



**Agricultural
Universities
Council UK**

Research strategy Evidence pack

May 2023

This contains supplementary information to the main strategy report.

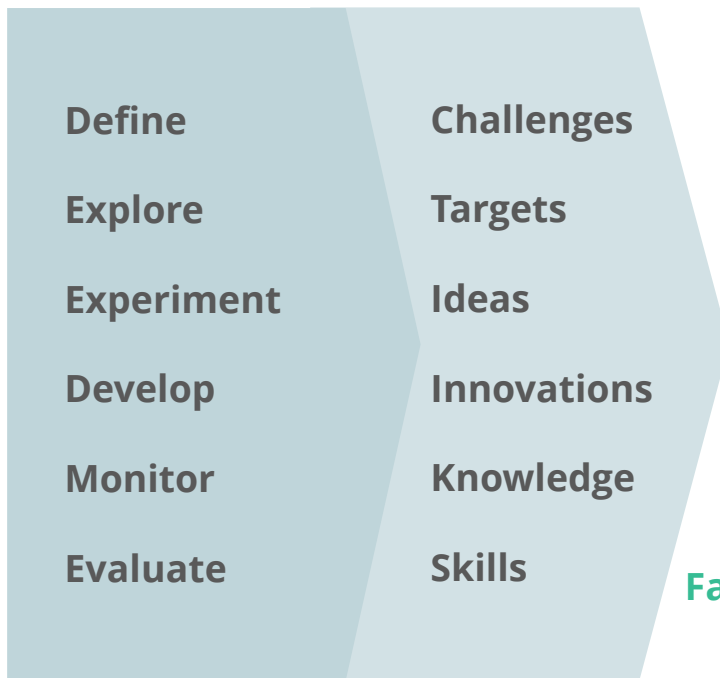
Visit <https://www.auc-uk.org/research-strategy> to read the report.



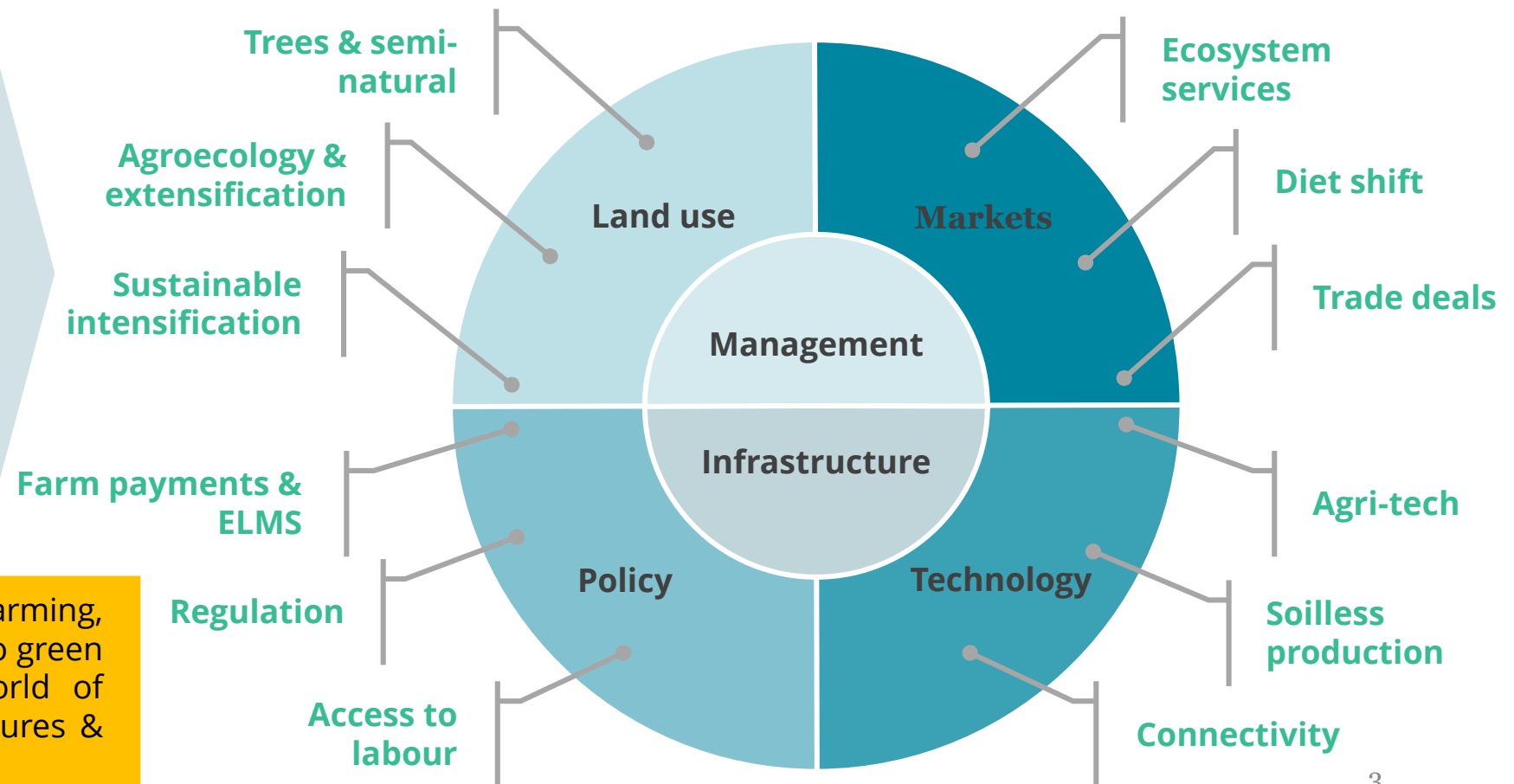
1. Context

1.1. Role of agri-food R&I in transition & green growth

How research can help



Current transitions in UK agriculture



Research and innovation (R&I) in farming, food & land use are foundational to green growth, and to prosperity in world of climate change, food supply pressures & obesity.

1.2. Questions the AUC set out to address through this research strategy review



The AUC is a group of 16 universities that research and teach agriculture



In this project we set out to answer 3 questions:

- What are the highest priority areas for challenge-led and discovery research investment relating to agriculture?
- Where does the UK most need to strengthen agricultural research capability in the short and long term?
- How can universities work more efficiently and effectively, as a sector and with other research, funding and stakeholder institutions?

Considered only in brief

Considered in more detail

1.3. Research providers are among many players in a complex ag R&I system



KE organisations

Networks

Supply Industry

Research, Universities & Institutes

Advisors

Supply chain

Initiatives & Agtech

Public, Policy & Levy Bodies

Press, web, events

1.4. Universities play a smaller role in ag R&I in the UK than some other countries



Public research expenditures and some features of public research organization, by country

