Agricultural Universities Council UK

Research strategy

2023

Comments on this strategy

Melanie Welham (Executive Chair BBSRC)

"Research and innovation can provide solutions to many of the global challenges we face today. To realise its full potential, we need a research and innovation system that is connected and engaged, allowing us to maximise opportunities for new discoveries and ways to deliver impact. The commitments and actions set out within the AUC Joint Research Strategy reflect these ambitions and are very much welcomed by BBSRC."

Minette Batters (President National Farmers Union)

"As bedrock of the food system, farmers and growers feel a great responsibility to be part of the solution. We see science and research playing a vital role in this: providing on-farm decision makers with robust evidence of what works; informing and analysing regulation; and ensuring that change leads to genuine and sustainable benefits for all. I'm very pleased that the leading universities also recognise their responsibilities and the opportunities to increase their value to farming through a coordinated research strategy."

Sir Charles Godfray (University of Oxford, Chair of Strategy Project Advisory Group)

"The UK university sector is a research powerhouse of which the country can be proud. It has strength in its depth and diversity with different institutions having their own focus and specialities. Capitalising on this complementarity is critical for the nation, something that is easy to forget in the competition for funding in challenging economic times. It is to the great credit of the network of universities with expertise in agriculture that they have come together to form the Agricultural Universities Council (AUC) and to examine critically how research in this area needs to evolve and strengthen. It is a highly timely initiative. Growth in UK agricultural productivity lags many comparable nations and in addition to producing more food we need to do it more sustainably and to ensure that farming meshes with other activities in our multifunctional landscapes. Understanding the social and economic aspects of food production can be as critical as the natural sciences in forging better outcomes. The UK Government recently published a Science and Technology Framework with a ten-point plan to make the UK a Science and Technology Superpower. This report, and future work planned by the AUC, will help ensure that agricultural research, interpreted broadly, is part of this vision."
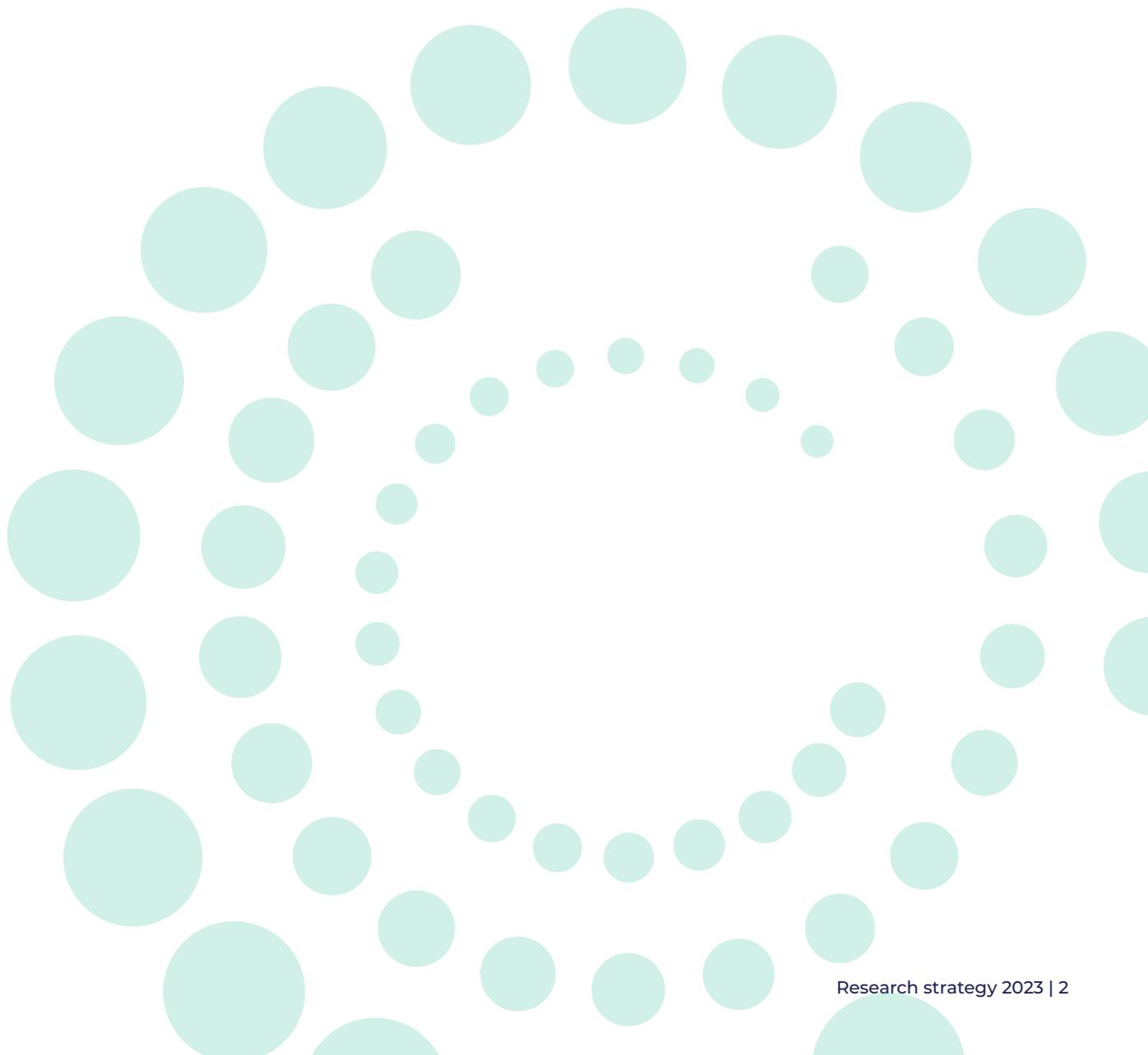
Lord Curry of Kirkharle

"I very much welcome this ground breaking report. It has become increasingly apparent over the last couple of decades that fragmentation within our research structure is impacting on our ability to translate and apply science as effectively as many of our competitors. To agree to collaborate, as members of the AUC have done, to inform research priorities, to partner on joint programmes and on delivery is a huge step forward. The challenges we face are daunting with climate change, restoration of habitats and the production of healthy, sustainable food dominating our agenda, but if we build on the willingness to work together that is evident in this report then we can look forward with much more confidence."

Henry Dimbleby MBE (Independent Lead, National Food Strategy)

"It is so welcome to see scientists join forces like this. This is the kind of strategic leadership called for by the deep and urgent crises in our food and farming."

Contents

Map of current AUC members across the UK

SRUC

THE UNIVERSITY of EDINBURGH

Newcastle University

QUEEN'S UNIVERSITY BELFAST

UNIVERSITY OF LEEDS

Harper Adams University

UNIVERSITY OF LINCOLN

WARWICK
THE UNIVERSITY OF WARWICK

University of Nottingham
UK | CHINA | MALAYSIA

Cranfield
Environment and Agrifood

1872 PRIFYSGOL ABERYSTWYTH UNIVERSITY

1893 Writtle University College

HARTPURY UNIVERSITY

Royal Agricultural University

University of Reading

University of Hertfordshire UH

Introduction

The Agricultural Universities Council (AUC) represents universities that teach and research agriculture in the UK. We need to prioritise wisely, avoid duplication, and boost the practical impact and public value of our research.

The AUC represents universities that both teach and research agriculture. Alongside strategic research institutes, we deliver the lion's share of agricultural research in the UK.[1] But, while groups of universities team up on projects all the time, we have not worked before as a whole sector. This shared strategy sets out, for the first time, steps that we have agreed to take together to make our research as effective and efficient as possible.

With agriculture in transition, across the UK and globally, research is more vital than ever in generating evidence, exploring possibilities and enabling innovation. Relevant research includes the biosciences and economics, often associated with agriculture, but also ecology, engineering, computation and wider social sciences.

While the case can be made to increase investment, our first task is to put current resources to best use. We need to prioritise wisely, minimise duplication, and boost the practical impact and public value of our research.

This strategy sets out new steps we are taking to achieve this. It may seem overdue. Yet, much like farmers, research providers are more takers than makers of strategy. Universities operate independently, are obliged often to compete, and dance to the tunes of policy, regulation and research funding. Some of our members are specialist universities, focused on agriculture, but most are departments within much bigger institutions, exposed to competing pressures and demands. While we cannot change all this, we can and should organise and coordinate our work better in support of the industries and communities we work with, and in the public interest.

The focus of this strategy is therefore on coordinating not only our own research, but also our engagement with government, research institutes and funders, industry and other stakeholders. It concerns how we work, rather than prioritising research questions. It is about how we can best contribute within a wider agricultural knowledge and innovation system that, alongside our universities, includes other research providers, government, businesses, NGOs and industry bodies.

This is a system so fragmented in the UK, that efforts like ours to join parts of it up risk duplicating likeminded initiatives and fuelling further confusion. Every step we set out here has been designed to mitigate that risk. We are committed as a group to stepping forward where needed, to stepping back and falling in where others could lead better, and to open, honest and pragmatic dialogue about how universities can help the system work better in the public interest.

Our strategy plays to universities' strengths as research providers. What is unique is that we combine research with education. Training the next generation of farmers, managers, leaders and influencers entwines our work with the industry's future. Our reputation for world-class basic, discovery research can make it seem otherwise. But the reality is that all our universities do applied research that has significant impact, and builds on underpinning basic research.

This document summarises a year-long process we have gone through together, which has included reviewing what others have already said and done about these issues, asking hundreds of stakeholders about their priorities, analysing research data, and exploring solutions with others. Rather than produce a wish-list of recommendations, we set out the actions we are taking or intend to take, many with others, as a result of this process.

