HM Government

Industrial Strategy: government and industry in partnership

A UK Strategy for Agricultural Technologies

July 2013

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Britain didn't just lead the Industrial Revolution – we led the Agricultural Revolution too. As science and technology change the face of agriculture, we are now in the vanguard of agricultural technologies, pioneering new approaches to food and farming systems.

The UK is home to world class agricultural research in technologies and science. Drawing on exciting breakthroughs in plant and animal breeding, remote sensing, meteorological prediction and the exploitation of data, the UK's most progressive farmers are leading the way. Our world class food and drink manufacturing and retail sectors are highly competitive, supplying consumers both in the UK and abroad.

In this Agri-Tech Strategy we pose questions and offer some answers about how the UK can meet the challenge of feeding a growing population without damaging our natural environment. We are committed to a range of actions that will realise our vision of enabling the UK to regain its world-leading role in the race for better, more efficient and more sustainable agricultural production.

Central to this is rebuilding the connection between basic research and applied science to create modern systems that allow our own farmers to access agri-tech expertise and use innovative techniques. The Government spent £450 million in 2011/12 on agri-food research and development (R&D). We have secured a further £160 million in this strategy to accelerate innovation by UK food and farming businesses and to drive UK growth through the emerging global markets.

The strategy also sets out actions to ensure we have people with the right skills to develop ideas from the laboratory to the farm. We are committed to improving the European Union (EU) regulatory framework and unlocking new opportunities in trade and investment. Importantly, UK science and technology can play a vital role in efforts to improve food security in developing countries. Through this, and commitments made at the G8 Nutrition for Growth event in London, we will support agriculture and food systems that address global malnutrition and lift millions out of poverty in Africa.

The Agri-Tech Strategy will be led by industry, working in partnership with the public and third sectors, to unlock long-term investment by businesses, private investors, foundations and trusts, and Government, as well as seeking long-term, sustained growth in inward investment in the sector. Our industry-led Leadership Council will shape the strategy and identify opportunities for industry co-investment.

Through this partnership we want to realise our ambition for UK farming to become more competitive, more productive, more resilient to plant and animal disease and better at protecting the natural environment. We want the UK to be at the forefront of the global race to sustainable intensification whether in the underpinning science, efficient farming practice, the level of supply chain innovation or the role played by processors and retailers in opening up new markets and stimulating investment.

The UK has a long history of global influence in agriculture. With a continuing push for innovation and a focus on making brilliant ideas a reality, we can again lead the world in this vital and expanding sector.

Rt Hon
David Willetts MP

Minister for Universities and Science

Rupert de Mauley

Parliamentary Under Secretary for Resource Management, Local Environment and Environmental Science

Rt Hon
Justine Greening MP

Secretary of State for International Development

2 Industry Foreword

The challenges facing the food industry are well documented. From adapting to the effects of climate change, to feeding a growing global population with dwindling resources, it is very clear that the degree of change that is required within food and agriculture systems, and the pace with which that change needs to be delivered, requires us to adopt new ways of doing things.

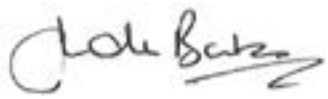
From an industry perspective this agricultural revolution is being determined not only by these global environmental factors, but also by the demands of UK consumers. Consumers rightly expect us to deliver quality food produced to increasingly high social, environmental and ethical standards. Leading food retailers, including my own, understand this issue well. After all, for most of the UK population, retailers are the public face of the food chain. It is this unique position in the supply chain – as the interface between the industry and public – which underlines the key role retailers have to play in connecting researchers, farmers, producers and manufacturers to the markets they serve. I am delighted to represent the industry and to co-chair the Leadership Council tasked with shaping this Agri-tech Strategy.

To some extent the universal challenges facing the sector are already being tackled: joint Government-Industry initiatives like DFID's Food Retail Industry Retail Challenge Fund help to improve sustainable production in developing countries; research clubs such as the BBSRC's Diet and Health Research Industry Club play an important role in engaging smaller parties; and retailers are working ever closer with farmers and growers through, for example, Farmer Development Groups, to develop an end-to-end understanding of the value chain. However, publication of this Strategy, supported by investment in agricultural informatics data, and the application of existing research and technology, will provide a further catalyst to industry to think about the bigger challenges.

The underlying goal is sustainable intensification of our agricultural sector. This is not a term we should be scared of. It is simply about getting better productivity and yields with reduced inputs and environmental impact. Industry has already shown this can be done by, for example, using GPS and precision farming techniques to ensure more targeted application of inputs. One of the challenges posed in the Strategy is how we translate existing research and scientific know-how so that we move the industry forward as a whole. The key to making this happen, and to delivering the other

challenges outlined, will be to secure the appropriate skills and capability, and to attract the right talent and expertise into the biggest industry in the UK.

At its heart, this Strategy is about ensuring we can continue to provide safe, healthy, nutritious food which is affordable and accessible to all. Delivering that is not just about financial investment. It is about new networks and collaborations between all supply chain members to find better ways of producing the food we need globally. This strategy addresses that challenge and that is why it is so welcome.



Judith Batchelar

Director of Sainsbury's Brand and Industry co-Chair

3 Executive Summary

This is the first time the UK Government, science base and food and farming industry have come together to identify and develop the opportunities and strengths of the UK agricultural technologies (agri-tech) sector as a whole. Overseen by the Agri-Tech Leadership Council, this strategy is the outcome of consultation and partnership with the agri-tech communities to agree a set of actions to deliver our vision:

That the UK becomes a world leader in agricultural technology, innovation and sustainability; exploits opportunities to develop and adopt new and existing technologies, products and services to increase productivity; and thereby contributes to global food security and international development.

The Context: Why Now?

Agricultural science and technology is rapidly becoming one of the world's fastest growing and exciting markets. It is driven by global changes: a rising population, rapid development of emerging economies with western lifestyle aspirations and growing geopolitical instability around shortages of land, water and energy. A technology revolution is also taking place. Breakthroughs in nutrition, genetics, informatics, satellite imaging, remote sensing, meteorology, precision farming and low impact agriculture are driving major global investment in agri-tech.

The UK has traditionally been a leader in agricultural science. In recent years we have pioneered new approaches to sustainable farming practices. Our world class retailers are at the forefront of greater consumer awareness in the provenance and standards of food production. The UK is therefore well positioned to play a leading role in the global challenge of the "sustainable intensification" of agriculture: producing more with less input and impact.

This strategy is about better integrating the UK's excellence in science and progressive food and farming businesses with the Government's support for trade, investment and international development. The aim is to help unlock a new phase of global leadership in agricultural innovation.

Our starting point

The UK has strengths in all three elements vital to support the growth of the sector:

1. We have institutes and university departments at the forefront of areas of research vital to agriculture and related technologies.
2. We have innovative and dynamic farmers, food manufacturers and retailers.
3. We are well positioned to make an impact on global markets through exports of products, science and farming practices.

However, the infrastructure to support industry in applying science and technology to help modern farming and food production has declined over the past 30 years. UK agriculture's productivity growth has declined relative to our major competitors. Aspects of the current regulatory regime and skills gaps can hinder the UK in developing and using innovation and new technologies. There is huge potential to attract more global investment and EU funding into the UK and open up new global markets for UK leadership in agri-tech innovation.

Our response – building on UK strengths

The strategy sets out a range of actions for the Leadership Council, industry, Government and the science base to deliver our vision for the agri-tech sector. The actions will:

- improve the translation of research into practice through a £70 million Government investment in an Agri-Tech Catalyst which will provide a single fund for projects, all the way from the laboratory to market. This will include £10 million to deliver international development objectives
- increase support to develop, adopt and exploit new technologies and processes through £90 million of Government funding for Centres for Agricultural Innovation
- help the UK exploit the potential of big data and informatics and become a global centre of excellence by establishing a Centre for Agricultural Informatics and Metrics of Sustainability
- provide stronger leadership for the sector. The Leadership Council gives industry a stronger and more cohesive voice with Government and the science base
- build a stronger skills base through industry-led actions to attract and retain a workforce who are expert in developing and applying technologies from the laboratory to the farm
- increase alignment of industry research funding with public sector spend by increasing understanding of what is being spent and where
- increase UK export and inward investment performance through targeted sector support

Implementation

The newly-established Leadership Council will oversee the delivery of the actions in this strategy. They can help to prioritise and focus activities, which should facilitate integration of the Technology Strategy Board (TSB) and other bodies. However, our aim is that the whole agri-tech sector should lead, participate and co-invest. The potential rewards are in increased productivity, reduced costs, growth, new investment and jobs and tackling the challenges of sustainable intensification and global food security. These are challenges that are common to all across the food and farming sector.