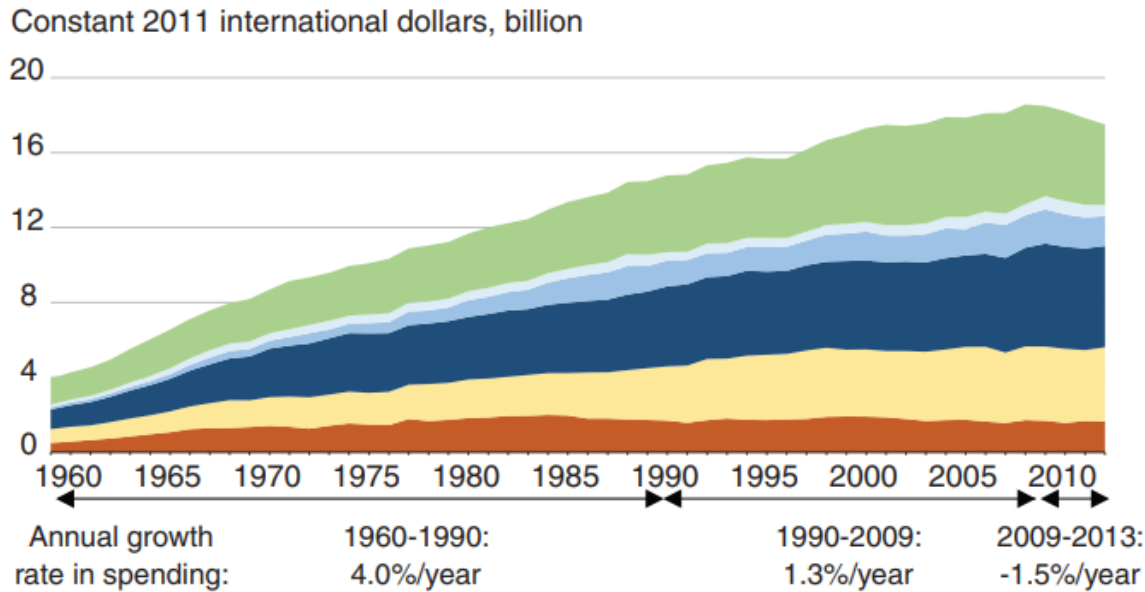
	Annual public research expenditure ¹			
	Small < \$100 million	Intermediate \$100-\$499 million	Large \$500 million-\$999 million	Very large ≥ \$1 billion
Government-oriented < 1/3 public research performed by higher education institutions	Israel Slovak Republic ² Greece Luxembourg	Norway Finland New Zealand Ireland	Spain ⁶ United Kingdom ⁷	Japan ⁶ France
Mixed 1/3 to 2/3 public research performed by higher education institutions	Iceland ²	Poland ³ Switzerland Austria Portugal Czech Republic ² Hungary	Korea Canada ^{3, 6} Australia ^{2, 6} Italy ⁶ Netherlands	Germany ⁶
University-oriented > 2/3 public research performed by higher education institutions	Slovenia Estonia	Belgium ⁴ Denmark ⁵ Sweden		United States

The substantial roles of the research institutes and private providers in delivering public sector research in the UK sees universities accounting for a smaller share than in many other OECD countries.

Heisey, P, and Fuglie, F. (2018). Agricultural Research Investment and Policy Reform in High Income Countries, USDA Economic Research Service, Economic Research Report 249.

1.5. UK public ag R&I spend peaked pre-2000 but has held steady in recent years

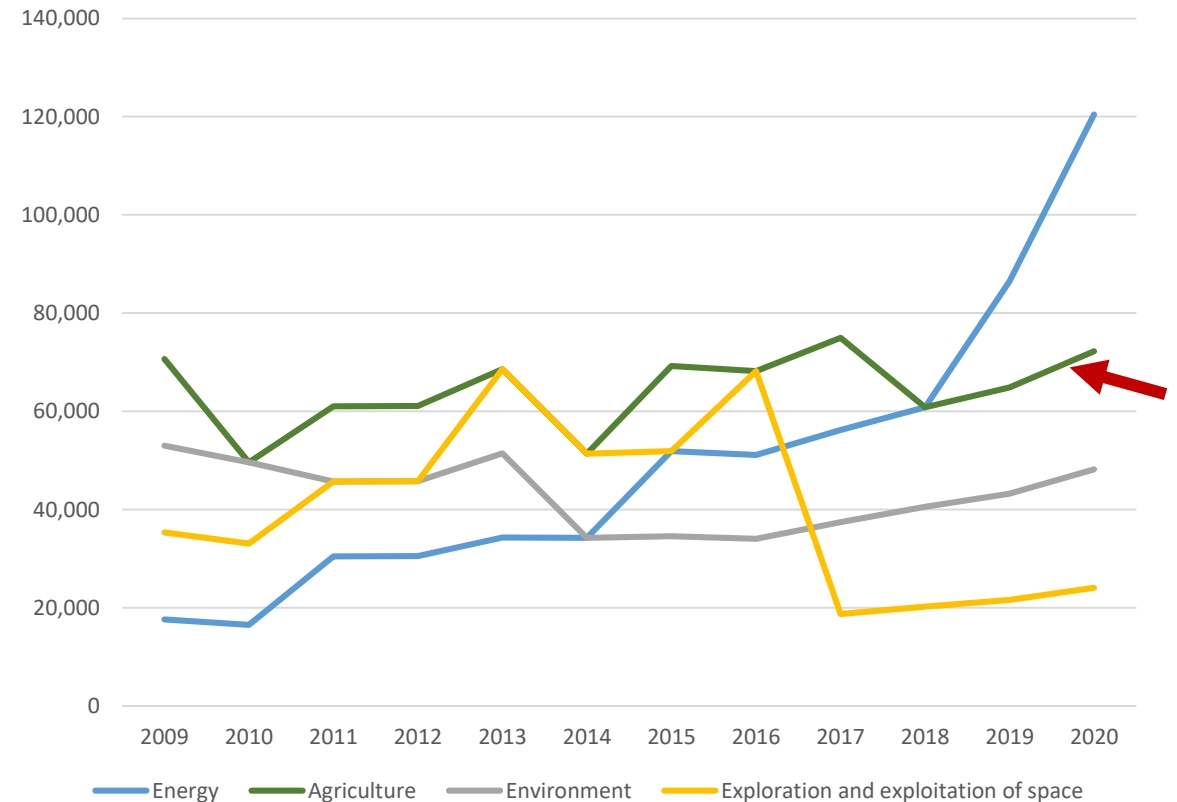
After many years of increase, real public agricultural R&D investment in high-income countries has fallen since 2009



- United States
- Central Europe
- S. Europe/Mediterranean
- Northwest Europe
- Japan & South Korea
- Canada, Australia, and New Zealand

Heisey & Fuglie (2018)

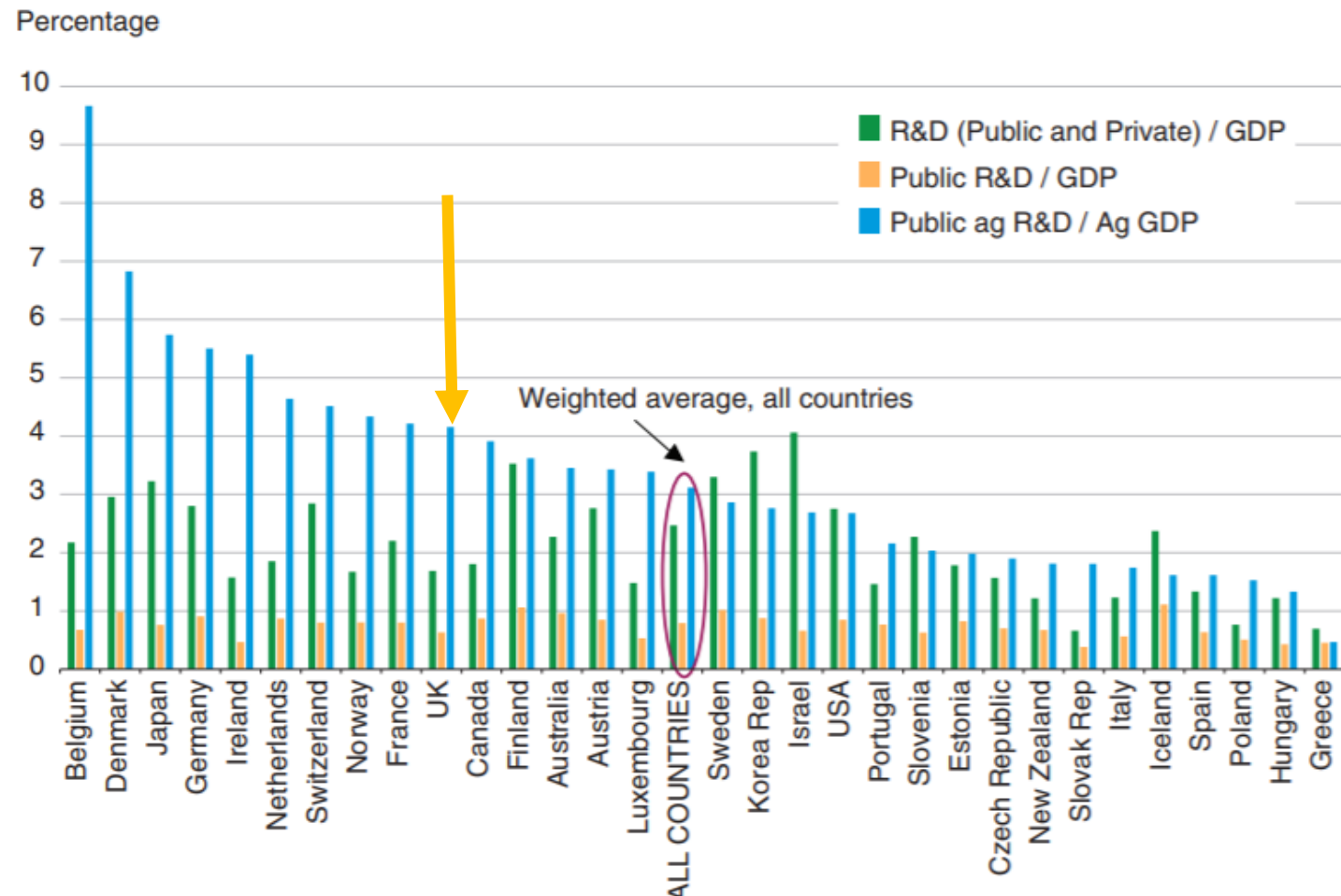
UK government expenditure on R&D by objective in constant 2020 prices (£000) - selected categories



