket approach for every farming system. It is about how we take our production of cereals, fruit, vegetables and meats, and improve them in their resource efficiency and carbon intensity. That is going to be a different challenge in each industry.

Q97 **Angela Smith:** Is there a role for crop protection?

Angela Francis: I am not sure if I know what that means. I am sorry.

Q98 **Chair:** That means the need to sometimes have chemicals to produce crops.

Angela Smith: That is absolutely what I meant, yes.

Chair: It is about getting the balance right. You talk about the margins. That is perhaps right for arable, which I think you were dealing with. Naturally, if it is permanent grassland, there is not a problem. Can I ask Dr Caldecott or Mr Taylor whether you have other points? Are there things about New Zealand that you think are useful for us to adopt?

Michael Taylor: I take the point on environmental regulation. One of the key messages from the New Zealand regulation was that the removal of virtually all state support in terms of subsidies and import protection fairly quickly produced a response from the farming sector. It learned to respond to the market rather than the Government, and costs were reduced. Over the longer term, a big diversification occurred. Previously, New Zealand had produced too much lamb and too little beef. That was corrected, and they diversified into kiwi fruit and the wine that we all enjoy today. In New Zealand, the farming sector now accounts for a bigger proportion of the New Zealand economy than it did in the mid-1980s. There have been positives.

Q99 **Chair:** Do you accept that that was at some environmental cost?

Michael Taylor: Yes, I am sure, given the regulatory environment in the 1980s, these things were less—

Q100 **Chair:** We are not living in the same world now, are we?

Michael Taylor: No, we are not, but the point is that the market works, as Australia and others have demonstrated.

Q101 **Chair:** I am playing devil's advocate now. The market works if you do not complicate it with a load of environmental regulations. You have intensive farming, and they can do what they like and compete with anybody else in the world, until you start saying, "You must do this." It is quite right; I am not saying you should not, but, the moment you ask farmers to do various things, some of the environmental controls might be useful and economic; others will not be. That is the issue. There will be people in this House who will argue that we can completely take the New Zealand route. I do not think we can, because we will want to have environmental restrictions.

Michael Taylor: There needs to be a regulatory standard. At the moment, there is the "polluter pays" principle. As we move towards alternative systems for providing environmental services, that system can move towards the beneficiary paying, so that farmers are paid for meeting certain regulatory standards. I accept there is that issue, but there are also some important lessons. As a more general point, the New Zealand authorities helped the adjustment process, regardless of any environmental issues, by providing debt write-offs and assisting farmers who wanted to leave the industry. There are lessons there that the UK could adopt too. There is never a perfect model for farm reform, but we can certainly take lessons from the New Zealand approach.

Q102 **Chair:** They set up Fonterra, which had 97% of milk production in New Zealand when it started, because only 3% was the home market and 97% was export. Therefore, they could support all that and market it. We cannot do the same here, because we have a much bigger home market. Milk Marque was split up in this country when it had 37% of the milk, if I remember rightly. There are lots of differences. That is the trouble. It is too simplistic to say, "Let us have a New Zealand model," because there are people about putting that forward.

Michael Taylor: Yes, there are differences. Policy Exchange is not saying we should adopt the New Zealand model lock, stock and barrel, but, in the report, we discuss the New Zealand approach and, as I say, there are elements of it from which we can draw lessons.

Chair: I detect you have a degree of enthusiasm for it.

John Grogan: I am slightly more sympathetic to the argument.

Chair: That is dangerous.

Q103 **John Grogan:** Lots of industries are regulated for environmental reasons and so on, with all sorts of regulations. They compete in the market and it does not stop them competing. We would not say that the manufacturing industry cannot compete because they have environmental regulations and so on. It is possibly an unfair question, because we have heard what happens if, as in New Zealand, you reduce the level of subsidy or eliminate it, but what would happen here? You talked about wine and kiwi fruit, and the decline of sheep. What would happen if there was a little more influence from market forces in agriculture in the UK? Which sectors would benefit and which would decline? Who would be the winners and the losers? We would all be running farms if we knew that, probably.

Michael Taylor: As Angela has said, everything is going to change. It is not just about the subsidy regime. There is the international trade environment and the degree to which UK farms are going to be subject to competition. I will make the point that the UK has very high animal welfare standards. We can compete at the high-quality end of the market in international markets. I do not want to get too quickly on to chlorinated chicken and those issues, but it is very important that we adopt a scientific approach to what is appropriate to import into this country, not the EU's precautionary principle. If something is safe to eat, we should allow consumers to choose whether they wish to buy those goods, provide them with all the information necessary and let the market decide in that way.

Policy Exchange approaches this based on the interests of the consumer, who, in the farming lobby, does not often get much of a voice. You would have to see. The UK has a wine industry. I am not sure it would necessarily grow hugely with a completely free market, but there are sectors that would clearly benefit from a much more open trading environment than they have at the moment, because of being within the customs union of the EU.

Dr Caldecott: I am no expert on the New Zealand case study, but we believe in the power of markets to unleash innovation and promote efficiency. The interesting question is how we can create markets in the public goods and ecosystem services that the country needs, and how we can empower farmers to identify opportunities to provide those services. They will often be the people who are best placed to identify them, and in a market situation they can then get them funded. That market structure for public goods and ecosystem services is absolutely key. I am cheekily side-stepping the question.

Chair: You sound almost like a politician there.

Q104 **Angela Smith:** I accept the principles around the free markets and particularly free trade within certain boundaries, but I wonder how applicable the New Zealand model is. There are very different ecological structures in New Zealand. The economy is different. It has a much smaller population, and consumer tastes and interests may be different. I wonder what you think, Michael particularly.

Chair: They have a different climate as well.

Angela Smith: They have a very different climate. Yes, that is part of the ecology.

Chair: They have virtually no winter as such. Grass grows virtually all the year round.

Angela Smith: Absolutely. This is part of the ecological argument. I wonder how applicable the New Zealand model is and whether you tested that in the preparation of your report.

Michael Taylor: We looked at the studies of the New Zealand approach to farm reform. The basic lesson we took from them was that farms, like any other industry, adjust to market forces. If you release market forces, there are benefits. Products are made that consumers want to buy. New Zealand competes in international markets. The prices of food in the shops are in line with world food prices, unlike in the United Kingdom, where our food prices—because of the common agricultural policy and the tariffs—are 10% or so above world food prices.

Q105 **Chair:** Your policy is to remove all tariffs, is it?

Michael Taylor: Ultimately, yes.

Q106 **Chair:** That is going to help farmers, is it?

Michael Taylor: It is going to help consumers, certainly. Ultimately, it will help to produce increased competition in the farming sector and a productive environment for the farming sector.

Q107 **Chair:** What worries me is that you will go down this route. You will open up all the markets, which is fine. You say you will bring in public goods if you feel like it. The Treasury will run out of money or decide to spend it on something else, and we will import all our food. That really does worry me. If we are not careful, what you are putting forward is a perfect storm.

Michael Taylor: I do not accept that. What you want in terms of food security is primarily a viable and productive farming sector that produces domestic food and, at the same time, protects the environment and maintains the quality of that domestic environment. Food security is also provided by having a wide range of international suppliers and importers of food at competitive prices, giving consumers what they seek in the supermarket. Food security is not the same as self-sufficiency. You do not set a target for whether we should produce 60% or 80% of our own food. It is a bit like trying to achieve an inflation target by having an incomes and prices policy. You do not do it that way. You create the policies that deliver the ultimate goal, which is free trade, minimal subsidies, paying farmers to provide public goods, diversifying their income stream so they have less income volatility, helping them to lift productivity and encouraging younger farmers into the industry. That is how you end up with, dare I say it, a New Zealand farming sector that is profitable and internationally competitive.

Chair: Angela, you have been keen to come back in.

Angela Francis: I hope you will have a chance to come back to some of the issues around food standards and chlorinated chicken later. I wanted to talk about New Zealand.

Chair: We will definitely get on to those at some stage.

Angela Francis: I wanted to come back to the New Zealand example. You made the point, Chair, that there are versions of how the UK competes in the world. The danger of the New Zealand example is that the UK tries to compete on cost in food and, in anything, the UK is not a low-cost producer. We are a high-quality producer of everything. That means we need to produce at every price point. We absolutely need to serve all parts of the market in the UK, but we will not be able to compete with New Zealand, Australia or the US on low-cost anything, pretty much. If we did, it would require a different type of geography. We do not have an Idaho or Ohio in the UK that we can turn completely into cattle ranches. We should not try to do that. It is not a place in which the UK will succeed, and it is not a place in which we will be innovating and developing the type of sustainable food production that we need to focus on. That is a false route.

If you decide you are not going to compete in that way, you need to decide how your values and policy around sustainable food production are expressed in your producer rules, which were the regulations you referred to, but also rules for consumers. We cannot have producers doing one thing but consumers being invited to buy food that is produced to completely different standards. Albeit that there might be transparency in terms of a label, that does not make it possible for farmers to compete in the UK, particularly when most of the food we eat is processed food. Some 60% of what we eat is processed. If we have cheaper bits of lamb and cereals coming in from other bits of the world, produced to much lower environmental standards—the evidence shows that, outside of the UK and EU, higher pesticide use, lower carbon content in soil and all those sorts of factors are part of the production system—we will be putting farmers in the UK out of business and getting lower-standard food from elsewhere.

Q108 **Angela Smith:** Can I go back to Michael? I did not get an answer to my question, but I will pose another question. Do you accept that, if we remove tariffs altogether, there will be a lot of competition, particularly from the US? That is quite clear. All the evidence in our previous inquiry suggested that. Does that not take the risk, therefore, of a lot of small farms in the UK going to the wall and the emergence of much bigger farms, and potentially rather big changes in terms of landscape? It could change the face of Britain.

Michael Taylor: You may well see larger farms, yes. In any radical change of policy there will be a change in the structure of the farming industry. Ultimately, if you wish to preserve landscape, that is a government choice in terms of public policy. That can be included in the public goods that are paid for. You may wish to preserve smaller farms, simply on the grounds that they provide the natural landscape that we wish to retain, and pay them accordingly.

Q109 **Angela Smith:** On the basis of that question, it almost feels as though we are suggesting that future payments should be used to address shortcomings in a free market model. What level of funding does the panel think we can redirect to other priorities and, at the same time, still achieve increased productivity and delivery of public goods? In other words, a significant level of funding would be required to correct any shortcomings that emerge from a free market model. What level of funding do you think would be required?