Defining Success

Over the longer term, as the Leadership Council's vision is realised through this new partnership between industry, Government and the science base, we should expect to see clear indications of beneficial changes such as:

- increased productivity in the sector, supported by research and investment that brings innovation and new technologies more rapidly into supply chains
- the UK being recognised as a global leader in the fast emerging field of agricultural informatics and the development of evidence based metrics for sustainability, to drive better regulation and incentives for innovation
- growing investment in the scientific and commercial skills required in the agri-tech sector
- faster and more widespread adoption of best practice and innovation across farming systems and the food and farming supply chain
- a regulatory framework that better supports innovation and increased investment in R&D

4 The Vision and Mission

Vision

Our vision is that the UK becomes a world leader in agricultural technology, innovation and sustainability; exploits opportunities to develop and adopt new and existing technologies, products and services to increase productivity; and thereby contributes to global food security and international development.

Mission

- We will invest in agricultural research and innovation, supporting their speedier translation into practice from farm to fork through agri-food supply chains.
- We will promote the UK's expertise and capacity in the agri-tech sector to stimulate investment, creating a new generation of spin-outs and start-up ventures, increasing export opportunities and new collaborations with emerging and developing economies.
- We will take a global lead in agricultural informatics and in establishing the metrics and techniques by which progress towards sustainable intensification can be assessed.
- We will encourage investment in change, including enhanced skills and knowledge transfer, exploitation of shared data and widespread adoption of best practice.
- We will make the case for regulatory and fiscal reforms to enable the UK to benefit from investment in agri-science research and development.

5 The Challenge and the Opportunity

Alongside the many challenges are huge opportunities for the UK agri-tech sector in global markets where environmental, economic and social goals are driving change. It is a sector that is also heavily influenced by Europe, as a major market and an important regulator. This chapter sets out the wider landscape and opportunities to support UK growth and sustainable intensification here and abroad.

Global Drivers for Change

Increasing pressure on natural resources

The world's population is expected to rise from 7 to 9 billion by 2050 and is becoming more prosperous. Diets are changing towards more meat and dairy products. This means there is increasing global demand for food, land, energy, water and other resources, such as phosphate for fertilisers. At the same time, agriculture is competing for resources as, for example, urbanisation and industrialisation put more pressure on land.

Environmental threats and resilience

The global climate is changing, affecting agriculture. Environmental change, water availability, soil degradation and biodiversity loss threaten food security.

The price spikes of recent years highlighted the vulnerability of international food markets to adverse weather events. Less predictable weather patterns are likely to become more common. Agriculture and food production will have to adapt to these changing conditions to increase the resilience of food systems. The sector will also have to make a concerted effort in helping reduce greenhouse gas emissions and meeting climate change commitments.

Global Opportunities

Technology revolution

Huge advances in the biosciences in recent years are driving transformational developments in agricultural science, technology and farming practices. Advances in biological, environmental and chemical sciences can improve yields of crop, livestock

and fish species whilst also reducing the environmental impact. Improving the nutritional quality of crops through biofortification can improve human health and offer more rapid weight gain in livestock. Novel crops can provide new types of food and raw materials for energy generation and high value chemicals. Breakthroughs in satellite imagery and remote sensing, soil and water monitoring and precision farming are reducing the energy and environmental footprint of modern farming.

Growing markets

Rising demand worldwide for food, feed, fibre and fuel is opening up new market opportunities. Developing countries in particular will need better-adapted agricultural practices and technologies. There will be new opportunities in non-food markets. The Organisation for Economic Co-operation (OECD) estimates that the bio-economy could contribute over $1 trillion of Gross Value Added (GVA) in OECD countries by 2030, of which 36% will come from primary agricultural production[1].

Research and Development

Public and private Research and Development (R&D) investments are becoming more international in their collaborations and outlooks. There are opportunities for the best researchers to link with their counterparts anywhere in the world. Our aim is to make the UK a centre for internationally mobile R&D undertaken by business and others.

Investment

Many countries are increasing their investment in agricultural R&D and production. The USA, Australia, Netherlands, South Africa and Brazil are all taking strategic approaches to their agricultural research systems, focusing on applied research.

Implications for Agri-Tech Globally

Sustainable intensification

The Foresight Report[2] set out five key challenges for the global food system: balancing future demand and supply sustainably; ensuring that there is adequate stability in food prices; achieving global access to food and ending hunger; meeting the challenges of a low emissions world; and maintaining biodiversity and ecosystem services. The United Nations Food and Agriculture Organisation (FAO)[3] estimated that if current patterns of food consumption persist, 60% more food will need to be produced globally by 2050, compared with 2005-07. In response, agriculture needs to become more productive and efficient in the UK and in the rest of the world.

However, this has to be in the context of “sustainable intensification” which the Royal Society describe as a process “in which yields are increased without adverse environmental impact and without the cultivation of more land”[4].

It will need multiple approaches. Adapting existing farming techniques, developing entirely new production systems, innovative engineering and novel approaches to crop and livestock genetic improvement will all be required. Underpinning all these will be better analysis of data to anticipate new challenges and model potential solutions. This is where partnerships between industry, the science base and Government will come into their own.

Improving resilience to environmental pressure and consumer concerns

The whole food chain needs to adapt to an environment in which some essential resources could increasingly be in short supply. The agri-tech sector must also become more joined up and responsive to diverse marketplaces. This includes changing to meet increasing consumer awareness of provenance and standards of food production and safety.

Measuring success

Achieving sustainable intensification is only possible if inputs and outputs can be measured and benchmarked against agreed standards so that industry can invest with confidence. A number of key studies and projects have shown the potential for better measurement, data and transparency to drive innovation. However, there is no generally agreed set of standards and a lack of global leadership.

Defining more scientific and evidence based metrics of sustainability creates an important opportunity for the UK. With our long history of research, and a world class food and farming sector, we can help set the lead in this fast emerging field.

EU Context for Agri-Tech

Funding and research

With a combined agricultural GVA of €145 billion in 2010, the EU is a major market[5]. The combined spend on agricultural R&D by 13 western European economies is estimated at around $4 billion (the US spends $7 billion).

The European Commission is itself a significant funder of agri-tech research through The Framework Programme of the European Community for research, technological development and demonstration activities. The new European Innovation Partnership on Agricultural Productivity and Sustainability supports closer links between researchers and farmers. All these are potentially valuable to the global agri-tech challenge and to the UK.

Common Agricultural Policy (CAP)

The CAP has long subsidised EU farmers. Past reforms have moved away from those subsidies linked to production: wine lakes and butter mountains are things of the

past. However, the remaining subsidies are market-distorting and do not encourage capacity building, competitiveness and resilience amongst EU farmers.

Regulation

Much regulation is at EU level. Good regulation sets the conditions for a well-functioning market that benefits industry and consumers and in general the EU has helped create these. However in some areas, EU regulations are acting as barriers to innovation, particularly when these are based on a hazard, rather than risk-based, approach.

The EU regulatory pipeline for genetically modified (GM) crops remains blocked. This is despite European Commission reports finding no scientific evidence associating GM organisms with higher risks for the environment or food and feed safety. The EU approach is in contrast to other countries: GM crops are now grown by 17 million farmers on over 12% of the world's arable land.

There is a continuing challenge to ensure the balance is right between innovation and regulation.

The UK Agri-Tech Sector

This Strategy is the first time that an 'Agri-Tech' sector has been explicitly recognised by Government in the UK. The constituents of the agri-tech sector, from public and private sector agricultural research through the supply chain spanning seeds, agro-chemicals, machinery, engineering and other inputs across arable and livestock agriculture, horticulture, and food processing and packaging and retailing by globally recognised brands, are easily recognisable. However, the full economic potential of the appliance of technology and innovation across the whole agri-food supply chain as part of an interconnected sector sharing a common theme – producing 'more with less input and impact' – is only just starting to be understood. We believe it has major value to the UK and global agriculture.

The entire agri-food supply chain, from agriculture to final retailing and catering, is estimated to contribute £96 billion or 7% of GVA[6]. The UK exported £18 billion of food, feed and drink in 2012 and is one of the top 12 food and drink exporters. There are 3.8 million people employed in the food supply chain including agriculture and fishing.