This short report outlines those actions. It is illustrated with examples of the impact of our research. An accompanying pack provides more detail of the evidence that informed our approach.
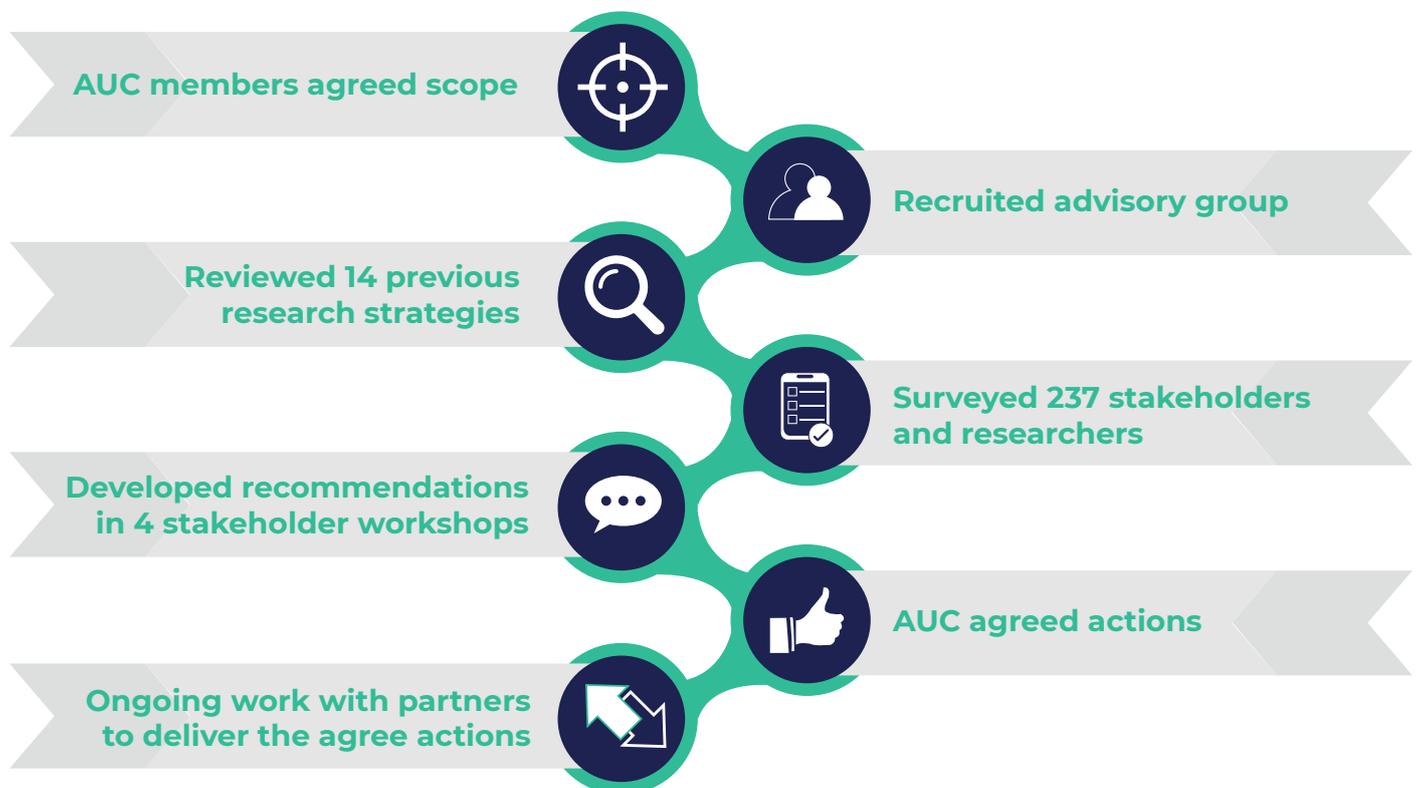
The challenge

Agriculture needs to change in the UK and globally. We must harness research more effectively and efficiently to support this.

The world faces stark and urgent sustainability challenges that can only be addressed by transforming food systems and land use, in the UK and globally. While this requires action on many fronts, it implies big changes in agriculture. Research is vital, helping understand the challenges, and supporting innovation to address them.

While UK research is recognised as being world-leading, farmers, industry groups and other stakeholders have longstanding concerns about the impact of publicly-funded agricultural research, including on productivity, which has been growing faster in some other countries (Figure 1).

They have highlighted needs to strengthen engagement between researchers and stakeholders, for more applied research, and for public funding to enable co-innovation by researchers, farmers and other stakeholders (Figure 2). To address sustainability and productivity challenges we must harness our research resources more strategically, effectively and efficiently.

The strategy review process

AUC members agreed scope

Recruited advisory group

Reviewed 14 previous research strategies

Surveyed 237 stakeholders and researchers

Developed recommendations in 4 stakeholder workshops

AUC agreed actions

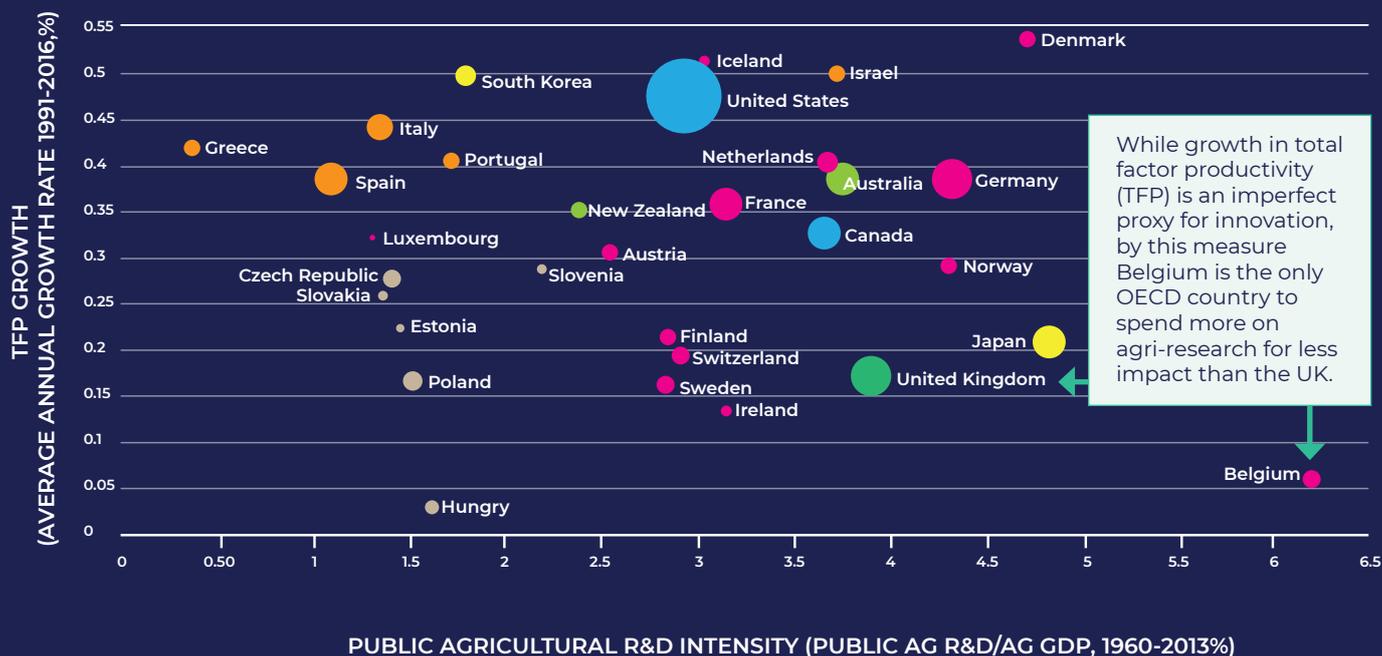Ongoing work with partners to deliver the agree actions

These concerns and ambitions are widely shared within the research community. Many in universities are frustrated that sector-wide strategic collaboration has proved rare and difficult in practice. Factors include limited data on research needs and capabilities, fragmented funding and investment processes, and strong structural pressures to compete.

Now is the right moment to address this, both due to the severity and prominence of farming and food challenges, and as wider reviews of UK science underscore the need for strategic collaboration and impact (Figure 3). The recent Nurse review of the UK research landscape highlighted the value of collaboration and the responsibility of public-sector research to benefit society.[2]

Is more public investment needed in UK agri-food research? In our survey, farmers and other stakeholders backed greater investment (Figure 4). Yet the public money the UK invests has held steady in recent years, we spend more than the OECD average, and welcome new waves of funding from Defra and UKRI are coming into play. For now, in this strategy, our focus is therefore on how we can work more effectively to make the make the best of this investment.

Over the next three sections of the report, we address the key aspects of this in turn (Figure 5). What do we research and how we could increase its practical relevance and public value? What is our research infrastructure and capability, and where are the gaps? And how can we make sure our research community has the skills, now and into the future, to do the work that is needed?

Figure 1: UK agricultural productivity growth has seemed sluggish relative to research investment [3]

TFP GROWTH (AVERAGE ANNUAL GROWTH RATE 1991-2016,%)

PUBLIC AGRICULTURAL R&D INTENSITY (PUBLIC AG R&D/AG GDP, 1960-2013%)

While growth in total factor productivity (TFP) is an imperfect proxy for innovation, by this measure Belgium is the only OECD country to spend more on agri-research for less impact than the UK.

NORTH AMERICA

ASIA

OCEANA

EUROPE, NW

UNITED KINGDOM

MEDITERRANEAN

EUROPE, CENTRAL

Bubble size = share of OECD ag/bio citations

**Figure 2:** Concerns that agricultural R&I is insufficiently effective & efficient [4]

"By Nobel Prizes awarded, scientific papers published and many other measures, the UK has some of the most creative and productive basic scientists on earth, but it has lagged in application of science to realise agricultural production."

"Co-ordination failures in the innovation pipeline between the critical needs of UK farmers and growers and fundamental innovation undertaken in the UK.

Limited investment in applied R&D."

"The UK already produces world-class food science and invests a lot in agricultural research... but the UK is less effective than comparable countries at innovation - the successful application of ideas."