Chair: Michael, you are on record as talking about phasing out subsidies to fund other priorities such as the NHS. Let us ask you a completely blunt question. You cannot, therefore, have it both ways; either you want to support agriculture through the environment and public goods, or you want to slash it all. I think that is where you really want to go, so you have to be quite straightforward with your answer.

Angela Smith: Is there £350 million for the NHS?

Michael Taylor: I do not have a bus parked outside with any numbers on it.

Q110 **Angela Smith:** Are we going to do less agricultural subsidy or more?

Michael Taylor: Probably less. For 40 years, while we have been in the common agricultural policy, reform of agriculture policy has been virtually free of any scrutiny by your good selves and Parliament. Farm policy and spending on subsidies now has to be assessed on a zero-budget basis, along with all the other public spending priorities that Government have. Does it offer value for money to the taxpayer? What is its objective? What is the objective of subsidies? How do we achieve that in the best possible way with the most efficient policies?

That is what I am saying. In the report, we identify spending on public goods and the environment, and increased R&D spending, which is a similar sort of public good, to support the competitiveness and productivity in the agriculture sector. Thirdly, we identify anything left over that is available for the Government to reduce the public deficit or increase spending in other areas. I would expect a good proportion of the current spending of roughly £3 billion a year to remain within the provision of environmental services and R&D support. You may well find there is a billion or so left over.

Q111 **Chair:** You cannot spend money twice. How much of the £3 billion do you want to go to the health service? Once you have given it to the health service, it is not going to go to the environment or public goods, is it?

Michael Taylor: No, of course.

Q112 **Chair:** I am not saying you are necessarily all wrong, but, if you make a statement that the money should be shifted from agriculture support to the health service, how much do you see going? If you see £2 billion going, that is £1 billion left for agriculture. It is no good talking about how much you want for the public good. How much do you want to give to the health service?

Michael Taylor: That is not the way to approach this decision.

Q113 **Chair:** Why put it in your report, then, if it is not the way to approach it?

Michael Taylor: We want the provision of public goods, and that may well be provided by government spending, but it can also be provided, as my co-witnesses' reports have argued and we agree with, by water companies, local authorities, highways agencies and all sorts of other organisations. Once you have achieved that—that can be done for substantially less than a £3 billion cost to the taxpayer, with extra for R&D spending—I am not saying that what is left over should go on the National Health Service, but it can be allocated to other areas of government spending, if there is anything left over. Again, we are heading into a completely new environment. We do not know what the trade relationship with the EU is going to be, or what the migration issue is going to be for agricultural workers.

Q114 **Chair:** I suspect, if you were before a different audience, you would be telling them—I suspect I could find on record somewhere, if I looked hard enough for it—how much of what is at present spent on the CAP should be spent on the health service. I would a bit more of a direct answer than, "We will stir all this around." If support for agriculture is coming from other parts of Government, it still costs the taxpayer money, so it is not cost-free.

Michael Taylor: It is not just other parts of the Government, is it? It is private utilities and insurance companies.

Q115 **Chair:** Some of it will be private sector, but the other things you were talking about were not private sector.

Michael Taylor: There are other non-public sector sources of support for the provision of public goods. The whole point of the payment for ecosystem services is that it becomes a market, where voluntary purchasers and providers of services get together to provide an additional service in terms of the environment. I do not have a crystal ball any more than you do.

Q116 **John Grogan:** I will just pursue this point about the quantum of money. As I understand it—I am increasingly sympathetic to the Treasury point of view on this—we inherit £3.1 billion, but that has no logic other than that being what we spend on it at the moment. I will ask Angela to comment in a second. Ben, you were arguing that, because we spend £3.1 billion on agricultural support at the moment, £3.1 billion should go back into the rural economy. Does that have to be on agricultural support or could it be on other aspects? Even if you accepted that principle, could it not be on other aspects of the rural economy, on hospitals in rural areas or buses? Farmers get £3.1 billion now because that is what it takes to run the current system. If we could do it for £2 billion with all the environmental goods, surely we would do it for £2 billion. If we could do it for £1.5 billion, we would. What is magical about the figure of £3.1 billion that farmers get at the moment?

Dr Caldecott: The first thing to say is that we do not think a penny should be taken out of the rural economy, particularly during a period of very significant transition. Clearly that money, compared to the existing commitments of public money, could be spent significantly more efficiently.

Q117 **John Grogan:** It need not go to farmers, because the rural economy is more than farmers.

Dr Caldecott: Indeed, it need not go to farmers. The emphasis should be on how you leverage that existing contribution of £3.1 billion into the rural economy to get co-funding from insurers, water companies, property developers, civil society, philanthropists and so on. That is the exciting opportunity, and that is the way we get much more money into the rural economy. I agree with you: how did we get to £3.1 billion? That is the amount going in at the moment. People are putting that into their spreadsheets, planning around it and thinking about the economics of their farms, and you need to provide certainty.

Q118 **John Grogan:** Sure, but the rural economy is a wide thing and a lot of that is going to big landowners at the moment. You could give £3.1 billion and distribute it rather differently, even if you wanted to keep £3.1 billion.

Dr Caldecott: I agree.

Q119 **John Grogan:** Angela, what would you say on this?

Angela Francis: We would say that that money needs to stay in provision of public goods through the management of landowners, by supporting them to do different things. It is farmers, but it is also other people who have landholdings. A bottom-up calculation that has been done by the RSPB is their needs assessment, which says that to restore nature, which is a commitment we have made, would cost £2.4 billion. It acknowledges that we could count more in that by looking at soil restoration, which was not part of the first assessment and would bring it up to £3 billion to £3.5 billion, so a bit more to meet our environmental commitments. That is a route to support farmers to restore environment, which will support their farming.

Q120 **Chair:** You might get a bit more going in.

Angela Francis: Potentially, yes, in terms of the commitments we have made and the 25-year environment plan to restore nature within a generation.

Chair: We have to take you along to the Treasury.

Angela Francis: I am very happy to come to the Treasury and make that case. It supports the tourism industry, and it supports provision of public goods that save us money. We will probably come on to this later, but if we had soils, re-meandered rivers and more riparian strips in the country we would have less flooding, and that flooding is costing us in England alone £2.4 billion. How can we start to get rid of some of the negative costs we are facing in health and mental health due to the fact that we do not have accessible countryside or catchments that are water resilient? All these issues can be improved by the provision of public goods. It is not just something for the environment. It is for the betterment of society, and we need to start looking at it differently. Farmers providing those things, alongside providing commercial products into the goods market, is a route that makes more sense.

Chair: When we did our floods report we looked at catchment management. Angela, we have started to stray into your questions, so finish your questions. We are getting some good evidence, but it is taking us a long time to get through the questions.

Q121 **Angela Smith:** I want to come back to the question I just asked, if you do not mind, because there are two things here. One thing is that a view has emerged from the panel that not a penny from the existing level of subsidy should go outside of the rural economy, to which I am very sympathetic. The £3.2 billion should stay in the rural economy. Does the panel—those who agree with that principle—not accept that, nevertheless, there are significant risks here? Does the command paper offer any degree of confidence that that transition will be managed successfully in terms of the rural economy and its sustainable future?

My other question is to Michael. If money from leaving the European Union is to go into the NHS, how can the rural economy be expected to thrive? It goes back to the question: how much would you take out of the rural economy? We still have not got that figure from you, and it would be helpful to know.

Michael Taylor: It is impossible to give a figure, given the information that is currently available, because the development of the provision of ecosystem services is still to be undergone. We do not know how much extra money from non-public sources will go into the provision of public goods. We do not know the trading arrangement that we are going to have with the EU. There are so many unknowns.

All we are saying, at Policy Exchange, is that spending on the rural economy, farm support or however you want to describe it now has to be assessed against all other spending criteria that the Government have, to give taxpayers value for money. The choice may be that the Government want to support a certain landscape, maintain marginal farms in uplands and spend more money on public goods. That may be their choice. That has to be assessed and judged against other spending priorities. If you want to spend more on the rural economy—if you want to spend £4 billion, as I am sure some people do—the question is what you cut back on elsewhere. Do you cut spending on the National Health Service to increase spending on the rural economy? You have to make these difficult judgments. That is all we are saying.

Q122 **Chair:** Playing devil's advocate, you are very keen on farmers being very productive, and that is great. You are also very keen on putting money into the health service, which we probably all are, but you do not talk about how productive it is and how cost-efficient every penny we put into it is. All these things have to be balanced, and that is what I cannot quite see. You obviously want to take some money away from what is being spent; otherwise, you would not have put that in your report. We have not had that case. Is it £1 billion? Is it £2 billion? Is it all of it? Where do you see it going?

Michael Taylor: Of course it is not all of it. The first two priorities are the provision of public goods and a reversal of the cut to R&D spending for the farming sector. Then the remainder, however much it is, needs to be assessed against other public spending priorities, such as the NHS, as we say. I am not even saying it should be the NHS. It could be increased defence spending, education, pensions or any other form of government spending. It just needs to be assessed.

Q123 **Chair:** I accept it will be part of a public spending round, will it not?

Michael Taylor: Yes. That is all we are saying in that. We are not saying £1.75 billion should be spent on public goods, £250 million on R&D spending and £1 billion extra on whatever public spending you want to increase. It needs to be assessed against all other public spending for the first time in 45 years.

Q124 **Angela Smith:** Given the contents of the command paper, do the other two members of the panel feel any confidence in the ability of Government, and particularly Defra, to deliver a positive outcome for the rural economy? I am using that term now as a more general way of articulating what you are looking at.

Dr Caldecott: Quickly reflecting on what Michael was saying, the £3.1 billion is a lot of money, but the rural economy and our countryside are the heart, lungs and soul of our country. Given all the things Angela was saying and all that we know, the cost-benefit analysis is that it is incredibly good value for money. The problem is that we have not been having that national conversation because of CAP and the European Union. Now we can have that conversation, and I think the politics, the economics and the value for money analysis would show we should be putting more money in.

The key thing for Defra and the Government is to lay out where they want us to get to, the broad arrangement of the future scheme and how it interacts with the market, FTAs and other things. They are doing a very good job of making progress in that regard. As we have said in our paper, you cannot transform these arrangements overnight. It is going to take quite a bit of time. We need that vision and that direction. Then we will have to have phased implementation. We will have to be grown up about that, have that conversation and recognise that there will be a lot of pilots, a lot of learning by doing, and it is going to take quite a bit of time.