Source: ONS Government expenditure on science, engineering & technology

1.6. The UK government spends more on ag R&I than the OECD average

Research and Development (R&D)/Gross Domestic Product (GDP) intensity ratios for agricultural and nonagricultural research



Public spending on research as a share of GDP is much higher for agriculture than for the economy as a whole in the UK, as in other OECD countries.

2. Strategic challenges

2.1. We reviewed 13 strategy reports that have tried to address similar challenges



	UK	International
Agri-food	Scottish Government. (2012). Environment, natural resources and agricultural research	United States Department of Agriculture. (2021). U.S. Agriculture innovation strategy: a directional vision for research
	HM Government. (2013). A UK Strategy for Agricultural Technologies	European Union. (2015). The Role of Research in Global Food and Nutrition Security
	Pollock et al. (2013). Feeding the Future Innovation Requirements for Primary Food Production in the UK to 2030	EY/Australian Government. (2019). Agricultural Innovation — A National Approach to Grow Australia's Future
	Langdale, J. (2021). UK Plant Science Research Strategy: A Green Roadmap for the Next Ten Years	<p>We wanted to make sure we built on previous thinking rather than reinventing the wheel. We also wanted know whether the issues they identified were constant or had changed. The reports were published between 2012 and 2021. We coded their insights and recommendations, to identify common themes and areas of divergence.</p>
	UKRI/BBSRC. (2021). Research in Agriculture and Food Security Strategic Framework	
	BBSRC. (2017). Strategy for UK Biotechnology and Biological Sciences	
	Global Food Security Programme. (2018). Game-changing developments in the context of food security and future research priorities	
General	HM Government. (2020). UK Research and Development Roadmap	
	UKRI. (2021). Corporate Plan 2020–21	
	UKRI. (2018). UKRI Framework Document	

2.2. Previous reports highlight persistent strategic challenges for agricultural R&I



	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

The review revealed a drumbeat of concern about the practical relevance, public value and co-ordination of UK agri-food R&I, with respect to the identification of priorities, outputs, infrastructure and talent.

While many changes had taken place over the 10 years, such as establishing the Agri-tech Centres, concerns persisted. Recent developments, such as UKRI's 'Transforming Food' programmes and Defra's Farming Innovation Pathways, are still to take effect, yet the latest stakeholder deliberations suggest similar concerns remain.*

Whereas earlier reports highlighted the need for greater industry engagement, more recent reports placed greater emphasis on the public value or mission-orientation of research (e.g. on net zero).

Although similar themes arose in other countries, and in reports on UK R&I in general, they were especially pronounced for UK agri-food. [* e.g. Application of Science to Realise the Potential of the Agricultural Transition]

2.3. The recent REF review of universities suggests that such challenges remain



REF Research Excellence Framework 2021

The REF is undertaken by Research England and informs recurrent quality research (QR) funding universities receive for their activity and infrastructure.

Most agricultural research is submitted to Unit of Assessment (UOA) 6: Agriculture, Food and Veterinary Sciences. These are quotes from the UOA6 sub-panel report.

We explore the data submitted to REF in Section 6, below.

“There is much to celebrate...”

“...excellent examples of research impact emanating from close working relationships with other sectors such as governments, policy makers, industry, and the voluntary sector.”

But:

“The quality profile... raises issues about the continuing ability of researchers in this area to maintain their world leading position with respect to quality.”

“The scale of research in this UOA is small compared to many other disciplines, although essential to support global food production and environmental sustainability.”

“7/24 institutions had <10% of their submitted staff return including Early Career Researchers... raises issues around sustainability and vitality...”

“It was recognised that some of the smaller institutions were not involved in... training partnerships and there were areas, particularly around agriculture, where doctoral training appeared to be less well supported.”

“Whilst many of the world leading outputs in the agricultural sciences related to molecular biology and genomics, as well as ecology there were fewer outputs relating to the multi-disciplinary enviro- agri-food system arenas.”

“11% of the research income... was received from the EU, and that much of this was in the agricultural/ plant and food systems areas. The potential loss of such investment was seen as a key risk to this research area.

“It was surprising that with the growing trend towards less meat-based diets, the importance of ensuring healthy nutrition as well as a sustainable food system was not covered to any great extent.”

3. Current views

3.1. We polled stakeholder & researcher views of agri-food R&I and universities



**Agricultural
Universities
Council UK**

Group	Description	Number
Farm & land management	Farming businesses, agricultural advice, estate management, land or environmental management	59
Agri-business tech processing	Agri-technology business, food processing or distribution, input supply and supply chain, industry association, consultancy (non-land management)	32
Research	University/higher education, research institute/centre, private sector research organisation, research consultancy	99
Other	Policy, funders, National NGO, charities, public service provider, non-departmental body/agency, professional body, bank, independent analyst	47
Total		237

We wanted to know what stakeholders and researchers thought about the current impact of ag-related research, priorities, challenges and role of universities relative to other research providers.

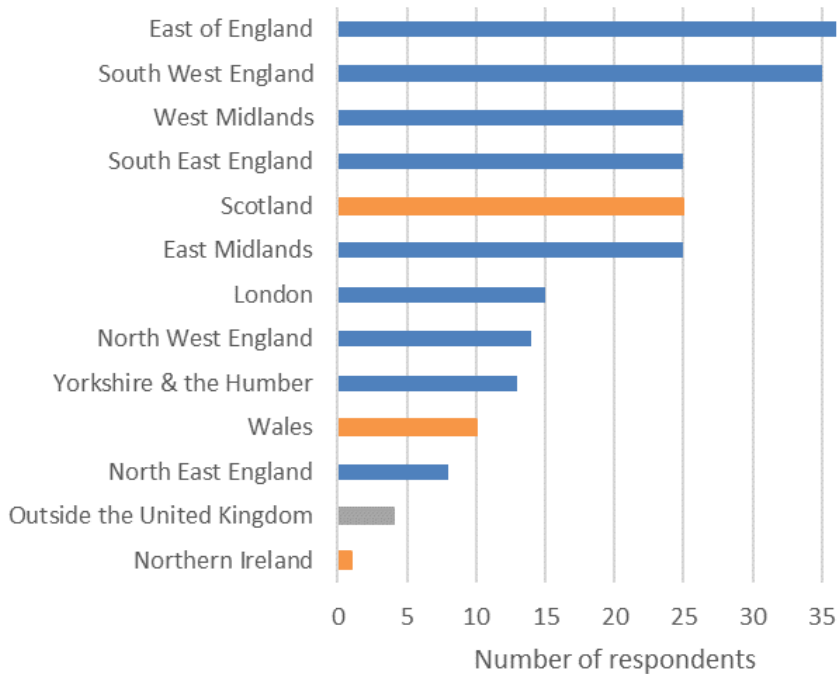
The poll ran from 9th June to 13th July 2022. It received 237 responses. We grouped these into four broad groups, according to their professional background. Where was there consensus and where did views diverge?