Figure 3: Converging factors make this the right moment for strategic action

UK & international commitments on environment & health	COP, SDGs, Environment Act
Pressures on food supply & affordability	Ukraine war, inflation
Post-Brexit policy & regulatory needs & innovation	ELMS, Horizon
UK agricultural productivity challenge	Food & Drink Sector Council, Food Strategy
Strategic reviews of UK science	Nurse Review, UKRI Strategy, Innovation Strategy, Plant Science Strategy
REF2021	Research Excellence Framework

Figure 4: In our survey, farmers, researchers and other stakeholders backed greater investment in interdisciplinary, mission-oriented, public interest research (strongest five preferences)[5]

| Strongly Agree (A) | Agree (A) | No preference | Agree (B) | Strongly Agree (B) |
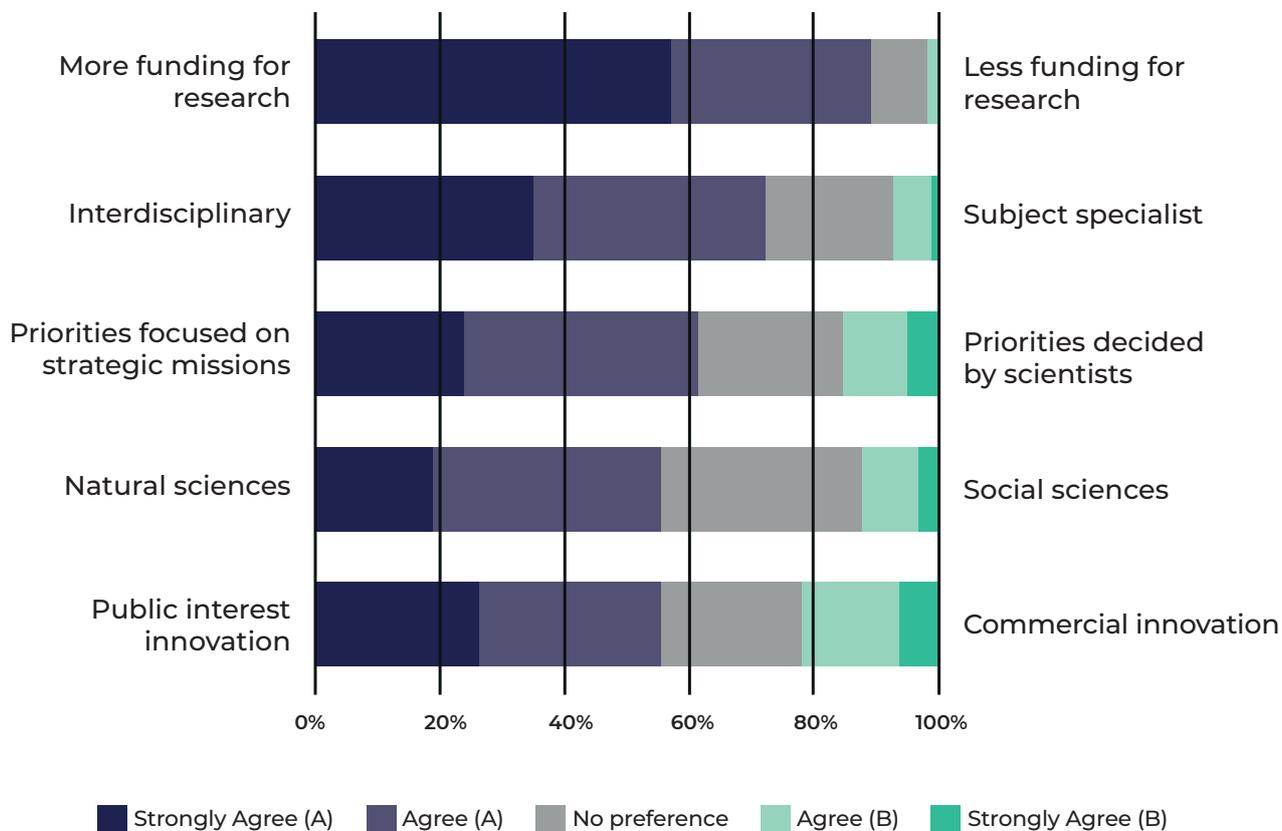
Figure 5: Previous reports highlight persistent strategic challenges for agricultural research and innovation [6]

	Practical relevance	Public value	Co-ordination
Activities	Insufficient user involvement in priority-setting	Need for mission-orientated research to tackle big goals	Lack of co-ordination leads to inefficiencies
Infrastructure	Limited infrastructure for KE & commercialisation	Lab & field facilities not equipped to meet ambitions	No co-ordinated, long-term investment in key facilities
Talent	Insufficient researcher KE & commercialisation skills	Insufficient researcher career incentives for KE & impact	Researcher shortages & succession problems

Impact case study

Developing improved housing standards for commercial poultry

Queen's University of Belfast

Funded by Innovate UK, Northern Ireland Department of Agriculture, Environment and Rural Affairs, Skea Eggs Ltd, Moy Park Ltd

Farm-level, large-scale research has led to improved welfare of chickens, by demonstrating welfare benefits of windowed housing, perches and other types of environmental enrichment through working closely with industry. Research outcomes informed changes to Red Tractor, RSPCA and RSPCA Australia quality assurance standards, and underpinned infrastructure changes directly on Moy Park farms, a leading distributor of poultry products in the UK and Europe (>£10M investment), helping to achieve high welfare standards.

The research also underpinned a major NGO-led welfare initiative for broiler chickens (e.g. the Better/European Chicken Commitment) with commitment from European and American food companies.

Full report available at REF2021

Research activities

We can do more to focus our research efforts where they can yield clear public benefits. Open and inclusive ways of understanding the needs of farmers and other stakeholders are crucial to this.

Farmers, agri-businesses and others often ask what research is happening, where they can go to find it, and how to make sure it meets their needs. But there has been no map, and no well-marked open door into the world of research.

With this review, we started to address those needs. We analysed data submitted to the Research Excellence Framework (REF), the main review of universities, to provide a clearer picture of our agricultural research. This revealed a decentralised sector, with research on most themes – from basic and applied plant and animal science, to soils and agri-tech – being done across most of our universities (Figure 6).

Our universities spent an estimated £56 M/y on agricultural research, shared across basic (£31 M/y) and applied (£25 M/y) science. Plant or crop research was dominated by basic science, whereas agri-environmental research was primarily applied.[7]

Significantly, this accounted for only half the research reported as 'agricultural' in the REF (Figure 7). The other half was unrelated to agriculture, mainly fundamental bioscience, potentially impactful but with no direct route to impact in the sector.

This may not be a fair picture, as REF encourages universities to submit their most 'academic' research. But it highlights the need for clear, meaningful and consistent ways of recording and reporting research in our sector.

Most AUC universities reported substantive KE initiatives involving agri-food industry, farmers or government, for example collaborating routinely on projects (Figure 8). However, fewer than a third provided strong evidence of engaging stakeholders strategically, in shaping research priorities. None provided comparable evidence of engaging with communities or civil society in agricultural research, also vital to the mission-oriented science and public interest innovation favoured by stakeholders (Figure 4).

This is a sector-wide challenge, including for other research providers and funders. Whereas diverse stakeholders periodically inform strategic research priorities for agriculture in the devolved nations, at a UK scale there is no such process (Figure 9).

We are taking three steps to focus agricultural research where it will make most difference in practice:

Open and inclusive priority-setting. We are in discussion with farming and other groups to develop practical ways to ensure diverse stakeholders regularly and openly inform UK agricultural research priorities, in the context of global goals for sustainable land use and food systems. Our aim is to agree an approach with all the main research funders and providers, to make this is useful as possible. We are committed to co-funding and co-organising such a process, as an open resource for research funders and providers.

Clear and meaningful research reporting. We will track research against such priorities so we can report clearly to stakeholders and funders. We will work as a sector to design practical reporting systems, exploring the use of shared reporting categories and dynamic analytical tools.

Sector representation. We are inviting other universities involved in agricultural research to join the AUC. Opening our activities to all research providers will help to ensure we represent the sector as fully as possible. We are also now working as a group with specialist research institutes, including those strategically funded by BBSRC (e.g. Rothamsted Research), to better co-ordinate our activities. Together we are ideally placed to ensure that the sector can remain world-leading, deliver what industry and society needs, and inform future government policy.

Figure 6: Number of agriculture-related AUC REF UoA6 research outputs by topic and institution [8]
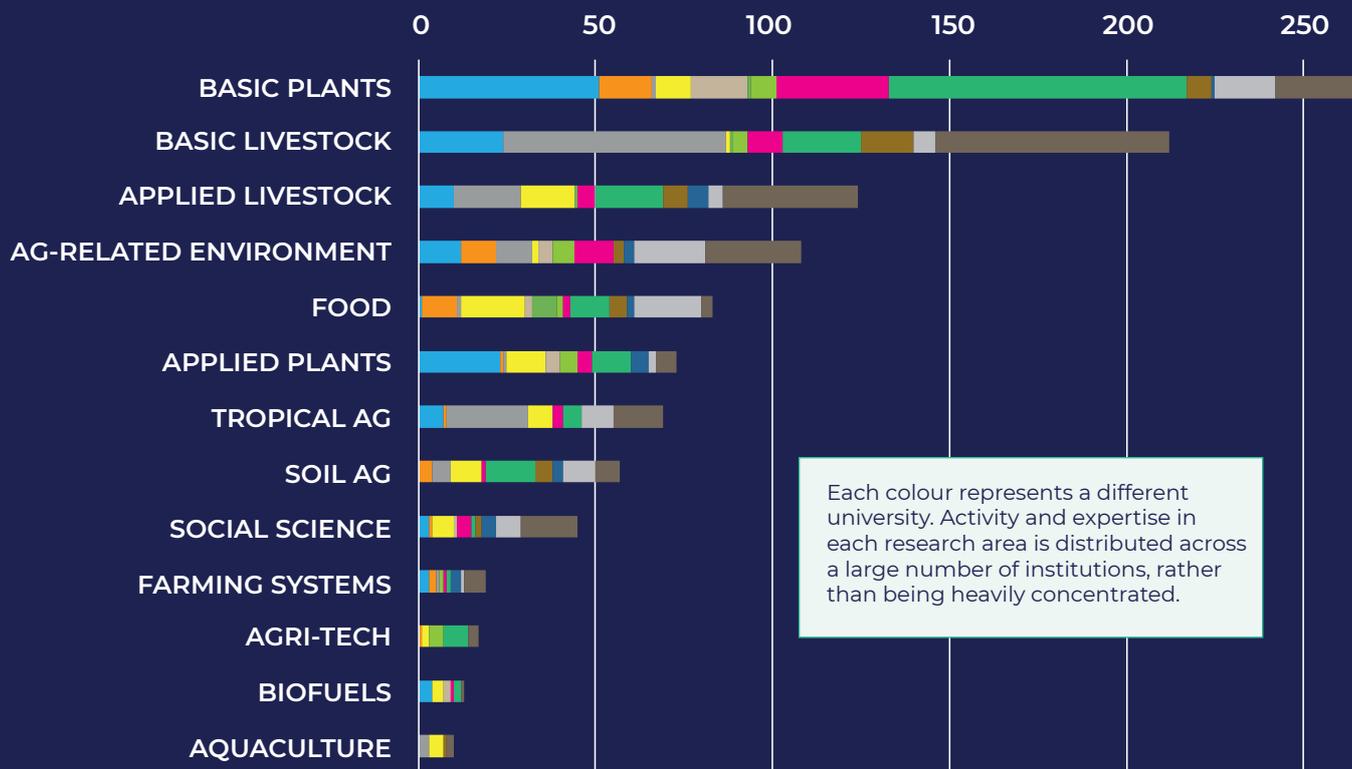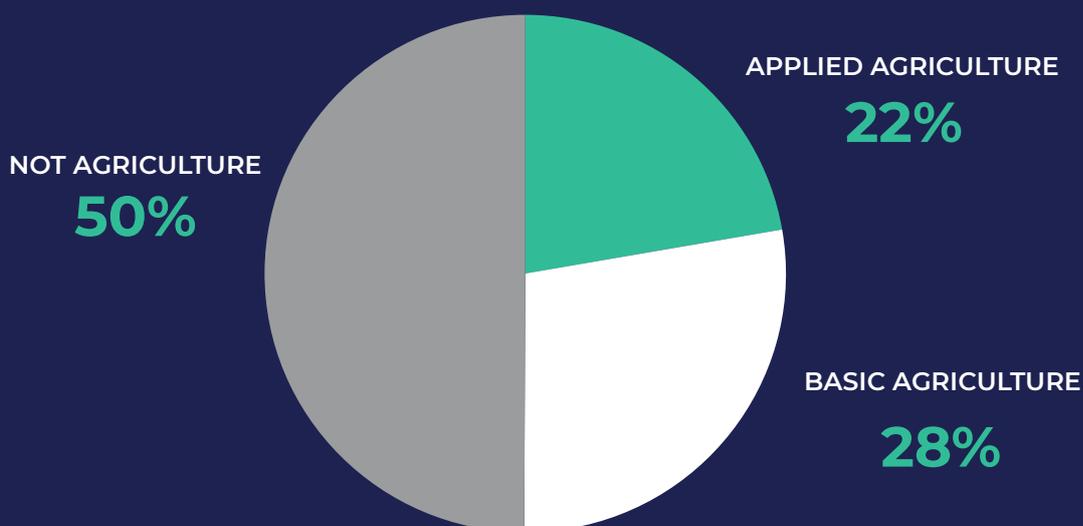