Technological and scientific advances, as the Taylor review[7] highlighted, are creating new opportunities that demand new combinations of skills and resources. Looking across the whole of the agri-tech sector:

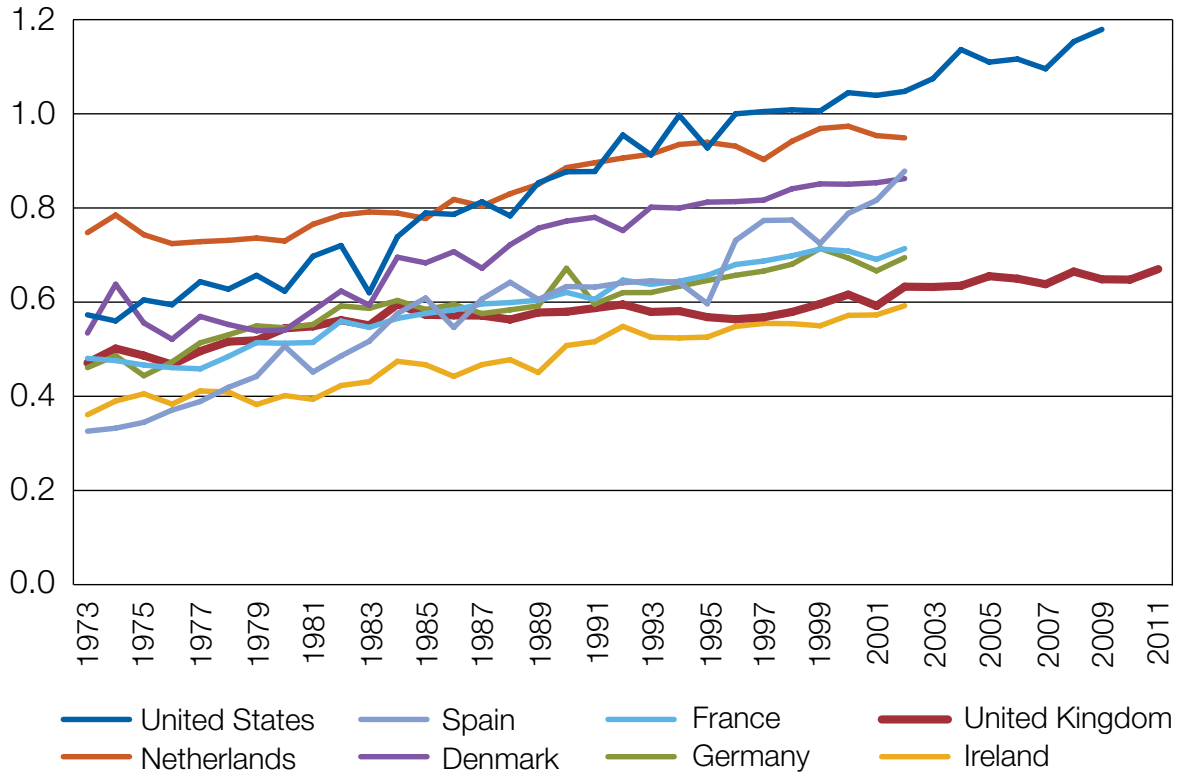
- The sector is very diverse and complex making it difficult for individual institutions to make connections to develop new partnerships
- The UK has a highly-regarded basic research base but there has been a lack of funding for applied and translational research. We have not found adequate

substitutes for some of the publicly funded research institutions that existed 20 or 30 years ago

- At least partly as a result, the UK's competitiveness in agriculture has been in decline for a number of years. Where the UK was once comparable to other western European countries, it now lags significantly behind our major competitors in productivity growth, which has stalled. Where the UK was once a member of the 'high productivity growth club', it is now towards the lower end (see Figure 1)
- While there are some good initiatives for training and development and well-established institutions delivering them, there is no clear path to attract, retain or recruit talent into the sector
- Because of the above, many foreign companies and small and medium sized enterprises (SMEs) have been reducing their investment in the UK

Through this strategy and work already taking place, there is a real opportunity to raise our game and become a global leader in agriculture once again

Figure 1 Total factor productivity in agriculture for selected countries relative to the United States 1996 level (indexed)



Source: Department for Environment, Food and Rural Affairs (Defra)

Public Perception and Engagement

Public perceptions of agriculture and the role of science and technology in the UK supply chain are critically important, and complex. There is a double challenge here. Whilst the post war years have seen growing levels of food security and an extra-ordinary sophistication in the UK food and farming supply chain with advances in refrigeration, food processing and packaging and consumer choice driven by the growth of the supermarkets and technological innovations. Recent years have also shown a growing public wariness about science and agri-business setting the agenda for public research, and over high tech solutions to social and environmental problems[8] and a growing appetite for 'naturalness' and 'organic', 'slow' and 'home grown' 'locally sourced' food. As a result, the sector sometimes plays down the importance of science and research to the products that the public buy every week. This can lead to the impression of a low-skill, low-technology industry.

This strategy is not about championing any particular type of farming or food: we want consumer choice to be the driver of investment through the supply chain. It is about ensuring the UK has a vibrant sector developing a wide range of innovations across the supply chain whether using organic, conventional or GM techniques.

We see the UK as a global hub for the technologies which underpin modern resilient farming with lower environmental costs and inputs, open to farmers and growers of all sizes and in all sectors.

6 Our response: building on UK strengths

We are confident that the UK agri-tech sector has the capability and capacity to be a world leader. This means building on our strengths in science, in supply chains and our impact in international markets. Importantly it also means building stronger links between them to ensure there is a strong flow of ideas, technologies and innovations from science to practical applications.

The Agri-Tech Strategy is a milestone itself. It is the first time that industry and Government have identified agri-tech as an economically distinct sector. It is a sector that already has strengths in:

1. **The science base** – we have research that is world leading in many agri-tech disciplines
2. **The food and farming supply chain** – we have global and trusted brands and world class businesses in food and farming. The UK's innovative and dynamic food manufacturing and retailing sectors are world leaders in translating the demands of consumers into product innovation and are driving innovation through supply chains
3. **Global markets** – the UK has historic links in agricultural research, farming and horticulture with a large number of Commonwealth and other nations. We already make a global impact through our exports of products, science and farming practices

The following chapters expand on each of these themes. They set out the starting point for the strategy and describe the UK response, including new actions. These actions apply across all farming systems, given the opportunities to develop more productive yet sustainable farming practices in organic and conventional farms.

We will ensure the benefits of the strategy are felt across the UK and will continue to work in partnership with the administrations in Scotland, Wales and Northern Ireland and their territorial offices. Wherever agreed, policies and business support activities will be aligned with the aims and objectives of this strategy.

6.i The UK Science Base

New ideas, processes and techniques respond to challenges, present new growth opportunities and help drive productivity. To work well, this needs a healthy and sustainable science base that has the confidence of industry and investors. This is a long-standing UK strength, reinforced by the Government's continuing commitment to ring-fenced research funding. In the agri-tech sector it could work more effectively with a better shared understanding of private and public sector research priorities and skills needs.

Research and Development

Our starting point

The UK is recognised globally as a historic home of agricultural research. The John Innes Centre, the Roslin Institute, Rothamsted Research, the National Institute for Agricultural Botany (NIAB) and East Malling are names that resonate around the world. We currently have many institutions including agricultural colleges, universities and institutes as well as private research organisations. Figure 2 illustrates the geographical spread of public sector activity.

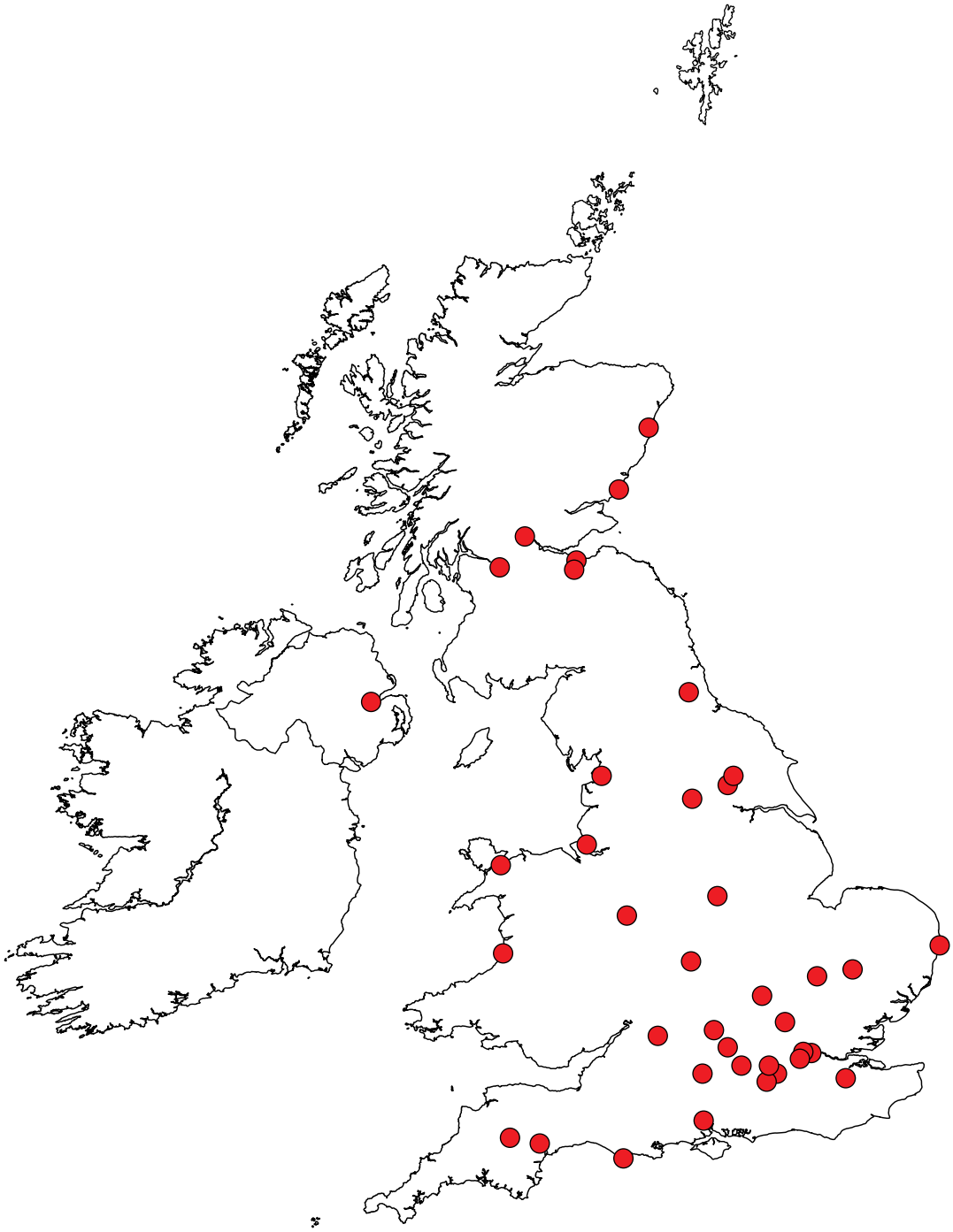
Norwich Research Park – A unique international resource and location for agri-tech research, innovation and business.