The following pages summarise what we found under the four themes we used to report our review of previous strategies: priorities, outputs, infrastructure and talent. As this was a convenience (non-random, non-representative sample) we do not make general inferences. The analysis simply describes responses of people from a range of stakeholder perspectives who, one might assume, are all unusually engaged in the agri-food research.

3.2. Respondents were from across the UK; we grouped them into four sectors

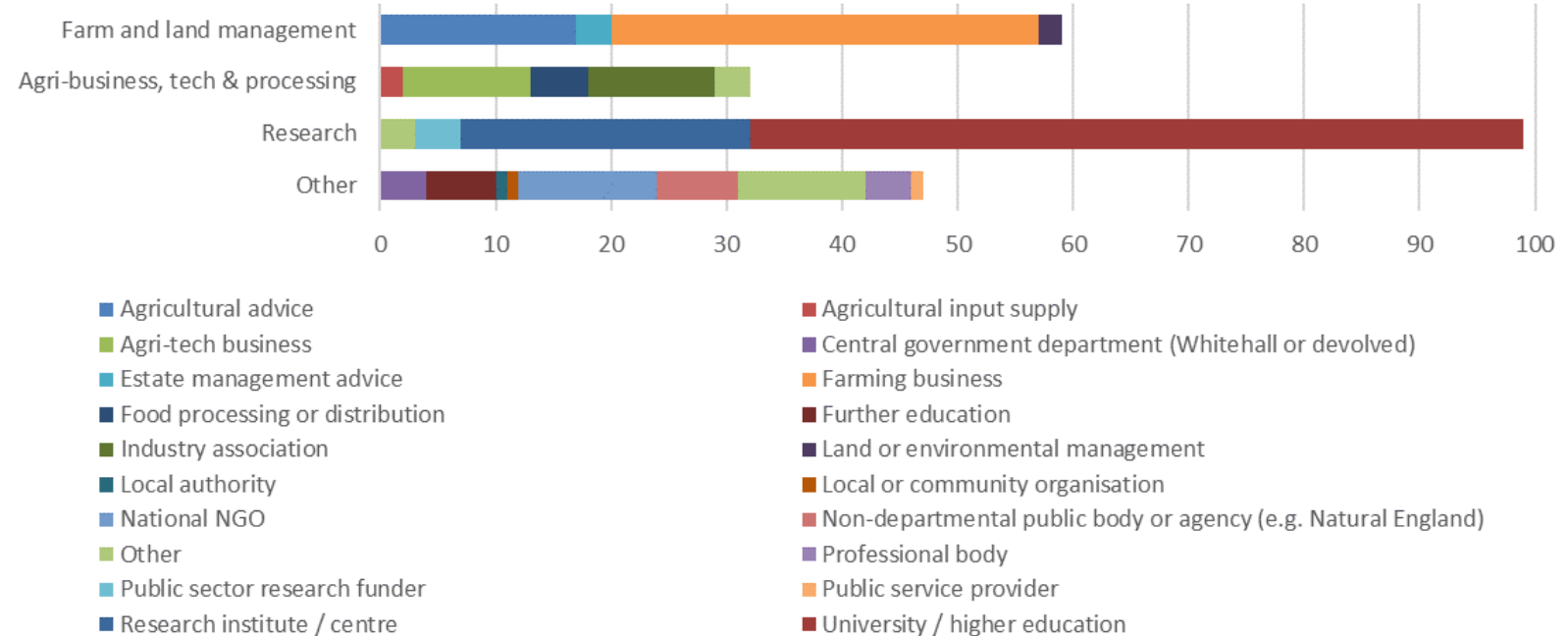


Nation/region



237 responses

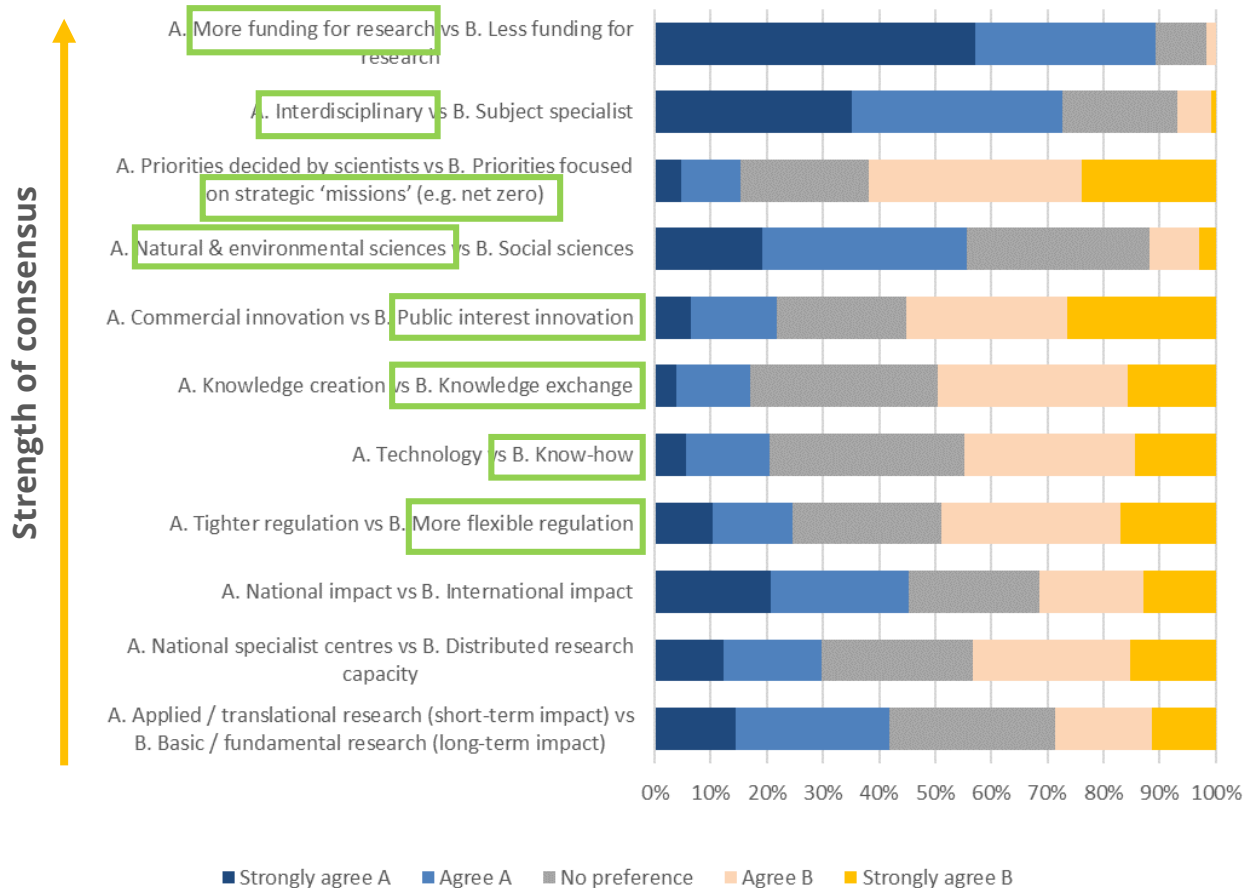
Respondents sector and group



3.3. Priorities: strong support for public interest, mission-oriented research



Research orientation priorities, ranked by strength of consensus



We asked respondents to make a series of binary choices, to highlight their preferences.

In the chart, these are ranked by the strength of consensus – those with the strongest agreement around either option ('A' or 'B' were labels were assigned arbitrarily) near the top.

One set of these questions focused on the purpose and orientation of agricultural research.