Angela Francis: In terms of risks from the command paper, we all want to get to the same place. We want to have a shift to sustainable food production, more environmental public goods and profitable farming businesses in the UK. That is an agreed position. The disagreement comes in how we think we are going to get there.

From our reading of the command paper, the first risk to that is that Defra is not talking enough about food production. It is not talking enough about how public goods fit into that frame. In our paper, we say that changing the way you produce food delivers public goods. Crop variety, different methods of tilling and more precision agriculture with less fertiliser use are all very valuable in delivering public goods. You have less pollution; you have less energy use. That is a public good. It is not just what you do alongside farming; it is what you do as you farm. That is crucial. Defra needs to tell farmers more that it will be supporting them to innovate and find new ways to be efficient and produce food. That is a critical part of the piece that is missing.

Secondly—and this is a very big risk—our farming policy and our trade policy are going in two different directions. There is a very real danger that we set up one set of rules for how we produce, and then we set up another set of rules that says you are allowed to use neonicotinoids and to chlorinate your chicken, so we have high welfare standards here but support low welfare standards elsewhere, and those come into the market. A farmer is not going to be required to take up our new scheme. He will be encouraged to do so, but he will be faced with Government telling him at the same time, "You could join this public goods scheme or not."

Q125 **Chair:** What you are answering—quite rightly, in a way—is question 5 here. The command paper, as far as I can see, is very good at telling farmers that the payments are going to go. It provides much less information on what they are going to be replaced with and whether that will be anywhere near the current level.

Angela Francis: We are very concerned that the vision of farming is not about farmers being gardeners. That is a term that Policy Exchange used at one point. It is not that they are going to be providing habitats and doing nothing else. It is about how we integrate habitat provision and soil restoration with farming, and those two things can complement each other. I gave a couple of examples, and there will be more. It is an innovation challenge. It is a huge innovation challenge for farming to find out how we produce food in a different way. The UK could be good at lots of those things. We are blessed with lots of water. We have lots of expertise in the science and technology that will change farming, and we need to be in that game.

We are in danger, through misaligned policies, of putting our farming industry out of business. We talk about this concept of an option value. There is an option value on being able to produce food sustainably in the UK. If we lose farming land to housing development—that is one of the other Policy Exchange proposals: to give over more farming land to housing development—and we lose the capacity to farm, we are in danger of not having the sustainable food production in the UK that we need. We will just be buying food from elsewhere, where we have even less control over carbon intensity and all the food miles associated with that. We are trying to get to a different place, and UK farming has to be part of that. We cannot have a hands-off attitude to what happens to farming as a result of policies.

Q126 **Chair:** You have thrown the gauntlet down to Michael. Come on; let us have an answer from you. You are going to build all over the countryside, are you? That is the answer to profitable agriculture, is it? It probably is, for a few individual farms.

Michael Taylor: Yes, a few select individuals. No, that is not what we said in our *Farming Tomorrow* report. We have a housing problem in this country and, if some land is released from farming, one option could be housing development. Equally, environmental and other services could be provided. We quote the value of an acre of farmland and the value of an acre of land that is available for housing development, and highlight the difference in that value, which is 40 or 50 times, as an example. It is not Policy Exchange's policy to concrete over the British countryside with lots of semi-detached houses.

Q127 **Angela Smith:** That is what the Barnsley local plan will do, if they get their own way—at the behest of the Government, by the way, not of Barnsley Council. I am losing agricultural land in my constituency to housing development because of government policy. Anyway, I have got that one off my chest.

I want very briefly to go back to Angela, because you raised a very important point. This issue of determining the scheme before we know what trade policy looks like could be quite risky because, if we end up with the removal of tariffs and a free trade position, particularly in relation to the US, the only protection farmers will have in that context is subsidy, in terms of being able to maintain the environmental standard. Does the panel think that farmers may be forced in the end to engage in the scheme relating to public money for public goods, because of the trading context that they will be working in?

Chair: Can I bring Michael in on this and add to that one? You tempted us earlier on with the chlorinated chicken from America, and you talked about a scientific approach to life. Is your scientific approach to life that these chickens are safe to eat? There is no doubt that they are safe to eat.

Michael Taylor: Yes, they are safe to eat.

Q128 **Chair:** The problem is that the animal welfare conditions and environmental conditions in America are much more intensive, and they whack them with chlorine or whatever they use at the end to make sure they are fit to eat. Are you saying we should accept chlorinated chicken from America? If you are, the only way we will compete is by using the same method. Is that what you were talking about when you talked about science? I am intrigued as to where you are on this one.

Michael Taylor: Yes, we think there should be a scientific approach, whether it is to chlorinated chicken, GM crops or hormone-treated beef. Are these products safe for consumers to eat? We should not use health, safety or animal welfare standards as an artificial trade barrier.

Q129 **Angela Smith:** On that basis, can I go back to my question? That would almost make it imperative that farmers make use of any scheme that allowed them to maintain very high standards. Michael Gove has made a commitment to not dropping standards. We would be forcing farmers to make use of the scheme, effectively.

Chair: Angela, he went further than that, did he not? He sat over there and I said to him, "Secretary of State, if there is one last thing on a trade deal, and it is chlorinated chicken, are you going to stop that coming in?" He said, "Yes." The chances are that he will probably not be Secretary of State for Defra when that situation occurs, but that is the issue. It is quite an interesting one, because I do not necessarily disagree with some of your economic arguments, but from an animal welfare point of view it would be the wrong way to go. Do not forget: Michael Gove wants to see very high welfare standards. How do these two things balance?

Angela Smith: Go back to my question as well.

Chair: I still want to pursue Michael for a moment. Then we will bring Angela in, to give you a rest.

Michael Taylor: Thank you. The point is that we are all about giving consumers greater choice across a range of products. Ultimately, it may very well be that UK consumers do not want to eat chlorinated chicken. Let us get to that point. In that case, it will not be imported into this country. It is safe to eat. Consumers may judge that they do not agree with chlorinated chicken for whatever reason and, therefore, they choose not to buy it. What is wrong with that? It is consumer sovereignty.

Q130 **Chair:** Once that chicken comes in under that standard—and we may well choose to do that—we either become uncompetitive by having higher welfare standards, which we rightly need, or we adopt the American system. What we cannot have is both. You cannot, on the one hand, let everything in whatever its welfare standards are, and then those who can compete on higher welfare standards do, and the rest of them go to the wall. That is not fair and equitable, and it is not good for animal welfare either. We are a nation that believes in animal welfare. That is the bit that we cannot quite balance.

Michael Taylor: You set minimum animal welfare standards. Are you saying that no country should be allowed to import food into the United Kingdom unless it also meets the UK's animal welfare standards, which are the highest in the world? That, to me, is an artificial trade barrier. I agree we cannot let in absolutely everything, but you set a minimum above which you allow imports. I agree this is perhaps a market problem.

Q131 **Chair:** Even in the WTO now, there are animal welfare standards allowed to be brought into the equation. Do you accept that there are higher costs of production with higher welfare standards?

Michael Taylor: Yes, inevitably there are.

Q132 **Chair:** Say you were saturated with a lot of chicken, maybe from America, from Thailand or from all over the world, which is to lower standards. We have a very effective poultry industry that is unsubsidised in this country, but one thing that matters to it is the way we trade. The poultry industry is a very good one to deal with, because this is about trade. It is not about subsidy or support. This is a real issue.

Michael Taylor: Chlorinated chicken would presumably be cheap. It would be low priced and low quality. The alternative would be higher-priced, higher-quality chicken. They would both be safe to eat. Assuming they both met minimum animal welfare standards and the consumers had the information—

Q133 **Chair:** Which would the consumers choose to eat then?

Michael Taylor: Surveys show that provenance and animal welfare are considerations in consumer purchases.

Chair: That is what they say. What they do is quite different.

Michael Taylor: Price is obviously important, especially in the current environment, but they should have the choice. That is all we are saying.

Q134 **Angela Smith:** If Michael's scenario is allowed to triumph, for want of a better way of putting it, we are in a position where we either have a free trade deal with the US that allows this much cheaper food, produced to much lower standards, to come into the country, or we are in a tariff situation with no deal. The point is that any scheme that is determined before those scenarios materialise would presumably be based on public money for public goods. My hypothetical argument is that farmers in that situation would be forced to take up the scheme on offer from the Government. They would have no choice. Is that not a risk in terms of farmers and Parliament being asked to agree the terms of a scheme, before we even have any idea of what any trade deal or trading scenario looks like? Are there not real risks in all that?

Michael Taylor: I agree there are real risks in terms of the trade agreement. For example, if it all goes wrong and we end up with no trade deal, UK farmers are suddenly subject to WTO tariffs imposed by the EU. That is a risk to the trade.

Q135 **Angela Smith:** I am talking about the dangers of putting a scheme together before we know what any trading scenario looks like, deal or no deal. That is the real danger, because then farmers will be trapped with a set of choices that they will feel incredibly uncomfortable with. If they have a scheme on the table that has been delivered and agreed by Parliament, which they may have reluctantly signed up to, they might find that they have very little room to manoeuvre in any case, because the trading scenario they have in front of them is so unpalatable in terms of their profitability.

Dr Caldecott: There are no regrets to setting up an effective market-based commissioning scheme for public goods and ecosystem services. The issue, which is what you may be getting at, is the amount of money that would underpin that scheme. You could argue that, in a low-tariff environment where farmers are getting less money from selling their produce because they are being undercut by lower-cost competitors, to keep their living standards at the same level, they would need to get money from somewhere else. We are saying that a good chunk of that money should come from a market-based commissioning scheme. You could end up with a situation where tariffs are very low but, if Government wanted to keep living standards at the same level for farmers, they would have to increase the quantity of subsidy.

Q136 **Angela Smith:** It is a public-money-for-public-goods system we are talking about.

Dr Caldecott: Yes, but we are arguing that they are not just public goods; they are also ecosystem services. Not all ecosystem services are public goods.

Q137 **Angela Smith:** Say, for instance, poultry farmers, to go back to Neil’s point, are being undercut by cheap US chlorinated chicken. The scheme on the table gives more emphasis to ecosystem-based outcomes, such as soil quality, water quality and so on, and does not put as much emphasis on animal welfare. That is where the problem may materialise, surely. Some parts of the agricultural sector, say poultry or livestock, may suddenly find themselves at a big disadvantage because of the shape of the scheme that has been agreed by Parliament.