The Norwich Research Park comprises four world-renowned research institutes, all of which engage in agri-tech research. The John Innes Centre (JIC) and The Sainsbury Laboratory (TSL) are at the forefront of plant sciences. The Institute of Food Research is the sole UK research organisation dedicated to post-farm gate agri-tech. The Genome Analysis Centre plays a pivotal role in sequencing and decoding genomes specifically of relevance to agriculture. This agri-tech focus is augmented by the strengths of the University of East Anglia and the Norfolk and Norwich University Hospital. These Institutions and over thirty research-based businesses are located on the Park, all within a fifteen minute walk.

BBSRC is investing £26 million in the Park to help create and support new companies and jobs based on world-leading bioscience.

South and West Elevations of the new Centrum Building at Norwich Research Park

Figure 2 Key public sector agri-tech research activity in the UK



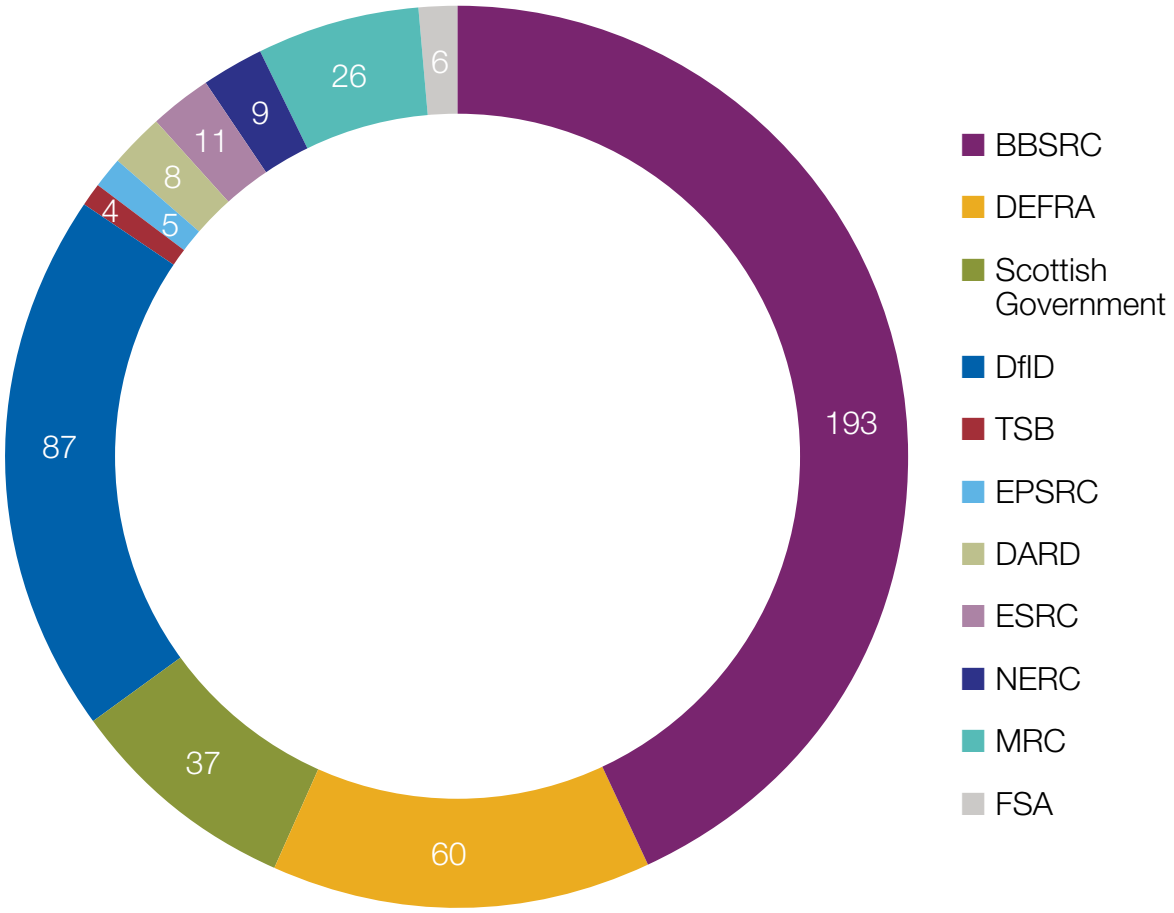
Research covers a range of disciplines. This includes crop and livestock genetics and genomics, agri-engineering, nutrition and health in crops and livestock, environmental sciences, food science and human nutrition. It covers new and emerging fields, including functional foods, nutraceuticals, clean technology and energy generation from waste. Research is also taking place in related topics such as industrial biotechnology and synthetic biology.

Pig 26

Researchers at the Roslin Institute have used novel 'genome editing' technologies to target specific changes in the pig genome. These findings are being used to engineer greater resilience to African Swine Fever.

Public sector research

Despite some perception that there is currently little public sector investment, in 2011/12 the Government spent £450 million on R&D on agriculture and food combined (see Figure below for the breakdown of spend by public sector bodies). This includes substantial capital expenditure supporting research institutes and campuses and spans a number of different sectors.



In this strategy we invite the Leadership Council to help us answer some key questions. How do we ensure we make better links between blue skies science and nearer market research and technologies? What can we do to attract more global and UK industry co-investment? Are we developing the right academic, technical and industry skills base? How can we attract a bigger share of the global investment in R&D to the UK? How can we capture and commercialise more of the upstream value

of our science base and develop a more active venture capital sector in agricultural innovation in the UK?

National Plant Phenomics Centre

The National Plant Phenomics Centre (NPPC) at Aberystwyth University is providing a step change in the way plant biology is being implemented.

Scientists use the centre to ask questions about plant characteristics, including everything from growth rate to water use to formation of useful metabolites. They ask how these physical parameters are affected by genes, the environment and the interplay between the two. Amongst other projects, the answers feed back into food security challenges and the need for better, more efficient biofuels.

Private sector research

There are no clear data on the levels of private sector investment in the UK. Conservative estimates of private sector investment in agricultural R&D suggest it is at least £100 million a year. However, this underestimates the true activity as farming makes up only one part of the agri-tech sector. Large companies like Syngenta and British Sugar as well as major retailers all fund substantial research activities.

The UK hosts substantial operations by some of the world's leading agri-tech companies for example, Syngenta, Genus, Aviagen, JCB, New Holland and Velcourt. Around 25% of Syngenta's research collaborations are in the UK. This includes recent investments in a £2 million glasshouse and a £3.5 million facility for the automated formulation of agri-chemicals.

Several multinational pharmaceutical firms also manufacture animal health products in the UK including Merck, Merial, Lilly and Novartis.

Agricultural Research Trusts and Charities have historically provided underpinning to many institutes, such as Rothamsted and NIAB. They are expected to continue to play an important role in maintaining and further developing UK capability.

One of the key tasks for the Leadership Council and Government is to capture much better data on the sector to help drive investment and inform public policy making.

NIAB

NIAB is a plant science organisation with over 90 years' experience in the agriculture and food sectors. With an internationally recognised reputation for independence, innovation and integrity, NIAB provides a pivotal hub for research, evaluation and knowledge transfer.