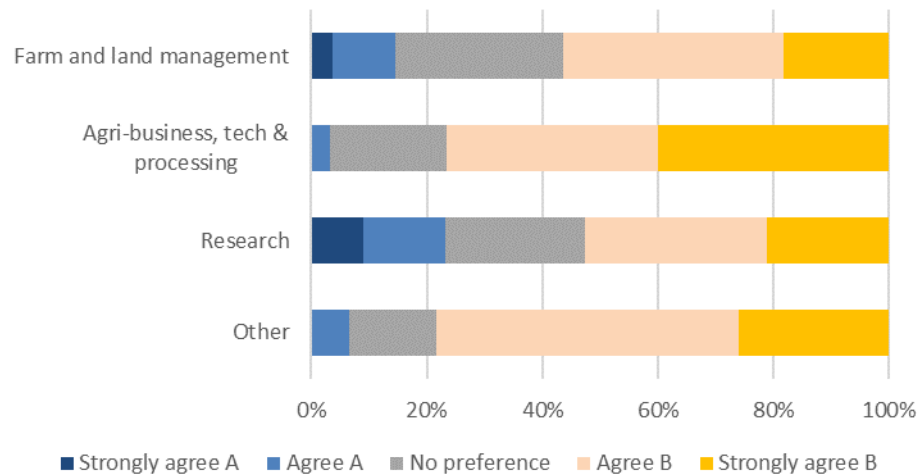
These revealed strong consensus in favour of more funding for research, interdisciplinarity, natural science focus, mission orientation, public interest innovation, knowledge exchange and more flexible regulation.

Other issues – notably the balance of basic and applied research, and the centralisation vs decentralisation of research capacity, divided opinion

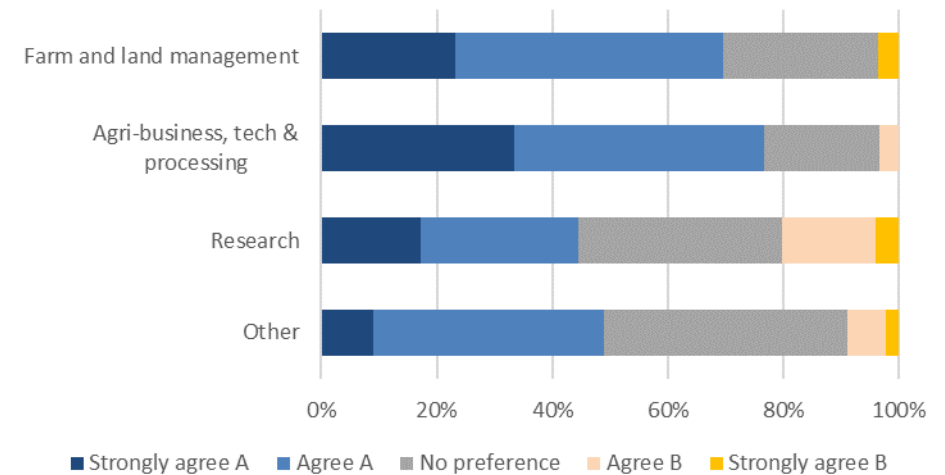
3.4. Priorities: researchers had different views on priority-setting & social sciences



A. Priorities decided by scientists vs B. Priorities focused on strategic 'missions' (e.g. net zero) across groups



A. Natural & environmental sciences vs B. Social sciences

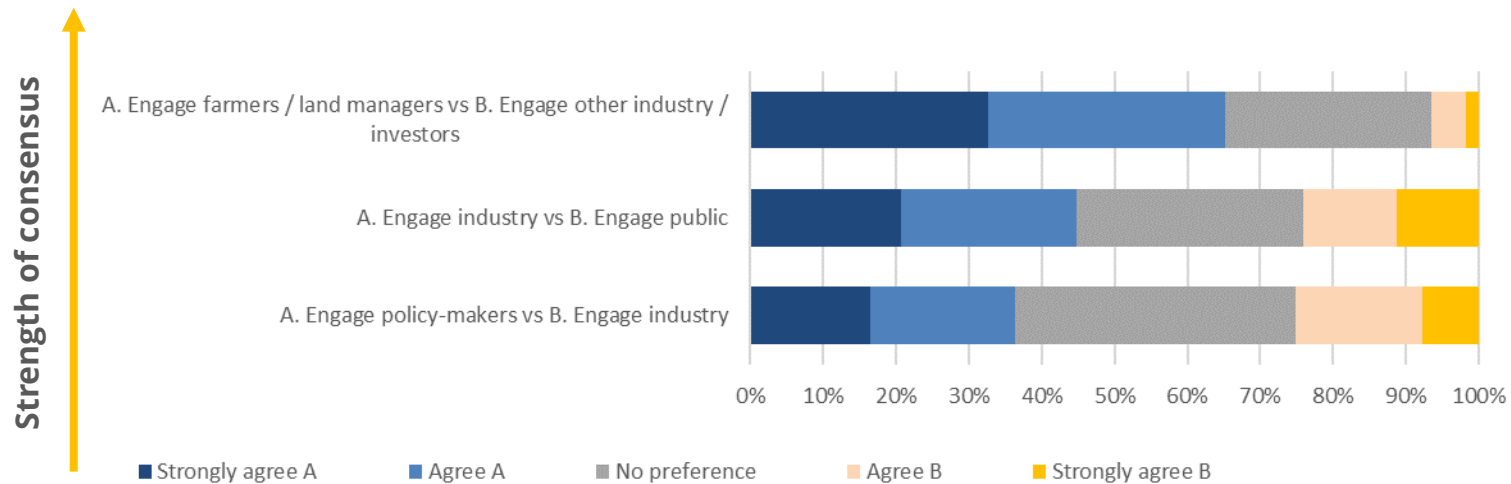


On most issues, looking at the results sector-by-sector revealed similar preferences to the overall group. However, for a smaller number of issues, there were notable differences between sectors. Researchers, perhaps predictably, had a stronger preference than other sectors for scientists deciding priorities. However, their majority preference was still for mission-oriented priorities. Researchers also saw more role for the social sciences than the other sectors.

3.5. Priorities: farmer & policy engagement favoured over other industry & public



Research engagement priorities, ranked by strength of consensus



Previous reports had highlighted the need for greater stakeholder engagement in setting priorities and doing research. We noted a shift from early reports that focused on agri-tech and 'industry' engagement, through to a more recent emphasis specifically on farmer engagement and public interest issues.