Dr Caldecott: I am not sure it is about the scheme. I think it is about the FTA that would have been entered into. If anything, a well-designed scheme should be a risk mitigator for them, in the event of an unfavourable tariff agreement.

Angela Smith: I am sorry; I cannot hear you.

Dr Caldecott: In the event of an unfavourable tariff agreement in an FTA, a well-designed scheme for ecosystem services and indeed livelihood support should be a way of mitigating that risk. It should help them get more income.

Q138 **Angela Smith:** How can it do that?

Dr Caldecott: It can, if it is properly designed and has money behind it.

Q139 **Angela Smith:** One of the criticisms of CAP is that it is very bureaucratic, and farmers are demanding a simpler, less bureaucratic, light-touch approach. We cannot deliver both in the circumstances that you are talking about.

Dr Caldecott: If a land manager, land farmer or land owner does not want to produce ecosystem services, and they do not feel that they can make any money from producing the produce that they are producing because of a tariff settlement, we have to entertain the prospect that they might not be in the farming industry any more. That is one of those outcomes that could happen. We would presumably all want farmers who are producing high-quality produce, who can produce and want to produce ecosystem services, to be very successful and to be profitable. If people do not want to play that game, they might want to do something else.

Q140 **Angela Smith:** Do you think certain sectors would be more vulnerable in this respect than others? Given what you have just said, I could see that livestock farmers may be more vulnerable on this score than, say, arable farmers.

Dr Caldecott: I would hope that we could design a market and commissioning framework for ecosystem services that is sufficiently broad that there are a wide variety of different options for different types of farmers. I am not a poultry expert but, for example on carbon sequestration or efforts to reduce emissions, there could be ways there. One of the ecosystem services could be carbon sequestration or carbon mitigation, so linking the reforms of ecosystem services to that climate mitigation agenda.

Chair: If you want to reduce the carbon in poultry, you have to produce them more intensively and more quickly so that they are on this world for a shorter time. It does not all work in this happy environmental scheme. This is why poultry is a really good example, because it is not subsidised. It is completely in the free market, and it wants to be able to produce a good-quality product and not have a lot of inferior poultry under lower welfare standards. That is what will kill it. It will be killed by the fact that you bring in these lower standards, because there is no subsidy going into the poultry industry. This is where we have to wake up and smell the coffee. We need a policy where, if you want to have more of an open market, that is fine, but you have to let those producers trade somehow equally. Take the laying industry. You might have a lot of free-range. That is good; that is more extensive, but most of the meat chickens that we eat in this country—the broilers—are reasonably intensively produced in poultry houses. Some are outdoors, but not very many. That is key to making sure those welfare standards are maintained on the imported product. I know John has been desperate to get in.

Q141 **John Grogan:** I will move on in a second, but I will take up that point and press Angela a little. Do you think you perhaps underestimate consumers and are in danger of allying with the producers? For example, I can choose to buy organic. You talk about not having consumers in a different position from producers, but that is true at the moment. I can buy organic if I want, or not if I do not want. Are you not in danger of getting into bed with the producers here and underestimating consumer power, which drives environmentalism around the world?

Angela Francis: It is an interesting point as to how far consumer power can drive environmentalism and the extent to which we have those premium markets. Organic is one version of farming. We are probably not going to solve our environmental problems by everybody turning to organic, but there are other things within commercial farming systems that could be improved, which we need to do, which customers do not and should not be expected to have a clue about. There is a role for Government in making markets work, by looking at where there is good practice and innovation, and raising the bar, raising the regulatory standards and taking out the people who cannot achieve them.

Q142 **John Grogan:** To press you a little further then, is the logic of that that we would not import any food that did not meet our very high animal welfare and environmental standards? Your post-Brexit future is basically autarky because, on that argument, we would not import anything.

Angela Francis: Not at all, no. At the moment we import most of our food from Europe, which has similar environmental and welfare standards to ours, although not as good; the UK's are better. We are trying to look to a world where we start to export our standards and hopefully start to improve. What we are looking at, at the moment, is a place where we end up importing worse standards, so we are going in the wrong direction in terms of the values we have around animal welfare and environmental protection.

John Grogan: So we can import from Europe but nowhere else.

Angela Francis: No, not only Europe, but it is our major source.

John Grogan: In the future, you admit we could continue to import.

Angela Francis: I would like to see us importing on the same basis and to the same standards. I would like to see us exporting standards, and we do that in some cases.

Q143 **John Grogan:** You would make it illegal to import if they were not the same standards. Would you or would you not? Is it an exhortation?

Angela Francis: I would maintain our standards. The European market at the moment is so powerful that, in Australia, they produce non-hormone-injected beef to our standards. We have purchasing power, which means that we can export standards that have an effect on animal welfare, and the UK should continue to do that. We are a smaller market, but we are still a very important one. Ideally, people will move to us. The point about whether those standards are necessarily going to cost us more is an empirical matter. Within the food system, buyers are increasingly looking for reliability and quality. There are so many issues in terms of milk quality, salmonella and CJD—all the issues that cost the food industry a huge amount of money. High standards are proven to be one of the things that producers want.

Chair: We have to try to keep our answers a bit more concise, because of time.

Q144 **John Grogan:** I will move on with one final one. Is it a bit convenient that we said £3.1 billion at the moment, and your bill for green policies in agriculture came to about £3.1 billion? You would not be saying £3.1 billion to make the manufacturing industry green. You would be saying, "Regulate, and you have to meet the standards." Is it not just a bit convenient that you do not talk much about consumers? Are you a bit in bed with the farmers?

Angela Francis: We are very interested in consumers, and 82% of consumers have said they would not want to trade lower UK standards for a trade deal with the US, for example. I know it is different in the supermarket and it is difficult for consumers but, if you ask them, "Do you want to lower UK standards?" they say, "No, we would like to maintain our standards. We would like to support our British farmers." We need to make a system that makes that possible for them.

I do not think we are in bed with the farmers. We want to strongly push the farmers to do more of what some of them are doing and move to higher environmental standards. That is not easy, but we want to support them, and that definitely requires regulation and enforcement of that regulation. It requires a support system that is clear and provides payment, so they can work out a business model that provides ecosystem services, food and potentially other services. It requires support for innovation, with grants for different business models. Somebody might want to change the production system they have had in their farm for generations. That is a huge endeavour.

Q145 **John Grogan:** Finally, because we are short of time, in a way this transitional arrangement—I am acting as devil's advocate here—means farmers have got it good again. They have more guarantees that the current system is going to go on than any other sector in the economy. It now seems to be meandering into the mid-2020s. Whatever system we bring in its place, this transition cannot go on endlessly, can it?

Angela Smith: I do not think automotive has done so badly.

Chair: I do not think it is to the mid-2020s; it may be 2022.

John Grogan: I am asking the panel. We can get on with this, can we not, in a couple of years?

Angela Francis: We are asking for a transition period of five years, and we want the transition to the new system to start in 2022. During that period we already know what the new system is, so farmers have certainty and can start changing how they provide public goods in their business model. We see that as absolutely critical because, otherwise, we are in danger of some of the things that you have raised and Treasury just taking the money. If we do not get to a new system and start delivering public goods, we are in danger of having a long period where we do not move from what is essentially a subsidy, which is very hard to defend and has been very hard to defend—the only reason we have it is because it is part of CAP—to a system for payments that is much easier to defend. It is a way that farming can have a long-term investment promise with Government that can be defended by the environment sector and by farming, and that is good for customers. We need to move to it quickly, because otherwise we are in danger of just going from subsidy to nothing.

Dr Caldecott: We need to recognise that this is complex. The endpoint is going to be disruptive and innovative. There are going to be new entrants and intermediaries. People have been working together in different ways. They have not done that before. We know, with the creation of new government schemes, markets and stuff like that, things can go wrong. Given that we are playing with people's livelihoods, there should be as much certainty as possible.

Q146 **Angela Smith:** That is the point I was making earlier. It is quite clear that the scheme would maintain current standards. Michael Gove has made that commitment; he will not drop standards. We are effectively putting a scheme together that is based on our current trading patterns, and the risk is that farmers will face a situation when it comes to implementation where the trading environment is completely different. I do not accept the notion that the scheme can be flexible enough to adapt to that. We never got Angela's response to that.

Angela Francis: I very much sympathise with the concern. I would reverse the question. We are designing an agricultural support system; we are designing it around the agricultural system we want to see, and our trade policy should be aligned with that. We cannot design something that says we want to have high standards of food production and then undercut ourselves with a trade deal that says we will allow all these different standards.

There are two bits of the trade deal. One is the tariffs, which are relatively modest in terms of prices. The analysis says that we could reduce prices by 1% for cereals, 1% to 2% for fruit and vegetables and 3% for meats, if we unilaterally removed tariffs. The big difference comes when you change standards. That is when you suddenly allow lots of different products. We could remove tariffs; I do not agree that we should, because I do not necessarily think it is a great first move, going into a trade deal, to unilaterally remove all your own tariffs. We could do that, but the issue really comes when we decide to change our food standards. That is a different question. As long as our food policy says we are maintaining standards and we will maintain them for the food we import, we do not have a problem.

Michael Taylor: If Green Alliance has said consumers care about standards, let them express that preference for high standards in a marketplace that includes lower-standard chlorinated chicken and other safe-to-eat products.

Q147 **Angela Smith:** Why do farmers not engage in GM, then? Surely that is because the *Daily Mail* has managed to wage a fairly successful campaign exactly on what is seen is a lower standard. I am in favour of GM, but I appreciate that the agricultural sector will not engage in and support the development of GM, because it fears the market.

Chair: We can agree on GM, but we might not be able to on chlorinated chicken.

Michael Taylor: The Australian model is interesting. They produce both non-hormone-treated beef for the high-standard EU market and hormone-treated beef for other markets. There is a choice of standards and prices.

Q148 **Angela Smith:** We are now able, under modifications to the European Union rules, to engage in GM production on a limited scale, but we are not doing it because the perception is that consumers will not accept GM foods, which is why it is on the labels in the shops: "No GM products or ingredients in this product."

Michael Taylor: That is good, then. Consumers demand certain standards so, therefore, they will not buy substandard products such as chlorinated chicken. Maybe one or two will, in which case they get cheaper food. What is wrong with that? You seem to think that consumers demand high standards in this country. That is very good. That is excellent, so there is nothing to be feared from a trade arrangement that allows slightly lower-standard products into the market. It is a market process of consumer sovereignty.