Its close connections with UK universities and plant science institutes, partnerships with industry and direct interaction with the UK's biggest farmer membership base have helped it establish:

- a pre-breeding platform to accelerate uptake of new genetic discoveries in commercial plant breeding programmes
- a community resource for wheat transformation which provides the most efficient GM wheat technology available in Europe for research and commercial applications
- with NIAB TAG and the Morley Agricultural Foundation, the NIAB Innovation Farm, which is helping to translate plant research innovations into commercial applications

Future priorities

A number of recent reports have set out a growing consensus in the industry about the potential for innovative tools, farming systems and practices to drive progressive

farming. Both Feeding the Future[9] and the Defra-funded AD Little study[10] set out priorities and goals for the sector which are reflected in this strategy.

Feeding the Future

The industry roadmap 'Feeding the Future' sets out the innovation requirements for primary food production in the UK to 2030 in eight priorities for research:

1. Use modern technologies to improve the precision and efficiency of key agricultural management practices.
2. Apply modern genetic and breeding approaches to improve the quality, sustainability, resilience and yield-led profitability of crops and farm animals.
3. Use systems-based approaches to understand better and manage interactions between soil, water and crop/animal processes.
4. Develop integrated approaches to the effective management of crop weeds, pests and diseases within farming systems.
5. Develop integrated approaches to the management of animal disease within farming systems.
6. Develop evidence-based approaches to value ecosystem service delivery by land users and incorporate these approaches into effective decision support systems at the enterprise or grouped enterprise level.
7. Extend the training, professional development and communication channels of researchers, practitioners and advisors to promote delivery of the targets above.
8. Improve the use of social and economic science to promote the development, uptake and use of sustainable, resilient and profitable agricultural practice that can deliver affordable, safe and high-quality products.

The breadth and diversity of UK R&D is one of its strengths. Much high-quality and useful research is taking place. However, more can be done to help users, including potential inward investors, find the right knowledge, information and partnerships. Getting it right could lead to more industry and research base co-investment than is currently achieved.

Our response

The Food Research Partnership and Global Food Security Programme are working with funders and the agri-food industry to strengthen coordination of research funding and collaboration across the public and private sector. There is also a growing number of public-private collaborations in this space, including the Sustainable

Intensification Research and Development Platform. With £4.5 million from Defra, the Platform will provide funding for research to help farmers increase productivity and profitability whilst reducing environmental impact.

Nevertheless, it is right to consider whether everyone involved in publicly-funded research is aware of what each other are doing and whether potential users are well-sighted on what the research might achieve.

This will require a frank appraisal of the opportunities to align priorities and funding. Any realignment of priorities would need to be managed within an individual organisation's constraints. In the case of the Research Councils, this will be in line with the Haldane principle[11].

Action 1: The Leadership Council, working alongside others, will conduct a comprehensive mapping and evaluation of private and government funding available for research, translation and innovation. The aim is to make research more accessible for users and to facilitate discussions on aligning priorities.

Skills for Research

Our starting point

The research skills needed to support the sector are changing rapidly. They are moving towards technology and higher level scientific and managerial skills to match advances in informatics, precision farming and engineering. The wealth of new fundamental science has necessarily pulled training towards detailed biology, arguably at the expense of the training needed to turn basic science into improved agricultural practice.

Many of the skills now required for the development of new technologies are inter-disciplinary. There is a need to bring together agronomy and automation, to develop production systems that are less dependent on human labour and interventions. The application of mathematics and computing are essential to biology for the decoding of plant, animal and microbial genomes. The sector also needs researchers with commercial understanding who are able to see the potential application of their work.

Attracting early-career researchers is a challenge, given the negative perceptions of the industry. As in many other sectors covered by industrial strategies, there is a lack of science, technology, engineering and mathematics graduates joining the industry and staying.

There is also future risk of higher skills shortages in 'niche' areas where there are currently only a handful of experts in the UK, such as agronomy, plant pathology and agricultural engineering. Succession problems are already reported with many

experienced professionals nearing retirement[12]. The skills need has to be precisely described.

Our response

We see a growing and potentially very significant global market to exploit the UK's leadership in agricultural education and training in innovation and skills development.

Government changes to the rules for university title have meant that well-regarded small institutions now have the right to describe themselves as "universities". Harper Adams University and the Royal Agricultural University at Cirencester have taken advantage of this, which should help these institutions improve their perceived standing internationally.

Action 2: Building on existing reports, the Leadership Council will work with the research councils to identify the skills needed to support the agri-tech research base. This could lead to targeted interventions along the lines of the Aerospace Engineering Masters Programme.

6.ii UK Food and Farming Supply Chain

To increase productivity, industry and the research base need strong partnerships to pull technologies and innovations from the laboratory to the farm and through the supply chain. This requires an infrastructure that gives access to translational research expertise to develop robust commercial applications. More UK success will come from better use of the wealth of data collected in the public and private sector, including in developing international metrics on sustainability. The whole supply chain needs a skilled workforce that develops alongside the new technologies and appropriate regulation that properly balances risk and innovation.

A Diverse and Complex Sector

Our starting point

The modern food and farming sector is unrecognisable in the levels of professionalism, investment and complexity from the industry which between and after the wars became heavily dependent on the UK Government for direct provision of research and extension services. This strategy recognises that innovation is driven by consumer demand flowing from retailers and processors through complex and varied modern food and farming supply chains. This is not about recreating the old Government agricultural advisory services or the days of the man from the Ministry coming to tell farmers what to grow when and where and how.

The agri-tech sector and food supply chain encompass a wide variety of different types of business: the farming sector, businesses that supply farmers, supply chain components from processing and food manufacture to retail and catering. Businesses range from large, R&D intensive multinational companies and major retailers to innovative SMEs and family farms.

This is a complex and interdependent chain that varies according to the farming sector and product. Each stage can influence production cost, supply and demand. Requirements for each product can be very different.

Ultimately these requirements are driven by consumers who are increasingly interested in food provenance, traceability and safety. Their choice is driven by clear information, trust and acceptability of products, production methods and technology.

Improved product information, in broadcast and print media, point of sale material and clear labelling is helping consumers better understand and accept innovative products.

Across the supply chain, there are innovative SMEs operating in specialist and niche markets. There are also large companies driving change and improvements throughout the supply chain. They are taking forward discoveries and developments from the science base, investing in closer to market research, and introducing innovations to drive productivity increases, environmental improvements and meet consumer demand. As an example, bakers, millers and seed breeders worked together to match consumer requirements with the right raw materials. Research identifying and mapping genetic markers laid the foundation for breeding superior wheat varieties to meet the needs of the end user. Bringing the entire supply chain together provided the step change in UK breeding for high value varieties.

Beneforté broccoli

Collaboration between two Biotechnology and Biological Sciences Research Council (BBSRC) funded institutes, the Institute of Food Research and the John Innes Centre, and Plant Bioscience Ltd brought Beneforté broccoli from the laboratory to the supermarket shelf. Developed by crossing standard cultivated broccoli and its wild-growing relative from Sicily, Beneforté broccoli has been available in UK supermarkets since 2011.

Extensive field trials at 50 sites across Europe, the USA and Mexico has found the broccoli consistently produces two to three times the amount of glucoraphanin (a compound believed to improve cardiovascular health and reduce the risk of cancers) as other varieties.

The Institute of Food Research and partners on the Norwich Research Park are continuing to study the health benefits of glucoraphanin and Beneforté broccoli.

Across the farming sector, there is significant disparity in relative productivity and performance. The top 10% of farms produce more than £180 output per £100 input while the bottom 10% fail to recover their costs[13]. Differences in motivations and natural circumstances can partly explain this disparity. However, inconsistent levels of knowledge, slow uptake of technologies and perceived or actual barriers to knowledge transfer are often contributory factors.

The diversity of the UK agri-tech sector makes it difficult for it to unite around cross-cutting sectoral issues, such as skills or R&D priorities. It also affects the UK's impact on influencing EU policies and regulations.

Our response

In partnership with industry and the science base, in April 2013, the Government established the Agri-Tech Leadership Council. The Council brings together representatives from across the sector to identify and tackle cross-sectoral issues. Its membership is set out in Annex A.

Funding for Applied and Translational Research

Our starting point

Public and private sector investment in basic R&D in the UK compares fairly well with other OECD countries. However, the economic performance of agriculture and related sectors is compromised through a lack of investment in applied research and translation[14,15,16]. This is part of the conundrum of the 'valley of death', where basic research is not being developed into new technologies, services, practices and systems on the farm that improve productivity.

Public investment in translational and applied research in the UK has declined significantly since the 1980s[17]. The infrastructure supporting commercialisation has become run down over the same period. We have rightly maintained our commitment to excellent research but it has not been matched with a similar effort to apply it to agricultural production. As a result, the balance of funding between basic, translational and applied research is not fully aligned with the agri-tech sector's needs. This might explain our lower level of relative productivity[18] compared to our competitors.