Each colour represents a different university. Activity and expertise in each research area is distributed across a large number of institutions, rather than being heavily concentrated.

Figure 7: Percentage of AUC REF UoA6 research outputs research by type [9]

NOT AGRICULTURE
50%

APPLIED AGRICULTURE
22%

BASIC AGRICULTURE
28%

Figure 8: Contrasting priorities for stakeholder engagement: stakeholder and researcher priorities implied in our survey compared with evidence of stakeholder engagement reported by AUC universities in REF [10]
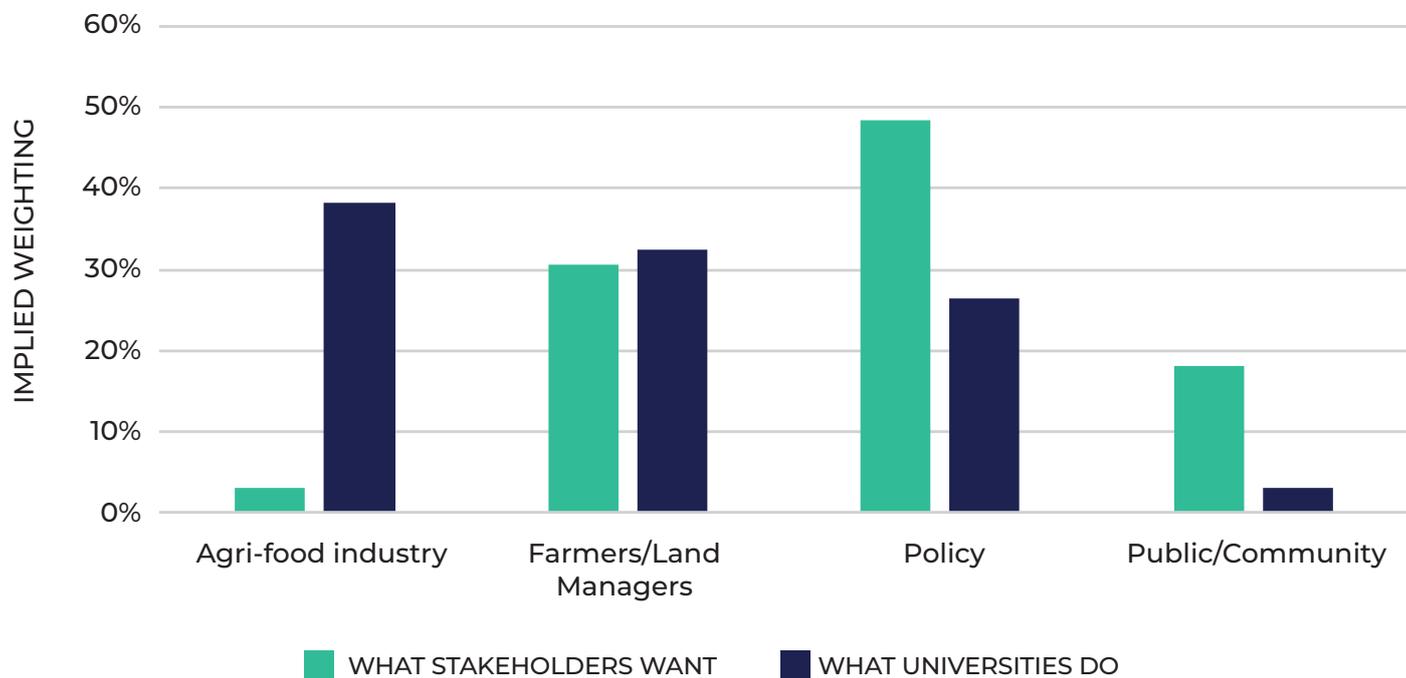
Figure 9: Missing ingredients for a strategic approach to UK agri-food research and innovation [11]

Strategy element	Outcome targets	Agri-food goals	R&I priority assessment	R&D investment priorities	R&D evaluation
Available	Net zero (Climate Change Act) Nature recovery (Environment Act)	Proposals in National Food Strategy [a] Government Food Strategy [b]	Previous scientific & industry assessments [c] Reviews by government [d] Plant science strategy [e] Funder/programme-specific advisory boards	Agri-tech Strategy [f], Research institute grants, Global Food Security Programme [g], UKRI Strategy [h], BBSRC Strategy [i], BBSRC Institute strategies, UKRI Transforming Food Production [j], UKRI Transforming Food Systems [k], Defra Farming Innovation Pathways [l], SEFARI [m]	REF (universities), Institute Assessment Exercise [n], Agri-Tech Centres review, UKRI programme review, UKRI food deep-dive, macro-economic studies [n]
Gaps	Diet-related health & inequalities targets	UK goals for dietary change, land use change, agricultural trade	Current, inclusive, sector-wide R&I assessment of priorities	Coherent approach across UK public funders Infrastructure investment plan for agri R&I Talent investment plan for agri R&I	Sector-wide/system-wide assessment of R&I capability, efficiency & impact More relevant measures of innovation than TFP

Impact case study

A new evidence synthesis methodology to inform decision-making

Harper Adams University

Funded by Defra

Harper Adams University established and developed a systematic mapping methodology for environmental and land-based decision-making, to investigate the state of research within a topic, incorporate diverse evidence, and identify knowledge gaps. Systematic reviews can answer a question in a structured and comprehensive manner, but are often unsuitable for broad topics.

This led to the development of Harper Adams University's methodology to collate and summarise evidence for environmental and agricultural decision-makers, which has been used globally (e.g. Defra, Scottish Government, NERC, Environment Agency, EU, Canadian development organisations, and part of evidence gathering for Ceres 2030).

Full report available at REF2021

Research infrastructure

We need to ensure that the UK's basic infrastructure for effective research in agriculture is up to scratch, equipping research farms for the 21st century and defragmenting our sector's systems for sharing knowledge.

The UK has many world-leading facilities for research relevant to agriculture, across the specialist institutes and universities. While some national capabilities are centralised in one or two institutions, the basic infrastructure for agricultural research – including research farms – is available at institutions across the country. This is appropriate, ensuring that farmers and other research users in every region, with diverse needs, have ready access to suitable research partners.

AUC members reported £365M investment in agriculture-related research infrastructure over the latest REF period.[12] This included new laboratories, precision livestock buildings, data science facilities, glasshouses and agri-tech incubators.

This investment comprised more than 40 projects exceeding £1M (Figure 10). However, it was concentrated in a few large initiatives, with the largest five accounting for 60% of the total. Just 5% of the investment over that period went to projects that directly expanded or enhanced our research farms.

Research farms are essential infrastructure, offering unique opportunities for long-term experiments and studies that are high-risk or need intensive monitoring. Their value relies on ongoing investment and development. Many have already closed and, by our assessment, those that remain are at risk of becoming degraded.

These dedicated facilities are increasingly complemented by research on commercial farms, enabled by a growing toolkit for collecting and analysing data. Both approaches rely on knowledge exchange with farmers and other stakeholders. Ensuring the relevance and impact of such research requires that researchers and practitioners not only swap evidence and experience, but also co-design projects and collaborate on their delivery.

We found ample evidence of knowledge exchange. The enduring challenge is to 'defragment' a chaotic and confusing patchwork of initiatives that crowd this crucial interface (Figure 11).

This is a particular challenge in England, whereas knowledge exchange is more co-ordinated in Wales, Scotland and Northern Ireland. This challenge is so evident and important that it has spawned successive, independent efforts to address it. Indeed, so much so, that these coordinating initiatives themselves risk adding further to the duplication and confusion.

In this context, it is vital that we back existing efforts to join up research and knowledge exchange, rather than bringing yet more new initiatives into this crowded field. We are therefore taking the following steps as a group of universities.