Angela Francis: Transparency is good. We should have transparency and there are labels on food. You can communicate all different sorts of features in terms of provenance and production standards. Most of the food we eat is processed, and it is very complicated to see, apart from buying a joint of lamb and a fruit or vegetable, where those bits of food have come from. Most of the food we eat is in that state, so I do not think transparency is a complete solution to the problem.

Q149 **Chair:** Without playing devil's advocate too much, going back to the GM issue, all the poultry coming in from the US will be fed on GM—fed on the GM that we cannot grow here—and imported here under lower standards, so we are at a competitive disadvantage again. I go back to my initial point that we either have to have this open market, letting the market take its course, or go down a much more controlled route. If we go down a controlled route, that is where we see the support. Michael, the argument I have with you is that you want to have an approach with very little support, and to open up the market. If you are not careful, you will drive our standards down and drive a lot of farmers out of business in the process. That is the bit that worries me. Would that be unfair?

Michael Taylor: That is one point of view. The other point of view is that you subject the markets to competition and you allow consumers to decide. That is what a market is all about. If high standards are a good thing and consumers value them, they will be maintained.

Q150 **Chair:** You are saying we should let the consumer decide as to whether he or she wants those higher standards.

Michael Taylor: Yes, and by all accounts they have expressed a view that they want high standards.

Q151 **Chair:** We have to put that to the test, do we not?

Michael Taylor: Indeed, we have the opportunity to do that and should seize it with both hands.

Q152 **Chair:** We have had a fascinating discussion. We have covered most of the other questions, and it has been really good. You have given us some really good food for thought; thank you very much. It has been most appreciated. This evidence will all be part of our reaction to the command paper, and it is really good. I am mindful that we have a second panel to come in, but I very much appreciate you. Thank you. We always have a very robust approach on this Committee, so do not be too worried about that. It has given us some different ideas, arguments and angles on the whole subject, so thank you very much.

Examination of Witnesses

Witnesses: Tim Bennett, Fraser Black, Professor Simon Blackmore and Tom Hind.

Q153 **Chair:** Welcome, everybody. Starting with Tom, if you would like to introduce yourselves, we will go across the panel.

Tom Hind: I am Tom Hind. I am the chief strategy officer at the Agriculture and Horticulture Development Board.

Tim Bennett: I am Tim Bennett and I am chairman of CIEL, the livestock research agritech centre, which works with a consortium of 12 leading universities. At the moment, we are making the largest investment in new livestock research and innovation capacity for a generation.

Professor Blackmore: I am Simon Blackmore, the head of agricultural robotics at Harper Adams University and at the new EPI centre, and director of the National Centre for Precision Farming.

Chair: Right, so we should be able to reduce labour if we have more robotics. Is that right? Good.

Fraser Black: I am Fraser Black. I am the CEO for Crop Health and Protection Ltd, which is another of the agritech centres.

Q154 **Chair:** Thank you very much. I will start off with an interesting question. Why is UK agriculture less efficient than some other EU countries' and the USA's? Is this to do with production standards? Where is it?

Tom Hind: I will make a start on that question. I would draw a distinction between efficiency and productivity. We know that our productivity is not growing as fast as that of some of our major competitors. The average rate of productivity growth in the UK agriculture and horticulture sectors, over the course of the last 10 to 15 years, is about 0.9% a year, whereas in the Netherlands it is around 3.9% a year. We only know so much about that. It does not necessarily tell us where we start from. It just tells us that we are not growing our ability to convert inputs into outputs as quickly as our major competitors are and that, if we have not lost competitiveness already, at some point we will. There is a productivity challenge that we need to get a grip on, in the wider economy and in terms of agriculture and horticulture.

The analysis that we have done already identifies six key drivers to productivity. A number of those do not appear to massively distinguish the UK, or at least England, from some of our major competitors. We have a relatively favourable macroeconomic climate. We have some strengths and weaknesses, in terms of our natural capital and natural environment, which enable us to farm reasonably productively compared to, say, the Germans or the French. We know we operate more or less in the same policy environment as the rest of the European Union.

In our assessment it comes down to three key things. The first is how we invest in innovation, which is primarily research and development. The second is how we translate knowledge, skills and techniques on farm to farmers. Finally, it comes down to skills. When we look at the UK, those three areas appear to mark us out compared to some of our key international competitors.

Q155 **Chair:** You compare us to the Netherlands and a lot of the Netherlands is highly productive land, pretty intensively farmed. We have a lot of land that we farm much more extensively, if you take the whole of the United Kingdom, especially if you take the west of the country and Scotland into the equation. Does that have an effect on our productivity?

Tom Hind: Absolutely, and it would fall under the category of natural capital and the natural environment. None the less, there are large parts of England that are equally productive and large parts of the Netherlands that have natural constraints, not least of which is the fact that it is low-lying, and water. The Dutch Government recently imposed phosphorous controls on the ability of farmers to farm there, so it does not appear to me that that is the big differentiator, although I admit it could play a part in terms of the productive capability of farmland in parts of England—certainly the part of England that I come from, but also large parts of Wales and Scotland.

Q156 **Chair:** In a new environment and agriculture policy, the hill land, the permanent pasture and all these things may well be seen as a more valuable commodity, but it may not be as efficient. That is the trouble. How do we balance the two?

Tom Hind: It is a question of the productive capacity of the land. You are absolutely right: there are large parts of England and the United Kingdom that are areas of natural constraint, however they are currently classified from a European perspective. That is unlikely to change. There are things that can be done to improve the performance of agriculture right the way across the country, whether you are in the upload or the lowland. That is probably a discussion we will come on to, but it is understandable that there are some constraints in some parts of the country.

Tim Bennett: On the productivity debate, from our perspective in terms of livestock, investment in research around animal welfare, animal health and the environmental impact, some of which we are doing and perhaps might get on to, is key for everyone. Sometimes what is missing in the productivity debate is that, when you start to produce a product, you might not be pushing maximum productivity because you are in a marketplace that has a differentiated product. That is my first point. Also, it varies quite considerably across the sectors.

Q157 **Chair:** In the livestock sector, in which you are particularly involved, is it the breeding? What is it that has potential to increase productivity?

Tim Bennett: Listening to the earlier exchange, you invoked poultry, Chairman. From a science point of view, in terms of adopting innovation and transferring it, poultry did it fairly rapidly. That was a combination of being in a competitive marketplace and having an integrated system. If you go to the other end of the livestock system, sheep and beef are particularly extensive. They are in a different marketplace. They are not so intensive. They do not pick up innovation and knowledge, or invest in that from one end of the sector to the other. Obviously, dairy has put massive investment in.

That is one of the challenges for the future. We have already had that challenge, but it is much more pertinent now. How do we transfer the innovation that is already there, plus the research that is coming on stream? How do we put that into a form such that our sheep, beef and dairy farmers can pick it up and then use it for better productivity, more efficiency and effectively producing the right product for the consumer? It is about producing something that the consumer wants.

Q158 **Chair:** It is almost designer chicken now. It has been bred to a stage where it has the right meat in all the right places, and it converts very quickly. The sheep and the beef industry are not quite there yet, are they? Do you think we can be targeting that in the future?

Tim Bennett: It is certainly something we have to be better at. It is very easy to say that farmers do not adopt new technology. Frankly, that is rubbish. If you have an obvious gain for the consumer that is simply communicated, there is good evidence that people will adopt that technology very quickly, so it is a combination of better communication and understanding the industry needs better. Science cannot be driving what the industry needs; it has to be a very good partnership between the priorities of industry and academia, and then finding better ways of communicating. The supply chains are so different from beef and sheep farming to poultry, so we just need to have a better communication system.

They are very vulnerable, if you look at all the economic analysis, so we have to get better science. We have to get that information and get them adopting it as quickly as possible, so they can cope. They are already facing a more competitive world; Brexit has just speeded it up. We started in 2016, but we were part of the agritech strategy in 2013, when Government moved back into the applied science role. If you remember, a couple of decades ago they pulled out and just did basic science. The fact that we exist is in recognition of that, because Government wanted to come back into the applied science role, having identified that that was part of the productivity issue. Now, we are mainly funded by the business department, but closely work with Defra.

Q159 **Chair:** Professor Blackmore, as far as you are concerned with robotics, are you mainly involved with the crop sector or the livestock sector as well?

Professor Blackmore: It is particularly crop production and, more recently, I have been more involved in the horticulture sector, fresh vegetables and so on. To come back to the concept of production in the UK, over many years we have seen how the advent of precision farming has brought in a whole range of new technologies. Very rarely have we been able to increase yields, but we have significantly reduced the cost of production, which makes things a lot more viable.

With the advent of Brexit and particularly since the referendum, talking to the major growers, there is a lot of panic, literally with the big growers, which use a lot of seasonal labour. We are now envisaging a completely new mechanisation system for crop production, based on small smart machines. The more we develop these ideas and the more I look at our current system, the more I consider that our current machinery system is not fit for purpose. It locks farmers into farming in a certain way. It is all based on economies of scale, which is very good and we all understand that, but we have now reached the end of the economies of scale, because the machines cannot be made any bigger.

There is a new paradigm coming in that I call intelligently targeted inputs. That is no more than what you and I do in our gardens. If you want a simple idea of how robots will work, it is just what you do in your garden. A little machine is going to do that out on the farm. It is as simple as that. We have the technology to do this. We now have the imperative to help the production system in the UK. It is a wonderful opportunity. We have the capability to lead the world in this area. We have the world's first commercial crop produced in the UK under the Hands Free Hectare, where one hectare of barley has now been produced with nobody going in. That was only a demonstration. The actual cost of it is ridiculous. It is the most expensive barley in the world, but we have proved the point.

Q160 **Chair:** What about vegetable and horticulture production, and the harvesting of crops and things?

Professor Blackmore: That is the area we are now focusing on: the row crops and so on. They have higher value and, I would suggest, higher management levels, and can therefore cope with more sophisticated technology. Also, a significant amount of horticulture uses hand labour. What is now happening is that instead of bringing the cheap labour to the production system, the major growers are moving the production system to the cheap labour, and I do not think any of us want that to happen.

Chair: That is a big challenge. You are saying that, with technology, we can reduce the amount of labour we need.

Professor Blackmore: In certain areas, yes.

Chair: That should improve our efficiency in the long run.