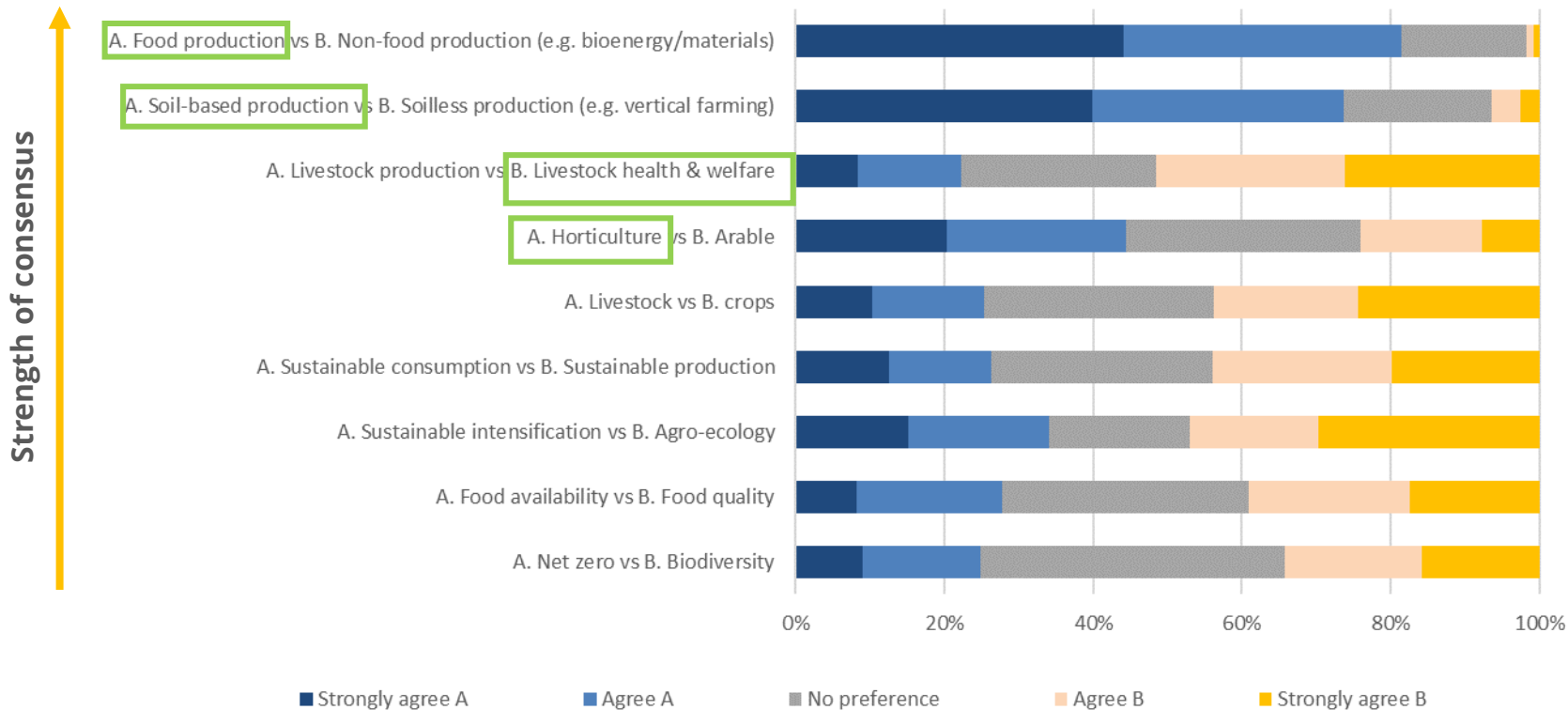
Respondents to the survey showed a strong preference for research engaging farmers and land managers over other industry sectors.

Views varied more on the relative priority of industry vs policy vs public engagement.

3.6. Priorities: strong focus on soil-based food production over non-food or soilless



Thematic priorities, ranked by strength of consensus



We used the same question format to explore respondents' preferences across some of the most hotly debate themes relating to agricultural research.

This revealed very strong consensus in favour of focusing on soil-based food production.

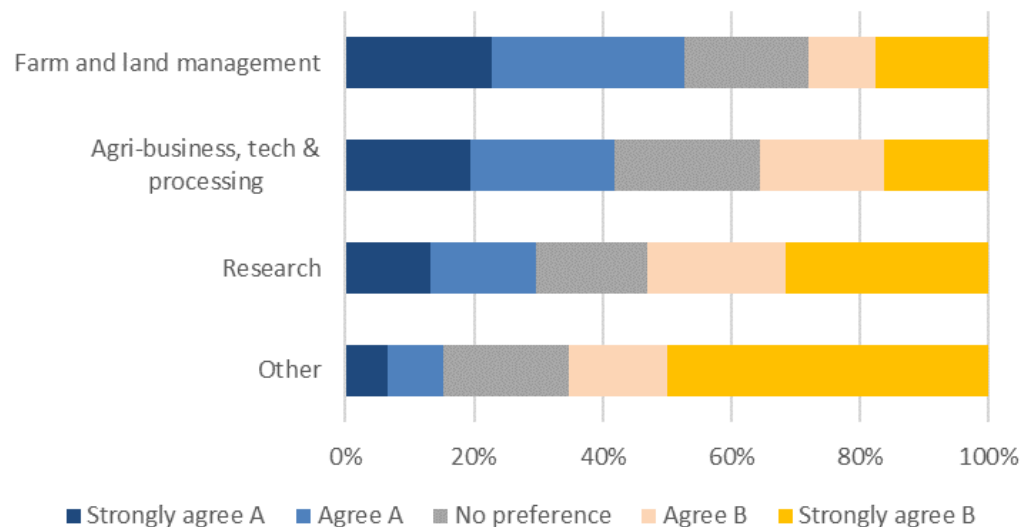
There were also overall preferences for focusing livestock research on health & welfare, and crops research or horticulture over arable.

On other issues, views were more divided. However, the strength of preference for research on food quality relative to availability, and biodiversity relative to net zero, are notable in a context where food availability and net zero might be considered more prominent issues in public discourse.

3.7. Priorities: farmers focused on sustainable intensification, researchers on agro-ecology



A. Sustainable intensification vs B. Agro-ecology



Across most of the themes, there was no clear relationship between respondents' sectors and preferences.

The exception was their preferences for 'sustainable intensification' vs 'agro-ecology'.

While views were divided across all sectors, most farmers expressed a stronger preference for sustainable intensification, whereas most research and 'other' respondents expressed a preference for agro-ecology.

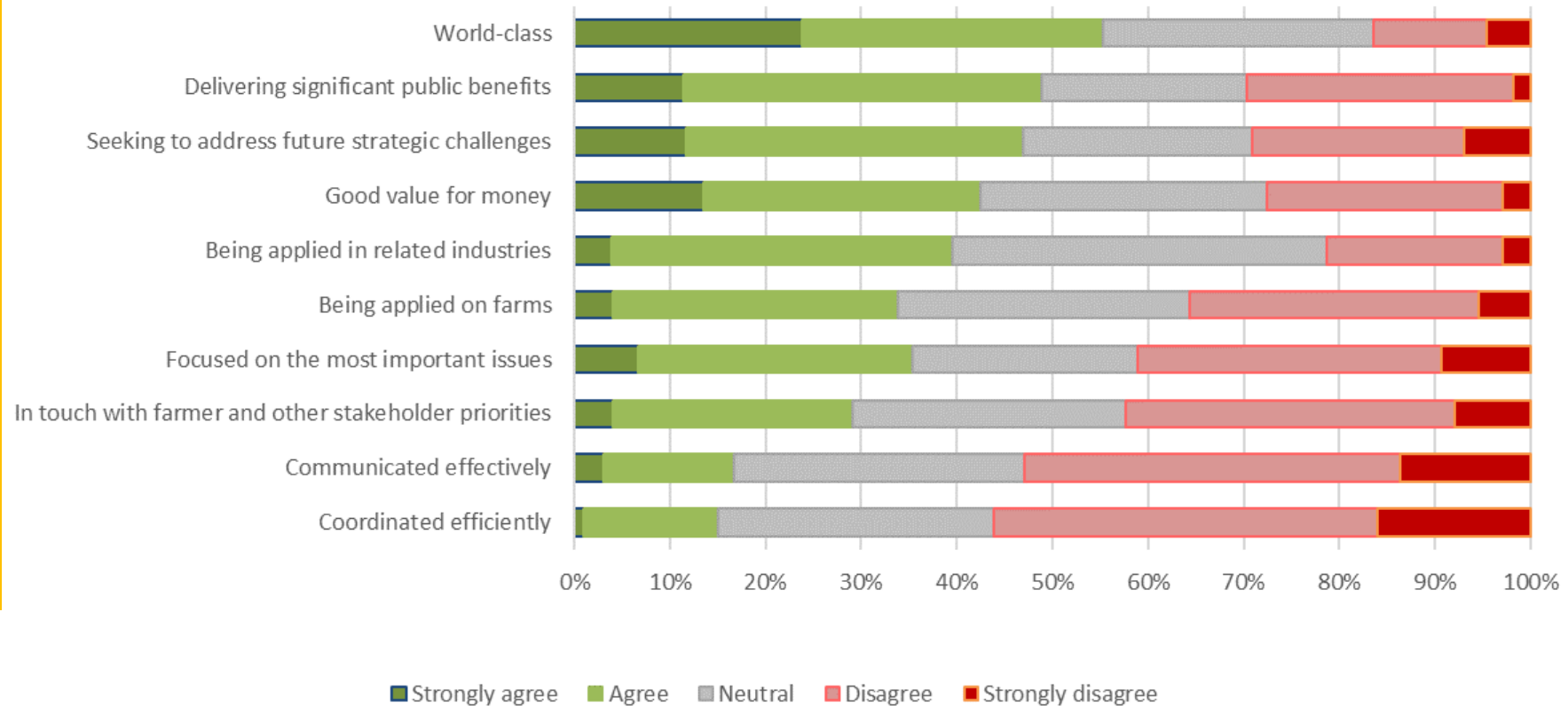
We explored whether preferences on this question explained respondents' other answers, but did not discover any noteworthy patterns.