What Works Centre. As a group of research providers, we are backing efforts to develop a What Works Centre (WWC) for Agriculture.[13] The WWC will fulfil a crucial function in the agricultural knowledge and innovation system (Figure 12), providing a one-stop-shop to digest, contextualise and translate emerging knowledge from research, practical experience and other sources. To offer a clear and trusted resource for the industry, this function needs to be centrally coordinated.
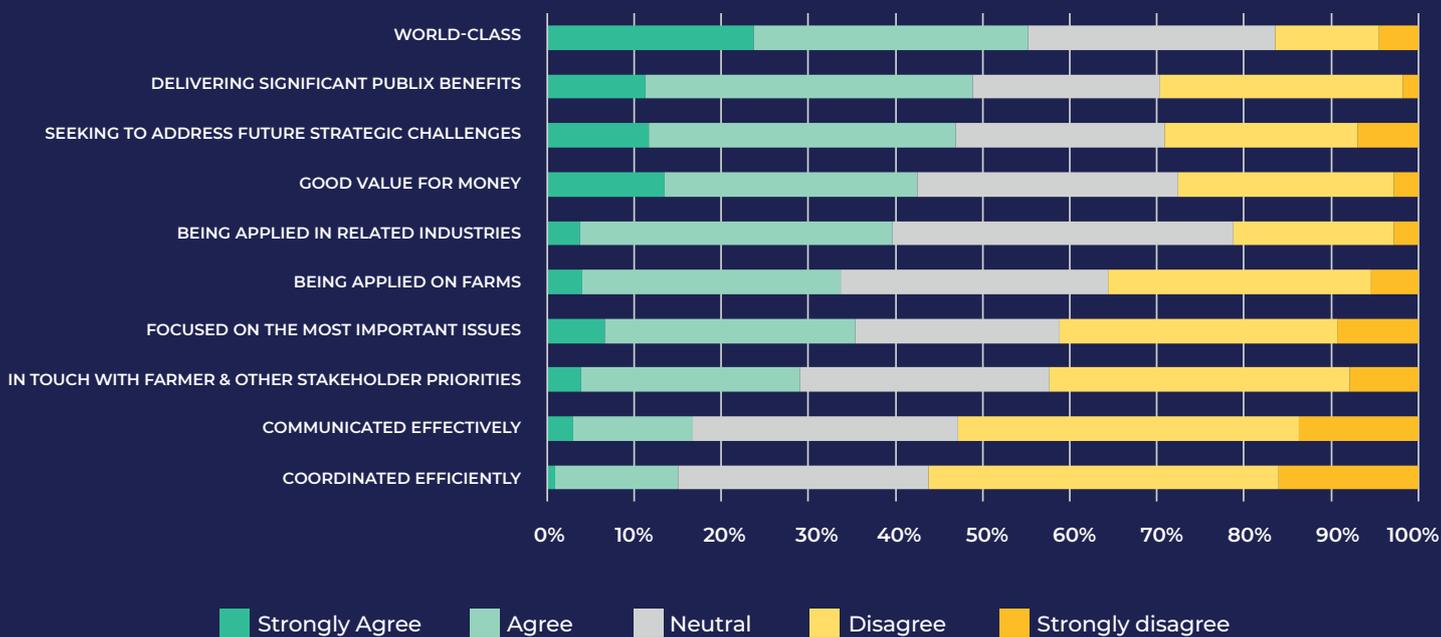
Co-ordinated knowledge exchange. We support the recommendation of Lord Curry's 2022 report for greater national co-ordination of demonstration and research farms, and of knowledge exchange (extension) activities across England.[14] We are supporting work by AHDB, the School of Sustainable Food & Farming, and The Institute for Agriculture & Horticulture (TIAH) to map existing facilities (Figure 13). We are also working with others to explore the potential for coordinating knowledge exchange activities across the industry at a regional scale.

Research farm infrastructure. We will assess the current state of research farms across all UK research providers, and identify where strategic investment is needed to maintain or develop essential capabilities.
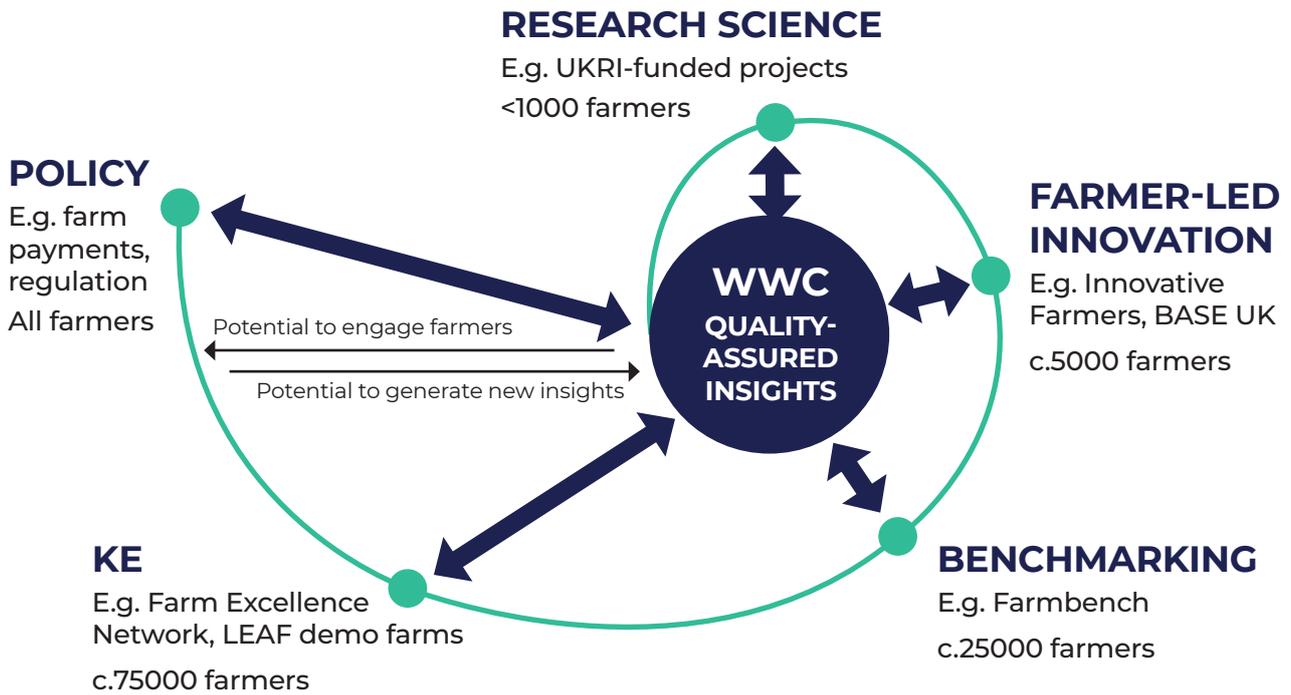
Figure 10: Investments in facilities reported by AUC universities over the REF period. Shown by theme and size of project [15]
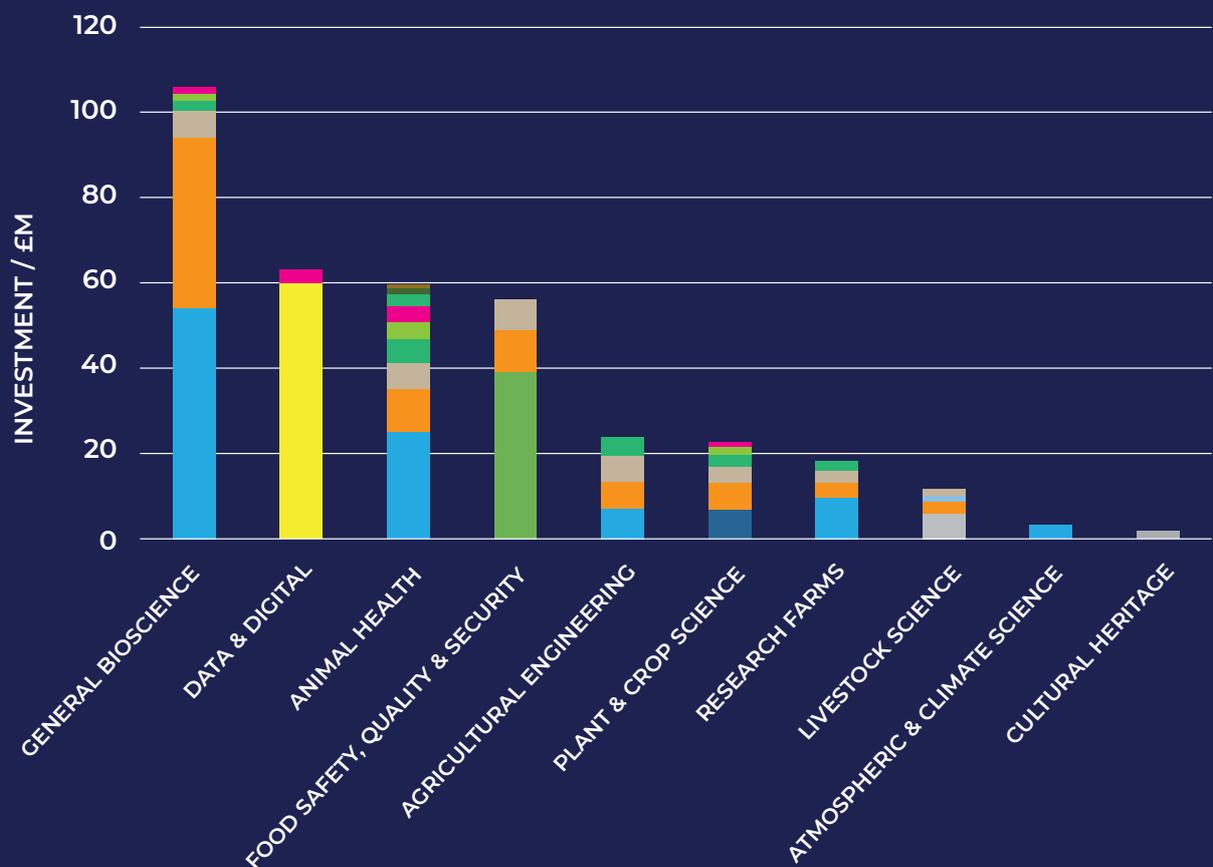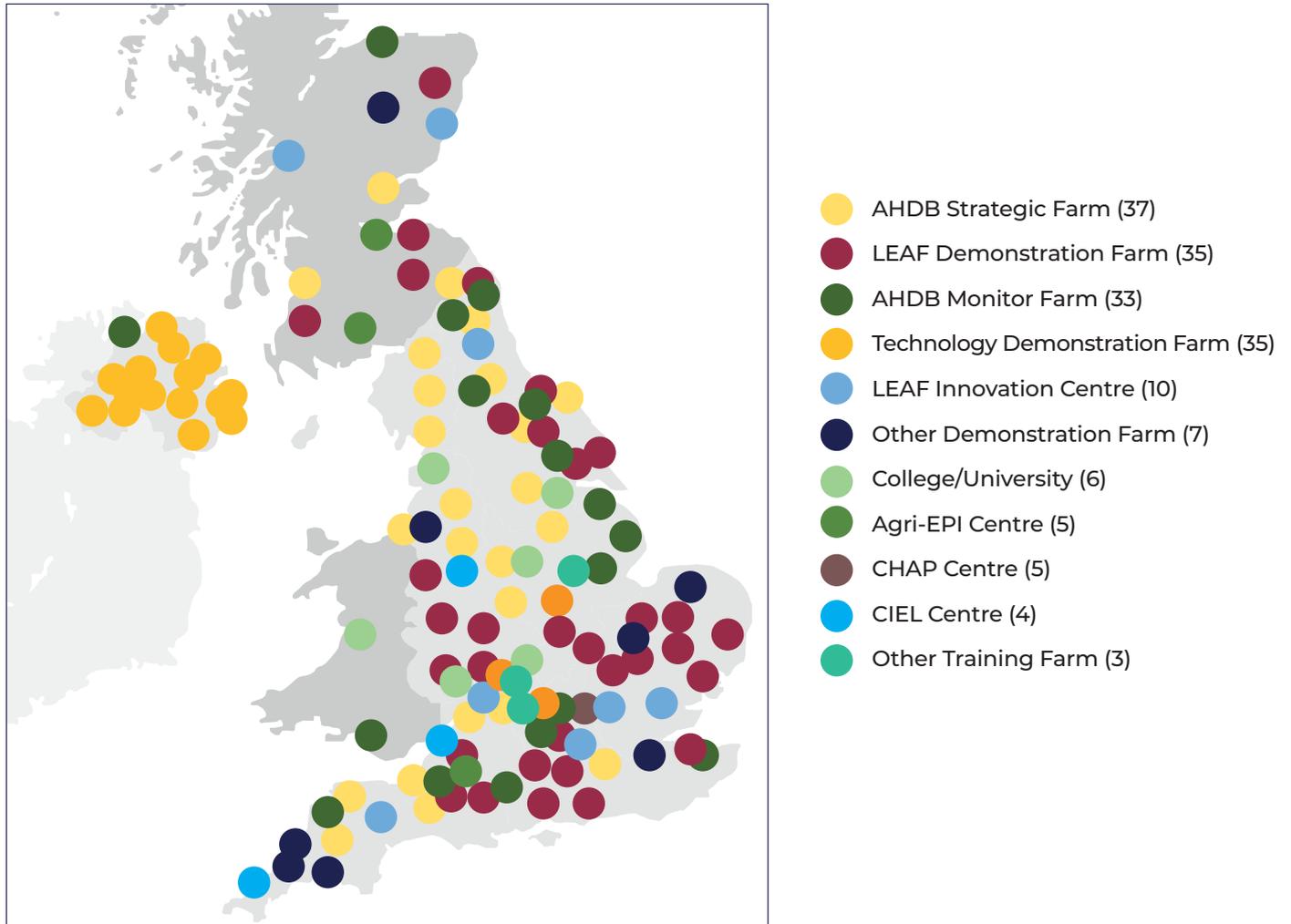