Addressing this gap could also help to strengthen the UK venture capital market for agri-tech. The UK could become a more vibrant place for start-ups and spin-outs complementing the innovation and investment activity by the larger players.

Our response

In other sectors, the Government has used the TSB to develop tools to translate high quality research into practical applications that support economic growth. The Catalyst and Catapults are already successfully helping to commercialise research in sectors including biomedicine, offshore renewable energy and high value manufacturing. Defra's site at Sand Hutton, where the Food and Environment Research Agency (FERA) is based, might, for example, be a candidate for a Catapult in the future.

The £90 million investment in the Sustainable Agriculture and Food Innovation Platform (SAF-IP) has gone some way to bridging the funding gap, through industry co-investment and public-private partnerships. However, there is still a need for further intervention to develop closer links between industry and the science base to exploit industry's expertise and stimulate further investment.

The Government is therefore investing £160 million to apply the principles of the Catapults and Catalyst to the agri-tech sector, drawing on the expertise of the TSB.

The Agri-Tech Catalyst

Whilst the UK has a vibrant venture capital sector supporting spinouts and start-ups and the commercialisation of new technologies in the biomedical and clean technology sectors, there is a distinct gap in the UK food and agriculture sector. This is despite the world-class research base and significant market potential. We see an opportunity to help create an agri-tech market in which venture capitalists come to the UK to help finance and manage UK agri-tech innovations and create a more vibrant agri-tech cluster.

Action 3: The Government will invest £60 million through the TSB and BBSRC to establish in partnership an Agri-Tech Catalyst to support the 'proof of concept' development of near-market agricultural innovations.

Based on the successful TSB/Medical Research Council (MRC) Biomedical Catalyst and complements the SAF-IP, the Agri-Tech Catalyst is designed to de-risk early stage translation of technology into common practice. It will:

- support collaborative partnerships between academics and industry that contribute to the challenge of sustainable intensification
- be designed to attract co-investment from the private sector
- support business, and particularly SMEs, to take part
- cater for a range of project types from quite large collaborative programmes of 3-5 years to shorter feasibility studies and proof of concept
- develop, monitor and evaluate a portfolio of projects with clear outcomes

Action 4: The Department for International Development (DFID) will contribute an additional £10 million to the Catalyst to support the transfer of technology and new products to developing countries.

Centres for Agricultural Innovation

Action 5: The Government will invest £90 million over five years to establish a small number of Centres for Agricultural Innovation to support advances in sustainable intensification.

The Centres will be focused on key sectors, technologies and skills to help business develop, adopt and exploit new agricultural technologies and processes. The theme for each one will be decided in consultation with industry to align with sector priorities.

There will be no single model for the Centres. However, each Centre will be expected to bring together consortia from business, higher and further education and research.

Each Centre will be designed in close partnership with industry, drawing on the expertise of the TSB, BBSRC and others to attract industry to come forward with funding and projects. The Centres will:

- maximise private sector engagement and co-investment
- generate more sustainable and productive methods for crop and livestock production focused on the requirements of the end-user and the changing needs of the consumer
- provide a platform for training, specialist skills development and succession planning
- provide a national focal point and source of expertise that is readily accessible to industry direct and through the technical advice network that supports farmers
- help take innovative ideas to market more quickly
- act as gateways to attract and anchor the knowledge-intensive activities of globally mobile companies

As well as being hubs for collaborations between industry and researchers, these Centres will be key to a refreshed network of support to help disseminate best practice across UK farming. Smaller family farms do not have the resources to do their own research and tend instead to be adopters of innovation once seen and demonstrated in the field. We want to see the UK's agricultural colleges and agricultural societies work with the Centres to bring best practice to farmers.

The Leadership Council will oversee the formation, running and evaluation of the Centres to ensure they remain focused on the overall vision of the strategy.

Informatics

Our starting point

Informatics is the collation and application of insights gained from the study of large integrated data sets. It is already starting to deliver benefits in agriculture across genetics, economics, agronomy, and hydrology and soil science. Important studies around the world are beginning to pioneer agricultural informatics as a fast emerging field, in which the UK has a huge advantage.

In the same way that healthcare genetics is beginning to unlock new insights and products that we could not have dreamt of a decade ago, so too can breakthroughs in agriculture. In agriculture, we could use these approaches to identify gene sequences corresponding to desirable traits in crops, such as disease resistance and an ability to adapt to climate change.

The UK starts from a good place. We already have a highly skilled workforce. We also host the European Bioinformatics Institute, which is one of the world's repositories of new genetic data and has helped in the development of agricultural products as well as new therapeutics and vaccines.

Big Data

Our starting point

The huge amount of data generated from the laboratory to the farm to the retailer has the potential to drive innovation throughout the agri-tech sector.

At the individual farm level, more precise data will increasingly be used to provide evidence of compliance with regulatory and quality assurance and traceability requirements. At an aggregated level, as the Keystone Alliance is demonstrating in the USA, benchmarking information allows farmers to compare their own performance with local, regional and national averages. Properly pooled, structured and mined, large datasets can identify new areas for research, development and innovation.

PepsiCo crop management tool

As the parent company of Walker's crisps, PepsiCo worked with Cambridge University and selected farmers to develop a revolutionary web-based crop management tool. Rolled out to farmers in 2011, the tool provides precision information about crops, helping farmers reduce their water use and carbon emissions, boost harvests and increase efficiency.

mySoil App

mySoil App is a free smart phone app from the Natural Environment Research Council's British Geological Survey and Centre for Ecology & Hydrology. It allows people to view and upload information about soils in their area and explore vegetation habitat data across Britain.

Since its launch in June 2012, the free app has attracted more than 2.6 million web hits and 12,500 users. More than 500 people have contributed to the databank to build even greater knowledge of soil properties across the UK.

Sainsbury's and data sharing

In the last 7 years Sainsbury's has been working closely with around 320 dairy farmers to audit all aspects of farm operations. Together they are using the range of data, on areas including electricity usage, manure storage, machinery and fuel usage, to drive change and improvements. The data allow farms to benchmark their own performance against others. The data show, for example, that the best 10% of producers are delivering 47% more yield than the worst 10% of producers using 11% less feed. This difference alone is worth £4.5 million a year.

Bringing farming data together with related information on areas including consumer preferences and trends and climate change data has the potential to generate even greater business benefit. It can provide the evidence to define, understand better and help deliver sustainable intensification. If achieved, it also gives the UK a leadership role in Europe and more widely.

Sustainable Intensification Metrics

Metrics and performance indicators at field, farm and landscape-level are critical to support progress toward sustainable intensification and to shape and prioritise the agri-food research agenda. They will help identify what works, why and in which environment, allowing for achievable and realistic targets. However, at global level, as well as in the UK, there is no consistent or agreed set of standards for what these metrics should be, what data should be collected and how they should best be analysed, presented and compared.

Our response

Action 6: The Government will establish a Centre for Agricultural Informatics and Metrics of Sustainability, at an estimated cost of £10 million. By developing UK expertise, our aim is that the Centre will become a global hub of excellence. This is the first of the Centres of Agricultural Innovation.

Agricultural Mechanisation

Our starting point

Agricultural mechanisation, or agricultural engineering, has been identified as one of the great achievements of the 20th century. As the Institute of Agricultural Engineers report[19] emphasised, there is huge potential for UK growth by combining technological advances from different disciplines. Agri-engineering can help to increase UK productivity through the wider adoption of best practice, for example advanced nozzle design and GPS guidance. It can also help to increase the UK's

share of emerging markets, through UK strengths in precision agriculture, remote-sensing technologies and robotic applications.

Our response

The Government will consider the case for a Centre for Innovation in Agri-Engineering.

Robocrop

Robocrop was developed and brought to market in the UK by the R&D company, Tillett and Hague, and Garford Farm Machinery. It uses video image analysis techniques to identify and locate individual plants to remove weeds mechanically on crops planted with regular spacing.

The technology relieves the driver of the need to concentrate on very accurate steering and removes the need to employ gang work force to do the weeding. As a result, it is leading to better quality work maintained for longer periods and at higher speeds.

National Centre for Precision Farming

The National Centre for Precision Farming, based at Harper Adams University in Shropshire, brings together the agricultural engineering manufacturing industry, the farming sector and the wider scientific community. It is investigating, developing and disseminating new technological solutions to ensure precision farming is more widely adopted. The Centre has collaborated with overseas research teams in Japan and the USA to improve farming practices by combining technologies such as advanced sensors, satellite positioning systems and automated machinery.

Developing Skills

Our starting point

Supporting the take-up of new technologies requires new and improved skills in the agri-tech sector and mechanisms to help businesses exchange knowledge. This means continuing professional development for the current workforce and new recruits to meet demand.

There has been no clear picture about how to make the sector more attractive to new entrants, either in farming, research or technology development. There is little to explain career progression and development for those already working in agri-tech.