Professor Blackmore: I am an engineer, and I am applying engineering principles to the crop production system. It is all about efficiency, but also about sustainable intensification. Again, we have had a lot of discussion recently, and I am sure you have been involved in all the glyphosate discussion. I say do not ban the chemical. There is nothing wrong with the chemical. Ban the dumb machine that is applying the chemical in the wrong places. We can now use cameras, identify weeds and put spray only, directly, 100%, on to the leaf of the weed and nowhere else.

Chair: The amount you would use would be vastly reduced.

Professor Blackmore: We can save 99.99% of the chemical. If we then go on to another project I have just finished, which is laser-weeding, we can recognise the weeds with a camera.

Q161 **Chair:** You can electrocute weeds now, can you not?

Professor Blackmore: There are a lot of ways of killing small defenceless plants.

Chair: Somebody came to me the other day who said you can electrocute weeds now. I do not know if you have done research on that. Is it effective?

Professor Blackmore: Yes, it is valid. As I said, there are 100 different ways of disrupting a small green plant, but the point is to identify it. The reason that I chose lasers is that I look at the whole system from an energetic point of view. We use huge amounts of energy in our current production system, and a lot of it goes off-target. Farmers have to pay for it and it then comes up as pollution, which is daft. None of us wants this.

Q162 **Dr Johnson:** I should mention at this point that I am a farmer's wife. The mechanisms that you describe for killing weeds sound very interesting. To what extent are they affordable on smaller or medium-sized farms, as opposed to the principle of use in all farming?

Professor Blackmore: I am glad you asked that question. There are a lot of assumptions about robotics, but most of them are wrong. Most of them think that it is only going to be for the big farms, and that is not the case. The big farms are very efficient with the big machines, but the robots, being smaller machines, will fit into smaller field structures and will cost significantly less—about the price of a car, I think. In fact, we will not be selling them; we will have them as a service, not a product, to share the risk with the farmer, instead of selling farmers new gizmos that they do not need.

Q163 **Chair:** It could be provided by universities. It could be provided by contractors.

Professor Blackmore: It will be by private companies.

Q164 **Chair:** Contractors will have these robots and go round to the various farms.

Professor Blackmore: They will just go and kill the weeds or do the fertilising. To come back to the point on who is going to benefit the most, there are two factors. The small to medium-sized farms are going to benefit the most, and those farms are actually going to help us feed the planet. The big farms are waiting for genetic modification and so on to hit yields everywhere, but yields and productivity can be increased now on small to medium-sized fields by appropriate use of new technologies. These small farms with small fields cannot use the big machines. They cannot tap into economies of scale, but they can tap into intelligently targeted inputs.

Chair: It might be better for some of our lanes and hedges as well, but that is another issue.

Fraser Black: First, I would endorse many of the things that my colleagues have said. We see the same thing: if we talk about the productivity that has come through, it is not that we are not getting better at productivity; we are, but we are just losing ground on everyone else. There are two key reasons around that. It is about the amount of innovation that we are able to bring forward. As we talked about, we have been spending more on basic research rather than applied research. I am glad to see that that is turning round and we are getting some money put into it.

Secondly, in the adoption of that innovation, we know that different types of farms have different capabilities and different farmers have different capabilities. Your top farmers are much better at farming than the bottom farmers, so the adoption of different easy techniques as well as technology is different across the spread. We have an opportunity to focus on these top farmers and make them the pioneer farmers, so we can bring innovation through. More important is how we get that from the top farmers down to the medium-level farmers. That has been lost over the last years. Our farmers tell us that they wish they had some kind of service where they could get free independent advice that allowed them to see what the best farmers were doing and bring that to their farms. If we could do that, it would be really engaging.

Q165 **Chair:** How would this free independent advice be provided? Does it have to be done by Government? How does it have to be done?

Fraser Black: I would imagine it would have to be done by Government, as it was done in the past. We still have a number of companies that do exactly this right now but, if you have that free independent advice, it makes it easier for all the farmers to get to it. It needs to be tied to delivery from the top-tier farmers. Equally, you have to be able to show the top-tier farmers how the innovation works. You cannot just tell them. We would always advocate that we get some demonstration farms out there that show us the best technology and take these guys who like innovation to it. They will pick it up, and they will tear it to pieces to make sure it works and get it really working. Then you can take that free advice to the next level.

Q166 **Angela Smith:** I visited a demonstration farm last week, Rawcliffe Bridge, which is a BASF partnership that goes back some years now. We discussed exactly this concept. Do you accept, Fraser, that it would be important to have almost a kitemarking process to make sure that farmers have confidence, not just in any advice given, but in the technologies and everything else that they are being offered by this advice service?

Fraser Black: If it is a licence, a kitemark or whatever it is, we need to get it. They absolutely have to be able to do that, yes.

Q167 **Angela Smith:** Simon, you mentioned the new technologies that are available. There is also weather observation and weather intelligence increasingly available to help the process of delivering precision farming.

Professor Blackmore: If we look at the machinery system we have now and the big machines doing the same thing everywhere, it is like a production line. The industry has moved over to flexible production and we do not have the tools, because of the changes in weather, market prices, legislation and all these things. The smaller smarter machines are part of a new flexible production system in the agricultural sense and allow a lot more versatility. One thing that we are trying to do is to take away the limiting factor from the machines and put the limiting factor back on the agronomy or the weather, because we cannot do anything about those things. We design and build the machines, and they are stopping us from doing what we really want.

Q168 **Chair:** They should be able to travel under wetter conditions as well.

Professor Blackmore: Yes, absolutely; the ultra-light machines we have been developing can go out at field capacity now without doing any damage. Farmers would not be able to take a tractor out at field capacity to put seed into the ground or do anything. Similarly, the weeding robots we are talking about are weeding over the wintertime, when a tractor would not normally be out in the fields. It is a new paradigm. We are exploring new ways of farming to achieve all the things that we want to achieve and look after the environment, but just do it in a different way.

Q169 **Angela Smith:** In the context of this inquiry, which is about the Government's command paper, when we talk about Defra's ambitions for the agricultural sector we are talking post-Brexit. Do you believe that the Government's ambitions for the agricultural sector can be met without increasing UK farm productivity?

Tom Hind: No, absolutely not. Put simply, if we do not grow productivity we will lose ground and lose our farming industry. The ability to maintain an affordable, high-quality, high-standard raw material supply from the UK depends on growing productivity, because it is the route to competitiveness. It is ultimately about the efficiency of what we produce, but it is also absolutely critical to our sustainability, because key to unlocking productivity growth is better use of our natural resources. Therefore, from my point of view and from our point of view, productivity and sustainability are two sides of the same coin. Absolutely critical to delivering the Government's vision, which is probably a vision that most of us would share in terms of the food industry that we want, is that we have to focus on productivity, just as we have to do that in our wider economy.

Tim Bennett: I could not agree more with that. A lot of the investment that, for example, is going into livestock production is not necessarily just about animal health and welfare and reducing disease. In a part of the world that the Chairman knows quite well, North Wyke, we have the most instrumented land in terms of measurement, greenhouse gas and leaching from land and production in the world—or so I have been told this morning by the research director there, so I believe that. There is a lot of investment going into that. All of that sensor technology and knowledge can be built into GPS tracking on nitrogen applications.

The new world that Simon describes is becoming available, and will hopefully be less bureaucratic. Data and sensors are a means to an end. You identify the objectives you want to achieve and then you use those as a tool. That requires quite a lot of investment in terms of livestock production. It is more productive, but it is also more sustainable, because that is where society, both through regulation and through consumer preference, is heading.

Chair: We also need to make it cost-effective. That is where the circle needs to be squared.

Tom Hind: I just want to rewind to a couple of observations from the earlier points. Fraser made an observation about losing that connection in terms of demonstration farm capability. There is absolutely something in that. You can correlate the decline in productivity growth in the UK with the demise of ADAS, the Agricultural Development and Advisory Service. We are not going to re-create ADAS. The world has moved on, but we need to do something that brings that back. However, we absolutely must guard against fragmentation. One of the reasons why farmers find it so difficult to access advice and information is that there are so many people out there. There are 14 different types of advisory service in the industry and 90 different actors, according to the AIC. We have to join that landscape up. We have to bring it into one place to make the private sector and the public sector organisations like us work much more closely together.

Chair: As much as I would like to hear from all four of you on each question, is there anything different you would like to add? You are welcome to, but I just think, with four answers to all these questions, we will never get there.

Professor Blackmore: One aspect of the production system is that we now find big data playing a major part. For certain products, we find that the data itself is worth more than the product, when you look at the chain going all the way through, to the point of tracking and tracing. When we develop this new system, we need to make sure that there is a metadata system there at the same time.

Fraser Black: The one point I would make about productivity is that, if you look at it, it is much easier to go after the inputs rather than trying to change the yield. If we focus our efforts on those elements, that is how we will get the best results.

Q170 **Dr Johnson:** I wanted to come back to what someone said about lots of different people giving lots of different advice. I know as a medical professional that that often causes people a lot of problems, because they are not sure which advice to take. Is it not simply the case that there are lots of different ways of doing things? I am aware of different groups like Nuffield, the Worshipful Company of Farmers and informal groups that function in Lincolnshire, which are like a club where farmers meet together to hear from somebody about the latest piece of technology. Surely having a variety of different opportunities for farmers to learn and a variety of different sources of information is better for the industry rather than one fix and an "everyone must do it this way" piece of advice.

Tom Hind: It could be if you had a market economy in which advice was available to everybody, in every part of the country. What we have is fragmentation across the different types of advice from agronomy and farm business consultancy to financial advice, animal nutrition and genetics. None of this is necessarily in one place, although we aim to provide some of that resource as a non-advisory service. We also have market failure. In a sector like beef and sheep, the only source of advice is the vet. The key sectors where we absolutely have to focus our attention to help the industry improve its performance, partly to navigate a successful path through Brexit, are the beef and sheep sectors. That is an area where there is a market failure in terms of advice.

I am interested in the analogy with the healthcare sector. You are probably better qualified than I am, Dr Johnson, but there is an interest in the agricultural and horticultural sectors in emulating the role that NICE plays as a what-works centre. We certainly feel, from the collaboration that we have had with some of the agritech centres, that a case could be made for using the opportunities we have to create a what-works centre for agriculture and horticulture. It would not necessarily require a big investment, but it would be quite an important investment to create that one-stop shop for evidence, advice and knowledge that is independently and objectively verified.