Figure 11: Stakeholders in our survey felt UK agricultural research was world-class but poorly coordinated and communicated [16]

Legend: Strongly Agree | Agree | Neutral | Disagree | Strongly disagree

Figure 12: Role of the What Works Centre in joining up the UK agricultural innovation ecosystem

RESEARCH SCIENCE
E.g. UKRI-funded projects
<1000 farmers

POLICY
E.g. farm payments, regulation
All farmers

FARMER-LED INNOVATION
E.g. Innovative Farmers, BASE UK
c.5000 farmers

WWC QUALITY-ASSURED INSIGHTS

Potential to engage farmers
Potential to generate new insights

KE
E.g. Farm Excellence Network, LEAF demo farms
c.75000 farmers

BENCHMARKING
E.g. Farmbench
c.25000 farmers

Figure 13: Demonstration farms across the UK [17]

- AHDB Strategic Farm (37)
- LEAF Demonstration Farm (35)
- AHDB Monitor Farm (33)
- Technology Demonstration Farm (35)
- LEAF Innovation Centre (10)
- Other Demonstration Farm (7)
- College/University (6)
- Agri-EPI Centre (5)
- CHAP Centre (5)
- CIEL Centre (4)
- Other Training Farm (3)

Impact case study

Photo credit: University of Lincoln

Agricultural robotics to transform agriculture

University of Lincoln

Funded by Innovate UK, BBSRC

Lincoln's interdisciplinary and collaborative research in agri-robotics and autonomous systems has influenced the data-driven transformation of farming and food production, with Lincoln's agricultural robotics underpinning and influencing changes to policy and investment in the UK (e.g. Farming Transformation Fund), informing EU Parliament AGRI committee on the future of agricultural workforces, and informing strategic responses to labour shortfalls arising from COVID and Brexit (co-leading the Accelerated Automation initiative).

Lincoln's industrial partnerships with Saga Robotics and Berry Garden Growers successfully demonstrated full robotic autonomy on farm in 2020.

Full report available at REF2021

Research talent

We need to strengthen and refocus postgraduate training to develop researchers with the skills and understanding that this changing sector will need.

Universities combine research with teaching. As well as equipping graduates to work in agriculture, we nurture the next generation of scientists and research leaders (Figure 14).

We reviewed the evidence on research staff that our sector had submitted to the REF. Our universities have been recruiting successfully, with the numbers of researchers growing across our sector (Figure 15). However, there are declining numbers of postgraduates, and there is a need to prioritise support for researchers' further development, and plans for succession (Figure 16).

Fewer than a third of our group provided evidence of substantial programmes to support Early Career Researchers and to plan strategically for succession (Figure 17). Our sector's REF Panel found that seven out of 24 institutions had fewer than 10% Early Career Researchers, raising "issues around sustainability and vitality".[18]

Our workshops highlighted the evolving skills needed to future-proof agricultural research, with growing requirements, not only for key technical skills such as data analytics and the ability to work across disciplines and systems, but also for social and management skills in stakeholder engagement, co-innovation and commercialisation.

We will initially take three steps to help ensure the UK has researchers working on agriculture with the range of skills needed, enabled and encouraged to work impactfully.
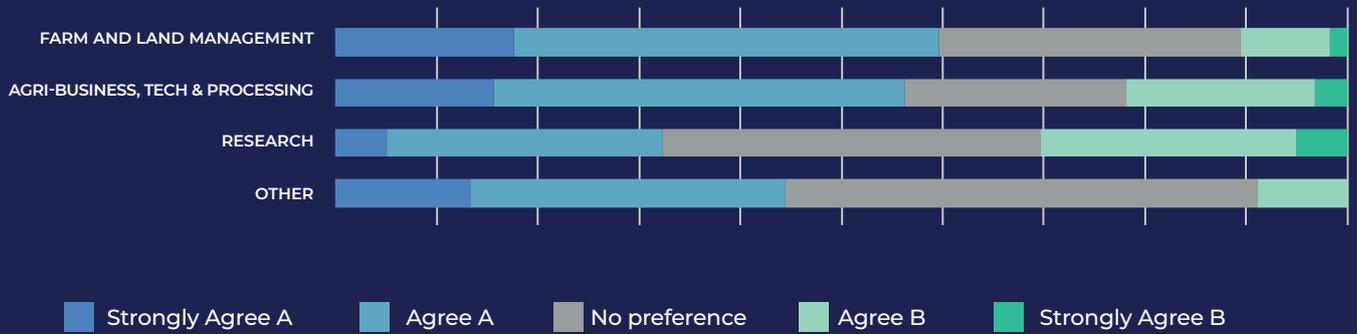
PhD conference. In 2023, we plan to bring together the community of PhD students working on agriculture-related research at a new sector-wide conference. This will not only be a networking and training opportunity, but also a census, mapping strengths, needs and gaps across the field of future researchers.

Doctoral training. Working with industry, policy-makers, NGOs and funders, we plan to develop a sector-wide doctoral training programme to address the gaps highlighted in our review of current PhDs. Our aims with this programme are to attract the brightest students from diverse backgrounds into agricultural research, and to grow a critical mass of mission-oriented, practically engaged and innovative agricultural scientists. The proposal will include an undergraduate research leadership programme that offers students from diverse backgrounds and disciplines the opportunity to gain hands-on experience of agricultural research, to increase numbers of high-quality applications to postgraduate research programmes.
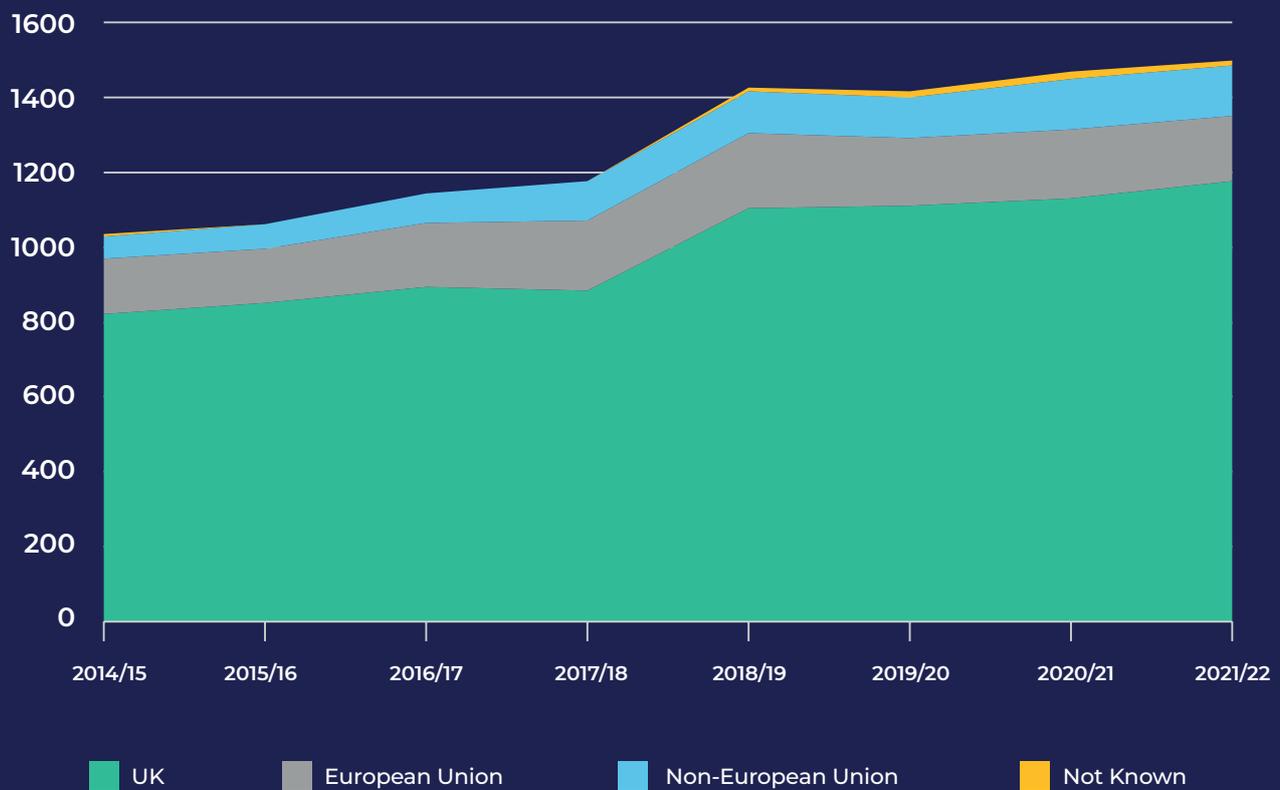
Sustainable academic careers. We will benchmark approaches to developing secure and impactful research career pathways across AUC universities, identifying the most effective approaches and building a shared evidence base to underpin investment. This includes increasing independent fellowships available at each career stage, the use of proleptic appointments to make such fellowships attractive to the brightest researchers, and ways of recognising in promotions academics who excel at research impact and knowledge exchange.