3.8. Outputs & research performance: 'world-class' but out-of-touch & inefficient?



Most respondents considered UK ag research to be 'world-class'. While nearly half also saw significant public benefits, and good value for money, almost a third disagreed. Views were divided on whether research was being applied, was in touch, and was focused on the most important issues. Most respondents disagreed that research was communicated effectively or coordinated efficiently.

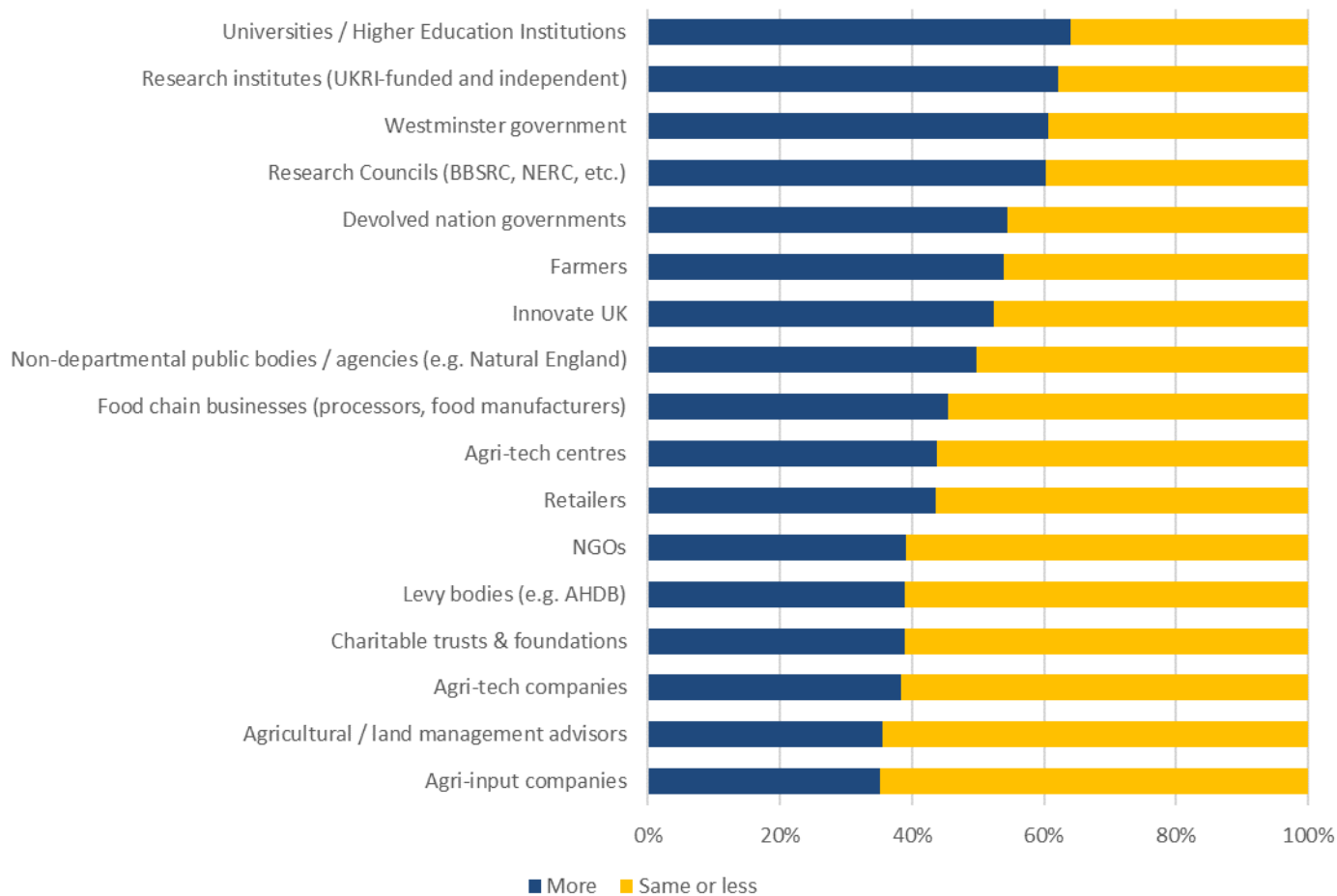
How far is UK research relating to agriculture currently achieving the following?
Ranked by strength of agreement



3.9. Infrastructure: more investment in ag R&I at universities & research institutes



Which institutions/sectors should invest more in ag research vs same or less



We asked respondents for their views on how much different groups and institutions involved in agricultural research *should* contribute and whether they should do so with the same or fewer resources.

This chart summarises respondents' views on the resources/investment requirements.

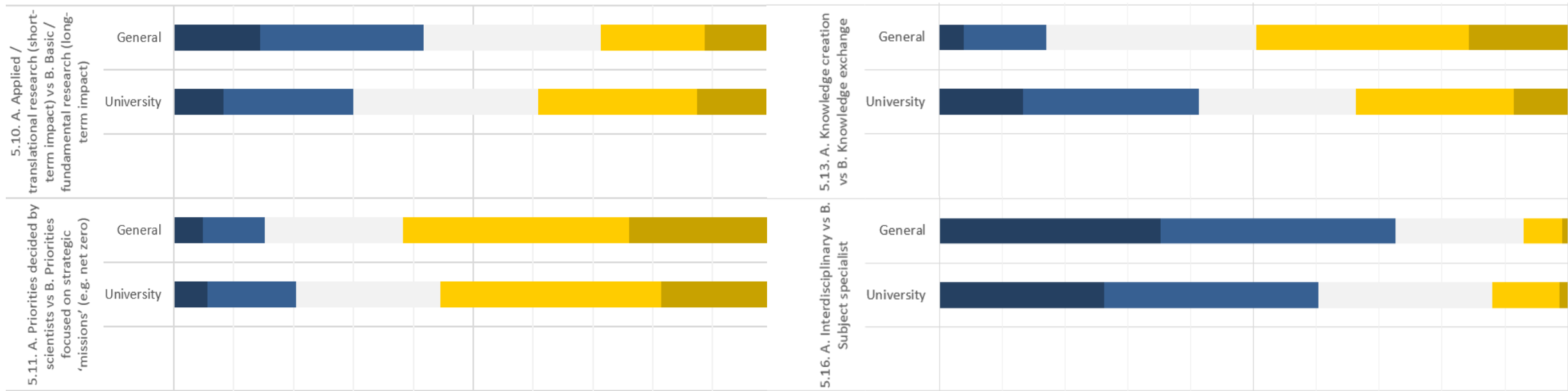
As the list includes research providers, funders and other sectors, the implications of 'investing more' vary. For some, it implies receiving more research income; for others funding more research.

The overall picture suggests a preference for more investment in and by public research institutions and less reliance on the private sector.