Tim Bennett: Very often, if you are in a large farm structure, there are lots of people employed and you can do a lot. With well-set-up systems you can pick up knowledge. If you are a family farm working very long hours, you have limited ability to know who is giving you good advice or not. This has happened for a long time, for the last two decades, Tom. You are not quite sure what the quality is going to be and how we measure that. These are people who have very limited time. If they get that first bit of advice wrong, it could cost them a lot of money. There is something about the quality of service, as well as an ability to communicate and create time for people on these family farms to be able to access that advice.

It is about time. We have to think of a better way of doing it. It is no use saying people can Skype; you have to get them into a farmer-to-farmer situation. You have to expose them to people, showing they are doing a better job in all sorts of ways and that it is perfectly accessible to them. That is not a criticism of anyone; that is the system we have. What are we going to do to improve the system if we are going to remain competitive and keep our farming structure?

Q171 **Dr Johnson:** If you had a NICE system, would you envisage it being funded by Government or by farmers, or would farmers pay for individual pieces of advice on a case-by-case basis?

Tom Hind: It could be both. It needs a catalyst to establish it. We as an organisation would be prepared to make our contribution to it and potentially house it as well.

Q172 **Angela Smith:** We saw with the previous panel a lot of focus on profitability. To turn the previous question around a little, I would ask if Defra is focusing too much on productivity rather than on profitability.

Fraser Black: I am assuming that better productivity would give you better profitability.

Angela Smith: I think so as well.

Fraser Black: That is where we are, but it often depends on market demand. You have to listen to the market. There is no point producing things the market does not want, because they will obviously not be profitable. On the assumption that you are producing the right things for market demand, you should be more profitable.

Professor Blackmore: The cost of production is an important factor here. Most farmers would tend to think that they are doing better if they get higher yields, but if they are coming at a significant increase in cost, it is better to go round the other way, in order to maintain the yields and significantly reduce the cost of production, and hence you get much better margins.

Q173 **Chair:** Do you not think that, for years, farming has been concentrating too much on this, in many respects? Sometimes the very last 100,000 litres of milk that you get from a dairy cow costs you the most of all the production. Will we have to try to reverse some of our thoughts?

Professor Blackmore: From my point of view, this is going to be very disruptive. If we have our eye on sustainability, making money and the long term, this amount of disruption is okay. It is acceptable, but it is going to be quite difficult. I agree with everybody else here that we need to demonstrate this. It is all very well talking about a robot being able to do this, that and the other. No farmer is going to be interested in that until he or she sees it on the farm actually working as an enabler. The only way of breaking into that market is to get these things to be demonstrated, so I agree entirely.

Tom Hind: We should clarify that productivity is not necessarily about producing more. It could be producing less or the same, but just doing it more efficiently. It is absolutely the same thing and Fraser is absolutely right: if you increase productivity, you will increase profitability at the end of the day

Q174 **Angela Smith:** Farmers, in my experience, know their own land and are notoriously—I was going to use the word obstinate, but I do not think that is the right word. They have to be persuaded very carefully to adapt and change their practices, because they know their own land. I just wonder how much of a challenge that may be. It is about the right way of going about doing the business, really.

Professor Blackmore: Precision farming is information intensive with all the sensors. We are coming down now to plant-scale husbandry. Do we have the knowledge to be able to deal with individual plants? If we have the right sensors, we might get an insight into them, but that level of complexity is there. I come back to the point that the current machines do not allow us to do that. They are 36-metre-wide machines, and they just do the same across the whole 36 metres. It is a new area that we need to move into and encompass that complexity.

Tom Hind: Coming as I do from a farming family in your neighbouring constituency, I can relate to the point. I am from the north side of Sheffield.

Angela Smith: I am from north Sheffield.

Tom Hind: It is the other side of Stocksbridge. You can tell a Yorkshireman, but you cannot tell him much. None the less, we tend to assume that farmers will be switched on by something that will help them reduce their costs or improve their turnover. For a lot of farmers, particularly farmers in areas like the Peak District, it is about making our lives easier and making it simpler. Tim made the point earlier about how we communicate and connect. Actually, communication and connection may not always be about how you improve your profitability or productivity. It might be about how to make your life easier.

Chair: The thing is how you demonstrate that to farmers. If you can take them out and show them how these machines kill the weeds, do all of this and do the smart technology, they are much more likely to buy into that than if you just send them a paper.

Tim Bennett: I think you alluded to genetic improvement earlier, Chairman. There is no doubt at all that we could have rapid improvement in productivity in terms of adoption of the latest genetics, particularly if sheep farmers adopted that. You then get into the sensitive area of breeds for particular areas. New Zealand did away with that; it just produced sheep that were for the marketplace at the right cost. I am not criticising that; I am being quite careful about this.

Chair: Then you have the hefted flocks.

Tim Bennett: You have all those traditional barriers that are part of the countryside and part, in a way, of the natural environment debate. It is about how you bring those into the policy as well.

Q175 **Chair:** Professor Blackmore, you have more or less answered this one, but the Government's command paper notes that the Hands Free Hectare project is a potential future model. How far away is this technology from a proper commercial rollout?

Professor Blackmore: Hands Free Hectare was set up I do not know how many years back. We were talking about grand challenges and so on, and I was trying to think about what the grand challenge for agriculture was. They used to call it the "autonomous acre", but the young bucks decided that we could not have acres; we had to have hectares, so we turned it into the Hands Free Hectare.

Chair: Our generation understands acres. When we come to sell it, we always sell it in acres, because it sounds a lot more.

Professor Blackmore: The Hands Free Hectare project took existing equipment and virtually free open-source drone software, and put it on to it. The purpose of this was to address the perception that it is expensive and is going to cost a lot of money. In that case, it does not. The most difficult part is still all the agronomy, understanding the weather and getting the management right.

Q176 **Chair:** The commercial rollout is an interesting part of the question, is it not? How ready are we?

Professor Blackmore: The trouble is that I am a research professor and my job is to look further ahead than most people. My current thinking is that we should now ban the tractor and ban the sprayer. Ban the tractor because it is doing more damage than it is worth. We are dragging bits of metal through the soil, putting a lot of energy into the soil, breaking up the soil and then compacting it. Some 90% of the energy going into cultivation every year is to repair the damage caused by the machines in the previous year. Every year we are damaging and repairing. This is just not sustainable and yet everybody is doing it.

Chair: Perhaps use the words "phase out the tractor" rather than "ban the tractor". I cannot entirely see myself selling that to all my farming constituents, banning the tractor, but I understand where you are coming from.

Professor Blackmore: The alternative is to use these small, ultra-light machines, but it is so disruptive that the big machinery manufacturers are not interested. The mainstream and all the different coloured tractor people know this. I have been talking to them for years and they are not investing in it. It has to come through start-ups, so I am working with two start-ups now.

Q177 **Chair:** Could Defra and Government try to stimulate that? We do not want to get too involved in the commercial sector, but how could we stimulate that to speed it up?

Professor Blackmore: I was in California last week. They have a lot of very similar problems, but on a much bigger scale. There are a lot of very big farms there, but they still have labour problems and they want to become more efficient. There is a lot more money there, and there are the accelerators. There are a lot of start-ups and people who have good ideas, but there is a much more formal or organised system for taking these daft, crazy ideas through to show that they are not so daft, and getting them into the commercial sector.

Chair: Are you saying your ideas are daft and crazy? But, yes, it is about getting it out commercially.

Professor Blackmore: To be honest, as I said, many farmers have these problems now. They say, "I want to buy this equipment now." I say, "No, you cannot buy it." Government have played their part in offering a 50% grant for laser weeding, but nobody is making laser weeding. We are battling this chasm of death the whole time. The early adopters are in there.

Q178 **Chair:** In a way, this may be partly beyond Defra and more to do with BEIS. It is something that we would probably need to talk to Ministers about. Very often, we are good at innovating and designing something in this country, but much less good at making it. You raise an interesting point. You think that, in order to roll it out to the marketplace commercially, quite a lot more has to be done. Unless we get going, it is going to be quite a few years away, is it?

Professor Blackmore: Government can play their part. We have just been talking about demonstration farms. If this was properly funded by Government—okay, they do not want to spend this money—and we could take these research machines and get them into the field working, the start-up companies and the VCs would be a lot more attracted.

Q179 **Dr Johnson:** If farmers can sell red, yellow, green and blue tractors at £100,000 and these machines are going to cost the same amount as a car, how are you going to persuade the large producers and sellers that they should sell a cheaper, less profitable product?

Professor Blackmore: You are talking of the dealers.

Dr Johnson: Yes.

Chair: They are mainly foreign tractors. There is hardly a British tractor there. They are all imported from Europe, basically.

Professor Blackmore: Again, I would put that down to the marketplace. I see these things as being a world commodity, not just for northern Europe or Britain, because this extra level of production can come in many other countries that have smaller field structures. We need to get that into mass production in order to bring the prices down. To be honest, I do not think it will be an issue because, although I have said that the machinery manufacturers are not interested, they are keeping a watching eye. They have what is called growth through acquisition. I was at a company last week, Blue River, doing smart spraying systems. John Deere bought it a few months ago for $300 million, so that is a game changer now. Everybody is now looking at this. The machinery manufacturers will buy the small start-ups when they are interesting enough.

Chair: The big machinery manufacturers really are the Americans and the Europeans. I do not know whether the Australians make much.

Professor Blackmore: It is worldwide. Every country has its own bits and pieces. We have some quite advanced machines here, but this is quite a new sector in terms of robotics, rather than bits of metal.

Q180 **Dr Johnson:** I have covered a lot of this anyway but, essentially, what are the main barriers to getting farmers to take on these new technologies on the farm? How can we overcome them?

Professor Blackmore: I want to make a quick point. Farmers want it now; there is no barrier. For a lot of the things that I am talking about, when I am talking to the farmers, they say, "I want to buy one now."

Chair: They just cannot, basically, because these things are not there.

Dr Johnson: They are not commercially produced.

Q181 **Angela Smith:** In relation to your wonderfully provocative statement about banning tractors, the farm I went to see last week is a no-till farm, so it does not use tractors. It has taken a long time for the farmer to adapt to that system. Is that one of the potential barriers for arable crop farming?

Professor Blackmore: We are now talking about micro-tillage, ultra-light tractors and not doing any damage in the first place. It takes quite a long time for the soil to recover. We have been doing our controlled traffic farming work for six years and it is only starting to improve in terms of structure now. All we are really doing is looking at it from first principles. Instead of damage repair, damage repair, damage repair, just do not damage it in the first place. That has to make sense to everybody.