Compared to other sectors, the proportion of agricultural businesses providing training to their staff in the last 12 months is below average. There are examples of

partnership between providers and employers. However, generally skills delivery is fragmented, which means there is limited collective work or agreement about likely future needs.

Our response

The Government is working to make the skills and training system more demand-led, including increasing the number of apprenticeships. To take most advantage, agri-tech employers, individually and collectively, will need to be better at identifying needs and articulating the agri-tech skills and career offer. In turn, training providers at all levels need to respond quickly and imaginatively to industry's requirements.

This means building on existing initiatives where industry and skills providers are working in partnership. This includes the 'Future of Farming Review[20]' published in July 2013 which set out where more leadership and work is required across the sector.

In addition:

Action 7: The agri-tech sector will build on the work of the Agri-Skills Forum, Lantra and the Agriculture and Horticulture Development Board (AHDB) to:

- improve clarity and communication of available training and advice
- establish and communicate the future skills needs for the sector
- participate in the design and investment in courses and vocational training

Action 8: The agri-tech sector will improve co-ordination and integration of on-farm demonstrations and use of demonstration and monitor farms to share best practice. These will establish clear links and networks with the Centres for Agricultural Innovation.

Action 9: The Government will work in partnership with the agri-tech sector in the design of the next Rural Development Programme to identify opportunities to support skills development and knowledge transfer.

Regulatory Frameworks

Our starting point

A clear and consistent regulatory framework is important in providing companies with a stable environment and plays an important role in securing consumer confidence. As it can typically take a decade or more to bring new innovations from the laboratory to the market, it is important that companies have confidence to make long-term investments. It should be a given that regulation responds to changing market conditions, is not overly burdensome and does not stifle innovation.

However, in some areas, EU regulations are acting as a barrier to innovation and investment because there is no predictable route to market for safe products. In addition, CAP spending is not focused on helping the EU agriculture sector become more competitive and market-oriented. It also lacks focus on support for the environmental public goals implicit in sustainable intensification.

Our response

The Government will continue to work with the European Commission and other member states for consistency in the use of the precautionary principle, particularly as it applies to new and emerging technologies, GM and pesticides.

The UK has consistently argued for further progress towards an open market that makes farmers less dependent on subsidies. It will also seek to identify opportunities to support innovation and good business practice through the new Rural Development Programme and the EU Structural and Investment Funds Growth Programme.

In addition, work continues on implementing the recommendations from the Farming Regulation Task Force report[21] to remove unnecessary burdens on farmers.

6.iii UK Access to Global Markets

There are huge opportunities for the UK agri-tech sector in global markets. This requires focused support that identifies, targets and accesses those markets with most export potential. It needs further effort to ensure inward investors fully understand the benefits of making investments in research, technologies and jobs in the UK. As the UK agri-tech sector develops, we are building valuable expertise that developing countries can also access to help meet global food security goals.

Increasing Trade and Investment by the Private Sector

Our starting point

The true scale of the commercial opportunity for trade and inward investment is becoming clearer. The global market value of agricultural input sales[22], for example, is estimated to be worth more than $400 billion and continues to show high growth[23].

As our international competitors race to attract investment in technologies, the UK cannot afford to be complacent. There are a number of proven technology advancements and areas of expertise that afford new export and inward investment opportunities, as well as new global collaborations for the UK.

JSR Genetics

JSR Genetics is one of the largest family owned farming businesses in the UK with an increasing presence in the Far East. Starting in 2011 by exporting 900 pigs to China, JSR now have franchising arrangements and a joint venture and are training Chinese staff.

Initial performance from the herd in China compares to UK levels and far surpasses that of indigenous Chinese herds. Demand for breeding stock is outstripping supply.

We want existing investors to grow their UK businesses. We also want to attract new investors to collaborate with our science base to develop novel, innovative and high value products and technologies and to manufacture here. On trade, the UK's ambition is to see greater access to overseas markets for British products. We want

businesses to view exporting as a key route to growth with more SMEs selling to overseas customers. We aim for the sector as a whole to focus more energy on the high-growth emerging markets.

For both trade and inward investment, activity should focus on those areas where the UK has a world class reputation and recognised lead and in those markets which offer the greatest opportunity.

Exosect

Exosect was established in 2001 as a spin-out from the University of Southampton to develop products for the protection of food from pests and disease. In 2005 it launched the first of its innovative crop protection products.

Recently it led a UK consortium to develop a novel biopesticide for the protection of stored grain. This will fill the gap in the market for sustainable grain protectants following the phased withdrawal of methyl bromide and increasing insect resistance to remaining insecticides.

Exosect has now gained more than 60 patents and 30 national product registrations. It is actively out-licensing its grain protectants and seed treatment platform technologies to multi-national companies throughout Europe, North America and the Far East.

Our response

UK Trade and Investment (UKTI) and Defra are drawing from the strategy as they revise the action plan for "Driving export growth in the farming, food and drink sector" to cover agri-tech. The Foreign and Commonwealth Office (FCO) is building links with a number of African nations to share UK expertise.

In addition:

Action 10: UKTI will set up a new dedicated team to increase the volume and value of overseas investment into the UK agri-tech sector.

Action 11: The UKTI Business Ambassador, James Townshend, will champion UK agri-tech and identify early stage markets for future growth.

Action 12: UKTI will provide strategic and practical support for UK companies seeking to work with foreign governments to help them deliver their food security programmes. This will start with Qatar and other Gulf States. In the longer-term, UKTI will focus its attention on the High Value Opportunity Programme for Food Security, particularly opportunities in Asia.

Opportunities in International Development

Our starting point

The strong links between trade and international development offer mutual advantage to the UK and developing economies. They can increase the UK's contribution to tackling the global need for sustainable intensification of agriculture and position the UK as a global hub for the agri-tech sector.

Eradication of Rinderpest

The eradication of the rinderpest virus (cattle plague) can be viewed as an achievement on par with the eradication of smallpox from the human population, the only other time a viral disease has been eradicated. Achieved through global collaboration over a number of decades, UK science contributed the key technological advancement, a thermostable vaccine.

In its severest form, rinderpest is capable of killing 80 to 95 per cent of the animals it infects. Eradication saved India US $289 billion from 1965-1998 with a US $1 billion benefit to Africa each year during the period.

According to FAO[24], in 2012 there were still 868 million hungry people, with an estimated 2 billion suffering the effects of poor nutrition. In the past 6 years two major food price spikes have been driven by rising demand and uncertain supply.

Despite increases in R&D spending in the past 10 years, the development and adoption of new technology has been very variable across regions and countries. Over the past 30 years, research has driven a rapid increase in yields in many regions and countries, lifting millions out of poverty and helping create dynamic new economies. However, the increases have been lower in Africa than in other regions. For example, in 2012 only 34% of crops planted in Africa were modern high yielding varieties, significantly more than in 2000 but much lower than in South Asia where over 80% of farmers grow improved varieties of crops.

Our response

The previous chapter set out that DFID will make a £10 million investment in the Agri-Tech Catalyst to support projects focused on developing countries.

In addition:

Action 13: DFID will commit funding to a scoping study for a project to develop technology that will contribute to development outcomes in Africa, by linking the best UK, Chinese and African research and private sector organisations.

7 Implementing the strategy

This strategy sets out actions for industry, Government and the science base.

Consisting of senior figures from across the agri-tech sector, the Leadership Council will act as the overarching Board to champion the strategy's vision and drive its implementation. It will use its knowledge and oversight of the sector to highlight new opportunities for innovation and growth arising from changes to funding, markets and policies.

The Council will also steer and monitor the new investment in translational research. It will work with research funders and industry, encouraging private and overseas investment to generate a world-leading capacity for converting basic science into innovative outcomes across the agri-tech sector.

Council members will act as leads for their communities. They will provide thought leadership on innovation and growth, facilitating new partnerships and building stronger links between industry, Government and the science base. Members will provide public leadership on the application of new technologies relating to the sector. They will do this in partnership with other groups, such as the Global Food Security Programme, the Food Research Partnership and the SAF-IP.

8 Actions

Action 1: The Leadership Council, working alongside others, will conduct a comprehensive mapping and evaluation of private and government funding available for research, translation and innovation.

Action 2: Building on existing reports, the Leadership Council will work with the research councils to identify the skills needed to support the agri-tech research base.

Action 3: The Government will invest £60 million through the TSB and BBSRC to establish in partnership an Agri-Tech Catalyst to support the 'proof of concept' development of near-market agricultural innovations.

Action 4: DFID will contribute an additional £10 million to the Catalyst to support the transfer of technology and new products to developing countries.

Action 5: The Government will invest £90 million over five years to establish a small number of Centres for Agricultural Innovation to support advances in sustainable intensification.

Action 6: The Government will establish a Centre for Agricultural Informatics and Metrics of Sustainability.