Figure 14: In our survey, researchers placed equal weight on developing research and other workplace skills, but few farmers and other respondents saw research skills as a priority [19]

A. Skills for the workplace vs B. Skills for research

Legend: Strongly Agree A | Agree A | No preference | Agree B | Strongly Agree B

Categories: FARM AND LAND MANAGEMENT, AGRI-BUSINESS, TECH & PROCESSING, RESEARCH, OTHER

Figure 15: Academic staff working in agriculture, forestry and food science by country of origin [20]

Legend: UK | European Union | Non-European Union | Not Known

X-axis: 2014/15, 2015/16, 2016/17, 2017/18, 2018/19, 2019/20, 2020/21, 2021/22

Figure 16: While AUC universities produced 45 more PhDs in 2019 than 2013, numbers peaked in 2017 and since declined [21]
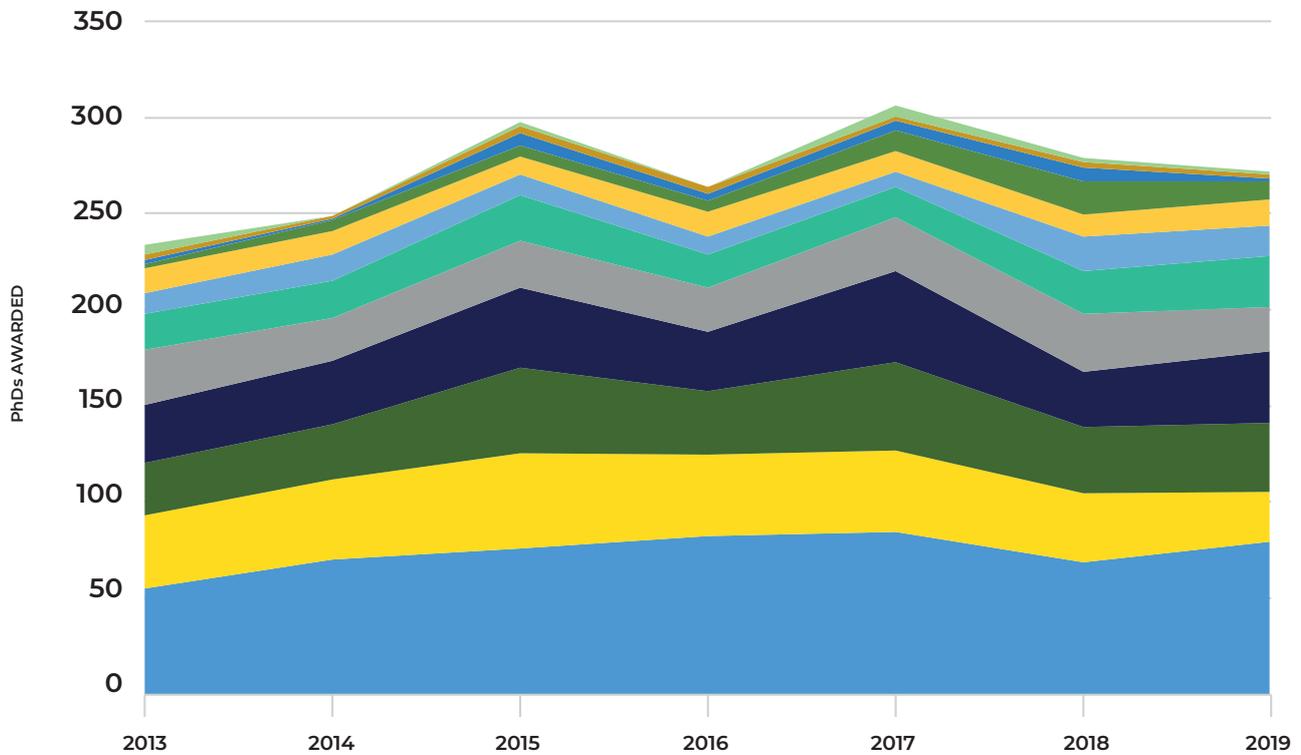
Figure 17: Evidence of strategically aligned recruitment and staff succession planning reported in REF by AUC universities [22]
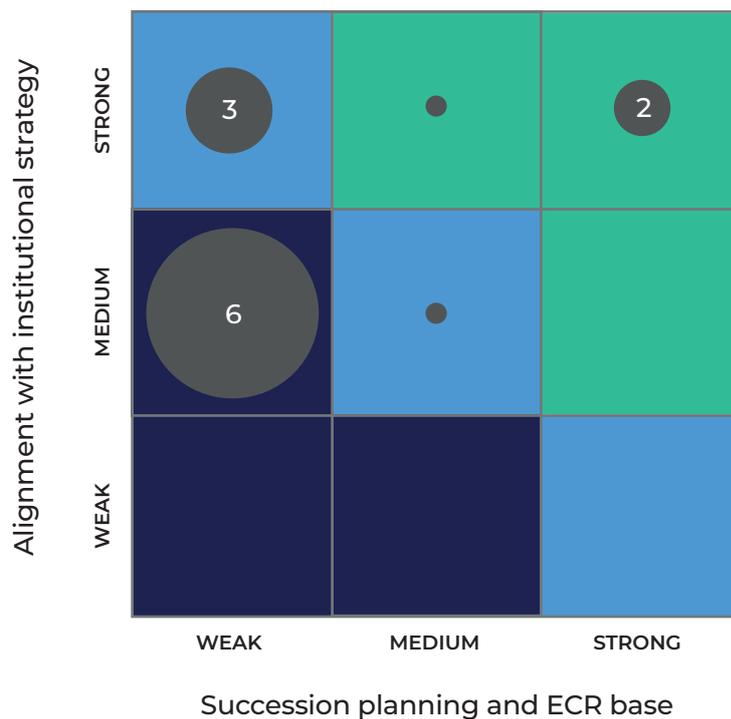
Impact case study

Photo credit: Prof. Daniel Carneiro de Abreu

Modelling to underpin Brazil's international climate commitments

University of Edinburgh with SRUC

Funded by ESRC, EU FP7

The team developed innovative bio-economic models showing that restoring degraded pasturelands can reconcile the competing goals of livestock production with reduction of deforestation and greenhouse gas (GHG) emissions in Brazil, underpinning Brazil's pledge to reduce overall GHG emissions to 43% below 2005 level by 2030. The models improved and supported the next phase of Brazil's Ministry of Agriculture Low Carbon Agriculture subsidy programme to provide incentives for farmers to adopt sustainable agricultural practices, including pasture restoration.

Models also demonstrated that reduced meat demand may not always lead to anticipated reductions in deforestation and GHG emissions, owing to reduced farmer incentives to implement pasture restoration practices.

Full report available at REF2021

Next steps

This strategy sets out new steps that we are taking as a group of universities to play our part in addressing the challenges facing agriculture. Co-ordinating efforts across the research sector is essential, and we welcome collaboration with others.

This strategy focuses on the steps we can take directly as a group of universities (Figure 18). We hope this is helpful in a context where strategies and reviews often focus on recommending what others – government, funders, industry or individual researchers – should be doing.

Yet, while seeking to take responsibility, we are all too aware that the challenges to improving the effectiveness and efficiency of agricultural research are collective, system issues. Although each of our actions tries to take initiative, they therefore all involve collaborating with others.

Several will depend, for their full impact, on us successfully making a case for targeting funding at addressing needs we have identified. These include our ambitions to invest in doctoral training and develop a community of researchers able to commit in the long term to transforming agriculture nationally and globally.

In some cases, we are falling in to support initiatives by others, for example to co-ordinate knowledge exchange and the development of a user-focused evidence base. Here, our commitment is to be active and substantial contributors.

The action that stands out among these, for addressing a strategic need for the whole research sector but not yet the focus of an established initiative, is to develop and embed an open and inclusive mechanism to inform strategic research priorities. This is essential.

We are committed to making it happen and being guided by its findings in our own work. Its full effect, however, will rely also similar engagement by research funders. How stakeholder input informs future strategic funding programmes – not only their thematic focus but also their design, for example regarding academic-industry collaboration – will have at least as much influence on the research we do as our own institutional ambitions.

All the actions we set out here are new steps we are taking as a direct result of working together on this strategy. They are all work in progress. We will report in a year's time against the milestones overleaf.

Figure 18: Summary of actions

	Theme	Action	By
Activities	Open and inclusive priority-setting	Review UK stakeholders' priorities for agricultural research, in the context of global goals for sustainable land use and food systems	May 2024
	Clear research reporting	Agree meaningful and practical reporting system for AUC research	May 2024
	Sector representation	Invite other universities involved in agricultural research to join the AUC	July 2023
Infrastructure	What Works Centre	Support efforts to develop a What Works Centre for Agriculture	Ongoing
	Co-ordinated knowledge exchange	Support AHDB and TIAH to map existing facilities, and work with others to explore potential for regional coordination of KE	May 2024
	Research farm infrastructure	Assess the current state of research farms across all UK research providers, and identify where strategic investment is needed	December 2023
Talent	PhD conference	Bring together the full community of PhD students working on agriculture-related research at a new sector-wide conference	November 2023
	Doctoral training	Develop proposal for a sector-wide doctoral training programme to address the key gaps we identify in a review of current PhDs	May 2023
	Sustainable academic careers	Benchmark approaches to developing secure and impactful research career pathways across AUC universities, identifying the most effective approaches	May 2023

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Impact case study

Reducing reliance on imported protein feed

Aberystwyth University / Prifysgol Aberystwyth

Funded by Innovate UK, AHDB, Defra

A combination of participatory and scientific research led by Dr Christina Marley in IBERS enabled Waitrose and their producers to understand and overcome barriers to adopting home-grown protein forages as protein feed for ruminant livestock. Despite research advances in alternative forage crops, plant breeding and product quality, the adoption of high protein forages by the industry was limited. Marley and her team recognised that underpinning research would only be adopted by the industry by collaboratively involving farmers in the research process.