Q182 **Angela Smith:** That is part of the conversation with the farmer now, is it?

Professor Blackmore: Yes.

Chair: Especially for those who farm on alluvial soils like I do, given the damage you do when it is wet, when unfortunately you have to get out there with the machine, it would make a huge difference. I suppose we are likely to have to do harvesting in a more traditional way but, by then, hopefully the weather would be drier.

Fraser Black: The adoption of any technology, particularly disruptive technology, is difficult. That is why it is disruptive, because you are changing the way things are done. It will take a generation to get this through. You have to start with the coalition of the willing: those who really want to buy it and do it. You have to be able to set them up, even if you are putting it into a trial farm, on a trial basis, for 10 years or however long it takes. You have to be able to show that it works. Without showing that it works, no one else will pick it up.

Q183 **Chair:** That is the obstacle. Once you get over that obstacle, the farmers will be very keen to get out there, and that is what you have all been saying. It has to be proved to them and, once it is proved, they are fine. If it is not, they will not touch it; they will say, "Oh, I do not know about that." That is the issue. In the world we are moving to, they will need to embrace that more than ever.

Professor Blackmore: It is interesting talking to the farmers, because it is the generation older than us that is buying into the robots directly. They say, "We remember what it was like before the big tractors came in." They can see it straight away.

Angela Smith: That is interesting.

Tom Hind: Some of the demonstration is happening, but it is happening imperfectly and there is not enough of it. We have now established a series of 46 strategic and monitor farms, working very closely with Agri-EPI and collaborating with other partners, but it is not enough. We need to do more.

Q184 **Chair:** Very quickly, I am not a great believer in Government putting their hands over everything, but how do we get the Government to stimulate the industry?

Tom Hind: There is much that we can do, working together, to collaborate with the people who already have the platforms, the college network, the likes of the agritech centres and our own farm excellence platform. There may well be a case for trying to catalyse and increase that through a limited amount of funding.

Q185 **Chair:** Is it a job for AHDB to put some funding into it?

Tom Hind: It does not really matter whether it is us or somebody else. The key thing is that we do it in a co-ordinated fashion; otherwise, we will lose ground.

Q186 **John Grogan:** I will confine myself to one question, largely to Fraser and Tim, on funding. Incidentally, I am particularly affectionate towards Stockbridge House in the Selby constituency, which I used to represent, and I had a bit-part role in helping to save all those years ago. I notice it is now doing a lot in lighting and how that combats mildew and so on. Given that, what is the funding going forward as we come to Brexit? Is all your funding secured until 2022, as other people's is? What is the situation?

Fraser Black: No, our funding is not secure, but we are hoping it will be secure as we go forward. We are delighted with the money that we have had, but that allows us to do just what we have done, and our ambitions are beyond that. To your point about what is happening down at Stockbridge, we have started to build an LED facility down there, which will be terrific for that whole area. We are looking at eliminating weather as a way of growing, so vertical farming is coming through. We see a lot more disruptive technology that we would like to go after, which we think should go in coalition with the evolutionary changes that we make to the traditional farming areas. Yes, thank you very much, but please can we have some more?

Tim Bennett: It is a very pertinent question at the moment, because we are just undergoing a mid-term review with BEIS and Innovate UK. We were given funding effectively to March 2019. I think that is probably linked to the comprehensive spending review round. We are very much at the early stages of that, because, remember, the announcement was 2013. You cannot just build new research capacity overnight. The companies were formed in 2016. From our perspective, we had the matched funding from 12 universities. There was a near £70 million investment in new capacity. Some of that capacity will not come on stream until 2019.

The plea I would make is that, having now moved back into applied research, as most countries in the world do, including those that do not subsidise their famers, we need that continuity. If you build the capacity, do not follow through with the research and then do not transfer that to the industry, you have wasted some money. This has to be a long-term plan.

It is in a very exciting phase now. When this was started, it was about industry and academia working together to improve productivity and flow out to the food and farming industry. While we have been building that, a lot of the research capacity we have is linked to society aims in terms of better welfare, better measurement of the environment and the natural capital debate, so that investment is going to start to bring results that the Government can use to measure whatever scheme they might bring in. Some would say that was a great vision in 2013, but we are now in the right place to start to deliver. That is a case we will obviously make, because most of our funding comes from the business department, but I know that BEIS and Defra are increasingly working closely together on this agenda, which is really important.

Q187 **John Grogan:** As a very quick follow-up, a couple of times you referred to the debate about blue-sky funding and more applied research funding. Has that debate definitely been concluded, in the sense that more is shifting towards applied research now?

Tim Bennett: You obviously have to do both. Tom alluded to the loss of a good advice system all those years ago. I would also suggest that we were very much keeping up with the rest of the world in productivity. You could also trace it back to when we lost the intervention in applied research from a government aspect.

I repeat this because it is important: Governments that do not want to subsidise their farmers around the world invest in this, because it is a market failure and it is good for the economy of the country to have that research coming through. That innovation is not just about domestic production. It is export. We are working with others around the world on this innovation, as I know Fraser is, so we will start to build that up ready for the UK economy.

Fraser Black: One point I would make is that, as we invest back in applied research, we will see private funding coming back to us. Basic research is less interested in doing that but, as we get closer to market, they are keener to do it. We are not just asking for money from BEIS or from Government, but it will help us leverage and build the confidence that we have this capability, in not just doing basic research, but translating it through. That will bring industry to us, from overseas as well as here, to help us to achieve the goals that we are after.

Tom Hind: While there is little doubt that the agritech strategy bolsters investment in applied research, there is still a fundamental problem in the way that we govern and organise our research funding. Far too often, funding is issued on the basis of competitive calls. We force these guys to compete with each other and with other businesses to obtain funding, rather than collaborating and working together on strategic research programmes. We have to turn the paradigm for how we commission research on its head to be much more strategic.

Q188 **Chair:** I have a couple of last questions. Should receiving public subsidy be dependent on farmers adopting new techniques to improve productivity? Do you see any link there? Does it need to be a carrot? Does it need a stick as well?

Professor Blackmore: With the sort of things we are talking about now, the two go hand in hand. It is built into the technology. It is a little bit difficult sometimes. We did a study a little while back on whether precision farming is good or bad for the environment, but it is like a tool. You can make money and make a career out of a hammer, but you can do some damage with it as well. It depends on how it is done. Where we are talking about fundamental efficiency, stopping waste and stopping pollution by the use of these technologies, they are already entirely built into that scenario.

Q189 **Chair:** If the public good and the environment are the basis for support in the future, one should follow the other.

Professor Blackmore: The two will go together, I am sure.

Chair: You will just have a few people who will be resistant to change, but of course they will be less resistant to change if they find that it increases their productivity, as well as improving the environment.

Professor Blackmore: Very rarely do you get economics and environment pulling in the same direction, but in this case they do. I can put my hand on my heart and say that we are going to have this equipment. Let us take advantage of it sooner rather than later.

Tom Hind: My nervousness is that it assumes that new technology is the only route to productivity growth. It is not. Skills are really important in this respect and, for many farmers, it may well be that reducing some of the previous capital investment that is sitting as depreciation on their books will enable them to become more competitive. Therefore, we need to look at it a little bit more in the round, but incentivise, yes, absolutely.

Tim Bennett: Stepping outside the scientific questions a bit, one of the criticisms of the CAP regime is that the state has told you what to do and that has stifled innovation. There are some dangers if you do not allow the farmers to respond to the market, with state assistance to help them make that progression. If we get back to a cross-compliance regime and say, "You must do this; you must do that," we probably will not have moved too far forward. The philosophy is about working towards the market, with help in terms of communication, skills and the science availability.

Q190 **Chair:** Farmers, like everybody, react better to carrots than they do to sticks, really. The final one is for Tom. What is AHDB going to do to help stimulate knowledge exchange? You are probably doing some of this already. This is levy money from farmers, so where can it be directed?

Tom Hind: We see it as a key part of our role. I mentioned earlier that we have bolstered our on-farm demonstration knowledge exchange capability through the creation of this platform of 46 strategic and monitor farms. We are extending that, and will be moving towards nine strategic dairy farms in the course of this year, for example. That will go some way to improving accessibility. Also, we know from our experience in the cereals and oilseeds sector that it is a great means of engaging farmers.

We are investing in benchmarking through the creation of our new Farmbench tool, which is a cross-sector benchmarking tool available for the first time. We are also investing in our people. We are working more closely with the private sector and our strategy has explicitly positioned us as the knowledge-exchange partner for the agritech centres. We want to do more in that space and we want to work with people. Jane King, my chief executive, talks about creating an army—a coalition of the willing—so we can all work together. That does not require Government. That is about us. It is about the industry all working together in a fundamentally different way. We think that we can play a really important part in that.

Chair: That was very positive.

Q191 **Dr Johnson:** This is a question about the NICE-type guidance that you suggested. That was a very interesting idea. I know that you are keen to get messages out to farmers who, like you say, are very busy people and work long hours of the day. The thing with the NICE guidance is that the clinicians who look at the evidence and make the decisions on a population basis have no interest, financial or otherwise, in the decisions that are made or how they are implemented. If you did such a thing for farming, how would you ensure that it was objective, that its objectivity was seen to be such by the farmers and that it was not dominated by what was best for the larger industries, which may have the opportunity both to invest in your NICE guidance and to provide the expertise, staff or whatever to go to that?

Tom Hind: That is potentially a complex question. I suspect it would be better if I provided some written evidence to the Committee that tried to explain how that might work.

Q192 **Chair:** Yes, that would be useful. If, gentlemen, you have any ideas that you think, as we have been through this session, you might like to put to us, please give them to us in writing.

Professor Blackmore: You asked what the Government can do. We need to change the legislation in the use of spray drones. In China, 100,000 farmers are now using spray drones, which we are not allowed to use in this country. Sure, we have to do it in the right way, but legislation is stopping us from using new technologies and we have to overcome that barrier.

The second point I would like to make is that the Government are interested in relationships with the farmers. With the removal of CAP, the payments and so on, how do we know what the farmers are doing? Before I came back to the UK, I was running a European FutureFarm project that was dealing with the information systems to allow farmers to adopt certain strategies, which are then financeable or payment can be made for adopting those strategies. That is all on the futurefarm.eu website.

Chair: Thank you very much. It has been a really good session with some really good ideas that we can put together, to go with our ideas on the command paper. We thank you very much for a very good evidence session.