Action 7: The agri-tech sector will build on the work of the Agri-Skills Forum, Lantra and AHDB to:

- improve clarity and communication of available training and advice
- establish and communicate the future skills needs for the sector
- participate in the design and investment in courses and vocational training

Action 8: The agri-tech sector will improve co-ordination and integration of on-farm demonstrations and use of demonstration and monitor farms to share best practice.

Action 9: The Government will work in partnership with the agri-tech sector in the design of the next Rural Development Programme to identify opportunities to support skills development and knowledge transfer.

Action 10: UKTI will set up a new dedicated team to increase the volume and value of overseas investment into the UK agri-tech sector.

Action 11: The UKTI Business Ambassador, James Townshend, will champion UK agri-tech and identify early stage markets for future growth.

Action 12: UKTI will provide strategic and practical support for UK companies seeking to work with foreign governments to help them deliver their food security programmes.

Action 13: Government will commit funding to a scoping study for a project to develop technology that will contribute to development outcomes in Africa, by linking the best UK, Chinese and African research and private sector organisations.

Action 14: The Leadership Council will agree a set of measures to assess the success of the strategy.

9 Benefits: what the strategy will deliver

The strategy highlights the breadth of the agri-tech sector and the benefits that greater industry, science and Government partnership and collaboration can bring:

To a UK farm business:

- Closer links and greater access to the skills and knowledge in agricultural colleges, higher education institutions and research institutes bringing new entrants to the sector and updating skills and practices
- A clearer understanding and greater access to the innovative new practices and technologies needed to improve productivity, competitiveness and environmental performance
- Better ways to signal priorities to the researchers who influence the national research agenda
- A quicker and easier framework for partnerships with the public sector
- Easier access to national and international markets providing greater export opportunities

To a global agricultural technology company:

- A positive regulatory environment in the UK and Europe
- Confidence in the UK as a place to invest
- Confidence in the UK as the leading place for new models of sustainable farming
- Stronger supply chain relationships
- Stronger links with the research base from early stage research to later technology development
- A UK hub from which to access global markets
- Access to a trained and skilled workforce

To a UK food processor, manufacturer and retailer:

- More resilient and stronger supply chains built on mutually beneficial priorities and collaborations
- Sustainable raw materials that match consumer demands

- Easier access to near market proof of concept innovation studies
- Access to technologies that support the move from lower cost to value added purchasing relationships

To an agri-tech venture capital investor:

- Greater access to new technologies and investment opportunities in the UK
- Easier environment to establish proof of concept studies
- More Government support to de-risk early stage investment

To a UK researcher:

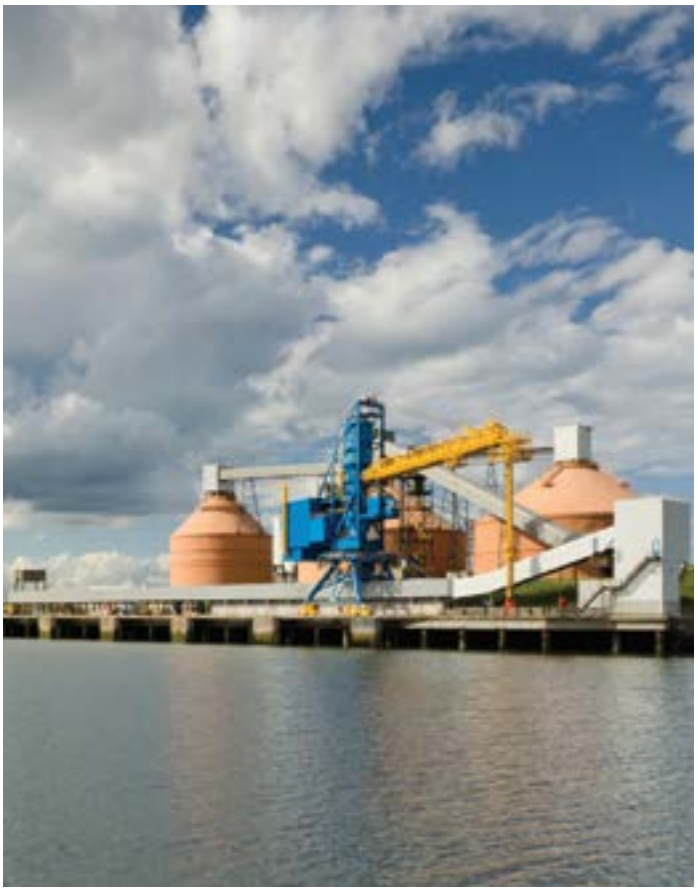
- Better recognition for research and its impact
- Increased funding for applied agri-tech research and nearer market R&D
- Increased collaboration and partnership opportunities with companies and the 3rd sector (including charities, voluntary organisations and social enterprises)
- Clearer mechanisms to enable the translation of knowledge into practical applications
- Greater career opportunities and recognition

To a consumer:

- More choice for healthy, nutritious food
- More affordable, sustainable products that have less adverse impact on the environment
- Greater understanding of how food is produced and where it comes from

To emerging markets:

- Access to UK science base to help tackle global agri-food challenges
- Greater exposure to new practices, technologies and innovative businesses



10 Indicators: what success looks like

This strategy has set out our vision and the previous chapter set out the benefits that we intend it to realise. The Leadership Council is keen to measure the success of this strategy and is looking at a range of indicators focused on outcomes. Potential measures include:

Long term

- UK agricultural productivity growth matches major competitors
- The UK is recognised as a global leader and hub for agri-tech innovation and sustainability metrics
- Investment in innovation and agricultural research is resulting in changes rapidly adopted in supply chains
- There is a clear framework for sharing data, knowledge and best practice across the UK agri-tech sector
- Regulatory reform provides a stable environment that supports long-term investment in new products and technologies

Medium term

- Centres for Agricultural Innovation are helping to bring new technologies to market
- New partnerships are developing with emerging and developing economies
- UK and overseas private sector investment in R&D and commercialisation is increasing
- UK agri-tech export performance is improving

Short term

- Centres for Agricultural Innovation and Agri-Tech Catalyst established
- A skills programme is agreed that addresses current challenges and maps future requirements

Action 14: The Leadership Council will agree a set of measures to assess the success of the strategy.

Annex A

Leadership Council Membership

In consultation with industry, academics and other stakeholders, the following were invited by Defra and BIS Ministers to form the Council to oversee the strategy and provide leadership to drive its implementation.

David Willetts MP	Minister of State for Universities and Science, ***BIS co-Chair***
Lord de Mauley	Defra Minister for Science, ***Defra co-Chair***
Judith Batchelar	Director of Sainsbury's Brand, ***Industry co-Chair***
Ian Crute	Chief Scientist, AHDB, ***Research Champion***
Tina Barsby	CEO, NIAB
Sir John Beddington	Former Government Chief Scientific Advisor
Martin Douglas	CEO, Cargill UK
George Freeman MP	Chairman of the All Party Parliamentary Group on Agricultural Science and Technology
Iain Gray	Chief Executive, TSB
Jim Godfrey	Chairman of the TSB SAF-IP and member of the BBSRC Council
Douglas Kell	Chief Executive, BBSRC
David Lawrence	Non Executive Director and Chairman of the Science and Technology Advisory Board at Syngenta
Ian Noble	Senior Director for Breakthrough Foods, Pepsico
John Shropshire	CEO, G's Group
James Townshend	CEO, Velcourt Group plc
Bob Webb	Principal of Scotland's Rural College
Tim Wheeler	Deputy Chief Scientific Adviser, DFID

BIS and Defra will continue to provide the Secretariat to the Leadership Council.

Glossary

AHDB	Agriculture and Horticulture Development Board
BBSRC	Biotechnology and Biological Sciences Research Council
CAP	Common Agricultural Policy
DARD	Department for Agriculture and Rural Development
Defra	Department for Environment, Food and Rural Affairs
DFID	Department for International Development
EPSRC	Engineering and Physical Sciences Research Council
ESRC	Economic and Social Research Council
FAO	United Nations Food and Agriculture Organisation
FCO	Foreign and Commonwealth Office
FERA	Food and Environment Research Agency
FSA	Food Standards Agency
GM	Genetically Modified
GPS	Global Positioning System
GVA	Gross Value Added
Lantra	Sector Skills Council for Land-Based Skills
MRC	Medical Research Council
NERC	Natural Environment Research Council
NIAB	National Institute of Agricultural Botany
NPPC	National Plant Phenomics Centre
OECD	Organisation for Economic Co-operation and Development

RCUK	Research Councils United Kingdom
R&D	Research and Development
SAF-IP	Sustainable Agriculture and Food Innovation Platform
SRUC	Scotland's Rural College
STEM	Science, Technology, Engineering and Mathematics
SME	Small and Medium Sized Enterprise
TAG	The Arable Group
TSB	Technology Strategy Board
UKTI	UK Trade and Investment

Endnotes

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BIS/13/1060