The resulting removal of imported soya from beef, dairy and lamb production systems by a major UK food retailer has impacted on production and commerce, provided environmental benefits for the sector, and contributed to a 17% decrease in UK soya imports.

Full report available at REF2021

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[1] The research institutes strategically funded by the BBSRC are: Babraham Institute; Earlham Institute; Institute of Biological, Environmental and Rural Sciences (IBERS); John Innes Centre; The Pirbright Institute; Quadram Institute; The Roslin Institute; Rothamsted Research. Other strategically funded institutes relevant to UK agriculture include, the NERC-supported UK Centre for Ecology & Hydrology, and Scotland's Rowett Institute, James Hutton Institute and Moredun Institute, and Northern Ireland's Agri-Food & Biosciences Institute.

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[4] APWG (2020) Agricultural Productivity Working Group report to the Food and Drink Sector Council. February; Dimbleby, H. (2021) National Food Strategy; Lowenberg-DeBoer et al. (2022). Application of Science to Realise the Potential of the Agricultural Transition. Food and Farming Futures & School of Sustainable Food and Farming Report. November.

[5] We polled stakeholder and researcher views of agri-food research and innovation, and the role of universities. The poll ran from 9th June to 13th July 2022. It received 237 responses. These were across the following groups: farming and land management (59); agri-business, technology and processing (32); research (99); and other including public and third sector (47). Responses here are ranked by strength of agreement.

[6] Previous reports reviewed for this strategy: UK agri-food research and innovation. (1) Scottish Government. (2021). Strategy for Environment, Natural Resources and Agriculture Research: 2022-2027; (2) HM Government (2013) A UK Strategy for Agricultural Technologies. DBIS. July; (3) Pollock et al. (2013). Feeding the Future. Innovation Requirements for Primary Food Production in the UK to 2030; Joint Commissioning Group. May. (4) Langdale, J. (2021) UK Plant Science Research Strategy: A Green Roadmap for the Next Ten Years. BBSRC. May.; (5) BBSRC (2021) Research in Agriculture and Food Security: Strategic Framework. UKRI. December.; (6) BBSRC (2017). Strategy for UK Biotechnology and Biological Sciences. Consultation.; (7) Global Food Security Programme (2019) Game-changing developments in the context of food security and future research priorities. Horizon scanning report.; (8) Lowenberg-DeBoer et al. (2022). Application of Science to Realise the Potential of the Agricultural Transition. Food and Farming Futures & School of Sustainable Food and Farming Report. November.; UK general research and innovation. (9) HM Government (2020) UK Research and Development Roadmap. July; (10) UKRI (2021) Corporate Plan 2020–21. UKRI. September; (11) UKRI (2018) UKRI Framework Document. BEIS. May.; International agri-food research and innovation. (12) USDA (2021) U.S. Agriculture innovation strategy: a directional vision for research. USDA Agricultural Innovation Agenda. January; (13) European Union (2015) The Role of Research in Global Food and Nutrition Security. EXPO 2015 EU Scientific Steering Committee discussion paper; (14) EY (2019) Agricultural Innovation — A National Approach to Grow Australia's Future. Australian Government. March.

[7] Estimated by apportioning institutional research income reported in REF according to the frequency of outputs by topic.

[8] CEIA analysis. Data source: REF (2022) REF 2021 submissions.

[9] CEIA analysis. Data source: REF (2022) REF 2021 submissions.

[10] Our survey (see note 3) asked respondents to prioritise between paired stakeholder groups, from which we derived an overall priority weighting. This relies on assumptions about how respondents interpreted terms, notably that 'industry' included 'farmers/land managers' and 'other industry'. We separately coded university 'REF 5b Environment Statement' submissions to identify any evidence submitted of engagement with specific stakeholder sectors. Additionally – not shown here – we quality-rated the evidence and coded it according to the depth of engagement.

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[12] CEIA analysis. Data source: REF (2022) REF 2021 submissions.

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Impact case study

University of Reading

Photo credit: Sean Webber,
University of Reading

Evidence-based policy and practice change for improved UK crop pollination

The University of Reading

Funded by BBSRC

University of Reading's research has helped steer England's National Pollinator Strategy (NPS) from its conception. After publication in 2014, the team's further research has informed ongoing development and implementation of the NPS by quantifying the essential role that wild bees and other pollinating insects play in UK crop production. Natural England's Entry Level Stewardship scheme had specific management options based on the team's research.

The team has worked collaboratively with companies supplying ca. 70% of UK's top-fruit market through knowledge exchange, understanding opportunities to increase yield and quality through improving pollination, leading to the introduction of actions to protect and enhance wild pollinator habitats. Reading's research has supported a leading UK food retailer to meet its sustainability targets, for example by informing the development of a periodic assessment of its growers.

Full report available at REF2021

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[14] Lowenberg-DeBoer et al. (2022). Application of Science to Realise the Potential of the Agricultural Transition. Food and Farming Futures & School of Sustainable Food and Farming Report. November.

[15] CEIA analysis. Data source: REF (2022) REF 2021 submissions.

[16] See note 3.

[17] TIAH (2022) Map of demonstration farms in England. https://tiah.org/demonstrations-farms/, including additional demonstration and research farms for Northern Ireland, Wales and Scotland. Not all farms yet identified on the figure.
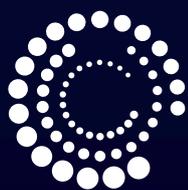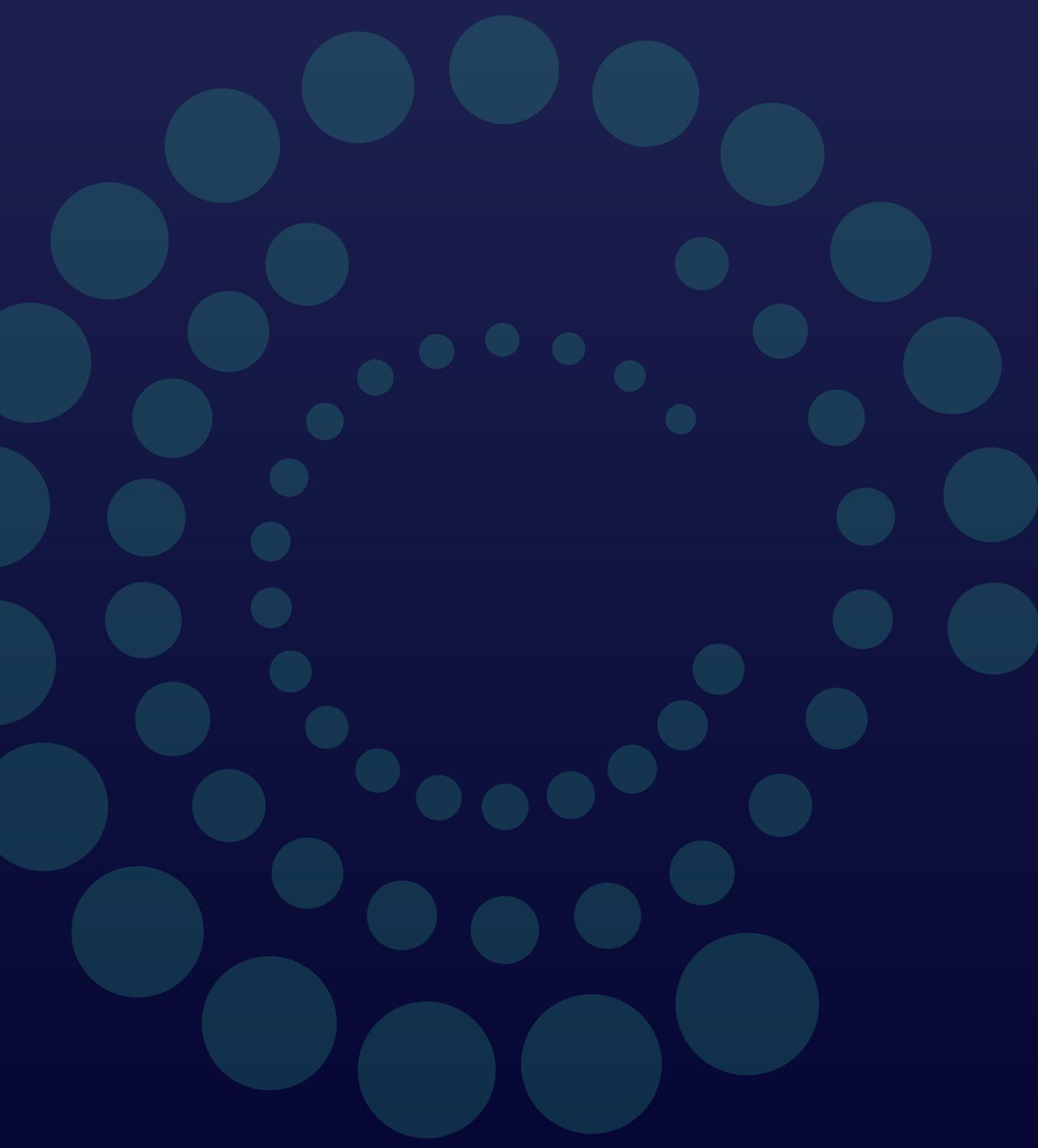
[18] REF (2022) Overview report by Main Panel A and Sub-panels 1 to 6. May.

[19] See note 3.

[20] This chart shows all academic staff, including those who are not research active, for all institutions submitting data to HESA under cost centre 110 (Agriculture, forestry & food science). This includes AUC universities and others. Data source: HESA (2023) Table 12 - HE academic staff by nationality and cost centre 2014/15 to 2021/22.

[21] CEIA analysis. Data source: REF (2022) REF 2021 submissions.

[22] CEIA analysis using the following scoring criteria to code evidence submitted in university UoA6 Environment Statements. Succession: high – strong evidence of thorough process around succession planning / strategy, and strong focus on ECRs; medium – some evidence of succession strategy, and evidence of strong focus on ECRs; low -general statements on succession and ECR numbers, but lack of detail on actual strategy. Alignment: high – evidence of overarching strategic approach to recruitment, with structures/processes in place to direct recruitment in a strategic way that aligns with research priorities; medium – evidence of significant recruitment in areas aligned with research priorities, with general text on 'strategic approaches' but lack of evidence of embedded structures/processes to support strategic recruitment; low – evidence of recruitment but disconnect between appointments and priorities. Data source: REF (2022) REF 2021 submissions.

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