3.10. Infrastructure: universities have a little more licence do basic, specialist research



Priorities for universities compared with research/innovation overall

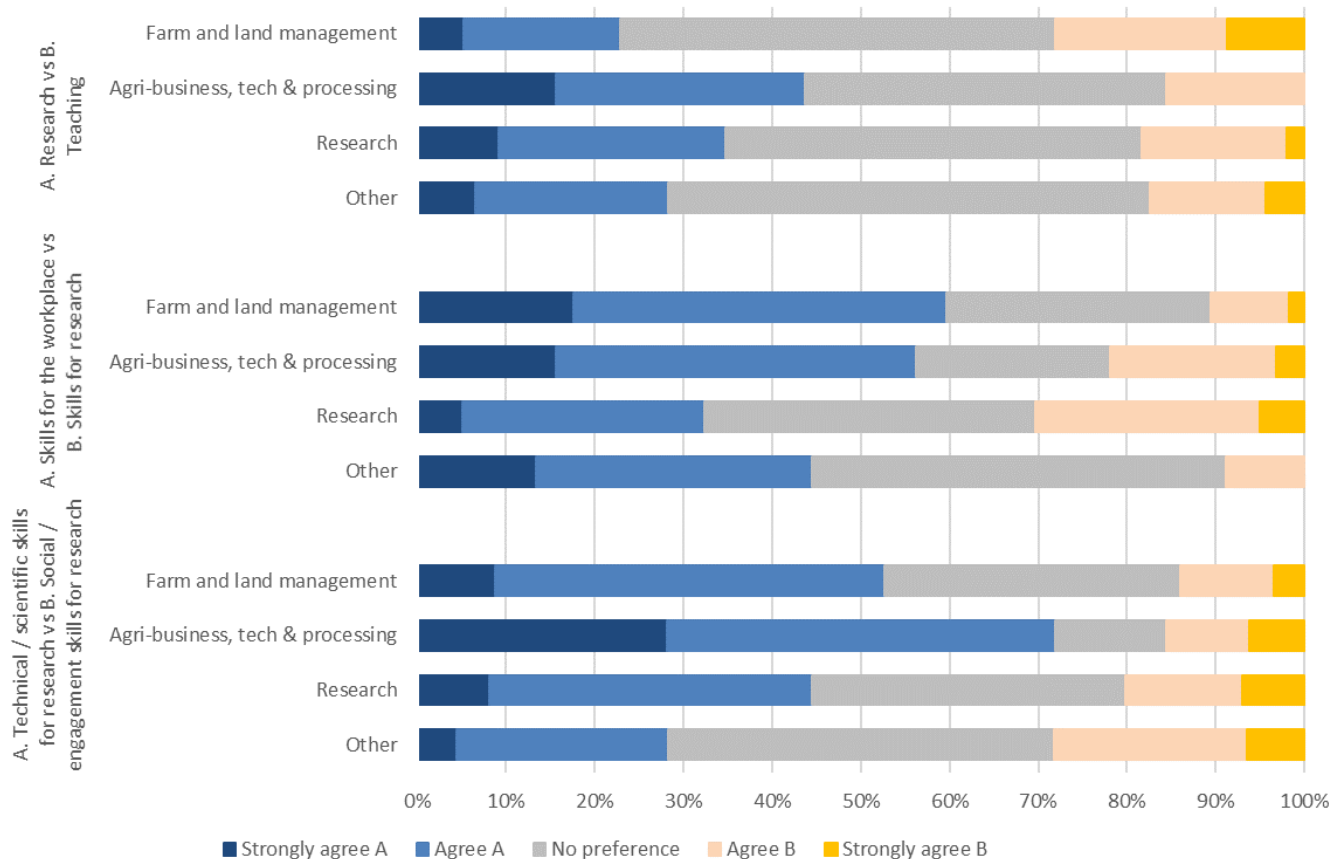


As well as asking about respondents' preferences for ag research in general, we also asked specifically about the roles of universities. While broadly similar, this suggested more licence for universities, relative to other research providers, to undertake basic, specialist, science-led research, and to focus on knowledge creation over knowledge exchange.

3.11. Talent: a challenge to make the case for developing research & engagement skills



University skills development preferences by response group



We asked respondents about where universities should place their priorities when it came to teaching and skills development. The findings suggest some challenges for universities.

While teaching is central to the role, impact and viability of universities, especially the agricultural specialists, all groups other than farmers saw research as the higher priority.

Previous strategic reviews, including the REF, have highlighted concerns over researcher succession. Researchers placed equal weight on developing research and other workplace skills. However, few farmers and 'other' respondents saw research skills as a priority.

Despite many concerns over the practical relevance of research and strong consensus it is poorly communicated, a minority of respondents saw social/engagement as priorities for developing researchers' skills.

4. University performance

4.1. We analysed REF data to get a clearer picture of our own sector's performance



	All UOA6 submissions	Of which AUC member submissions
Number of universities	24	13
Outputs (e.g. academic papers)	3,430	2,063
Impact case studies	103	58
Research income (annual average)	£227 million	£112 million

The REF relies on information submitted by universities, including thousands of academic papers, case studies of research impact, data on staff and income, and statements about their strategies and investments.

While not comprehensive – universities select the papers and case studies that they hope will show them in the best light, and make tactical decisions about which themes to submit them under – it is one of the most thorough evaluations of research in the world.

We reviewed this data for our own institutions, which do the majority of ag-related research by UK universities.

How do the priorities we describe in our strategy statements match up with the research we do and publish?

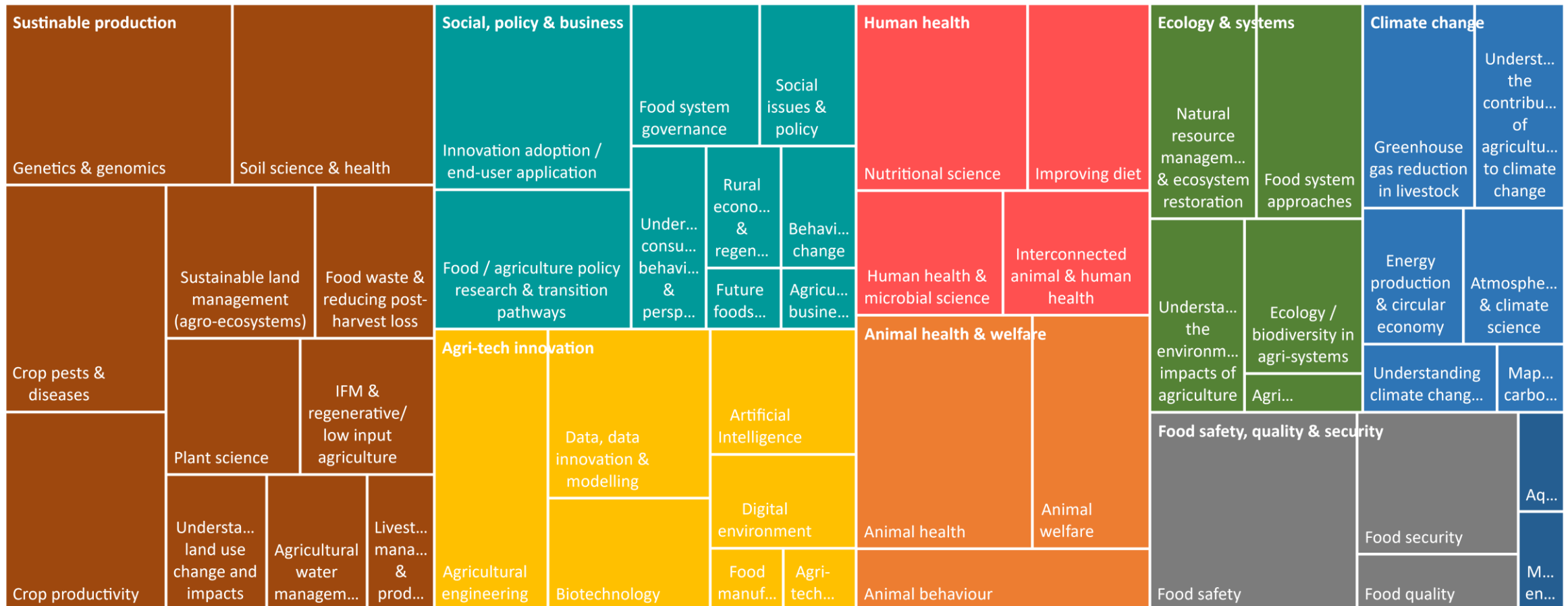
How much of the headline £112 million a year average university research income across UOA6 (Agriculture, Food and Veterinary Sciences) really goes to ag-related research? And how much of that could have a direct impact?

Are we all doing similar research in similar ways, or do we specialise in different areas?

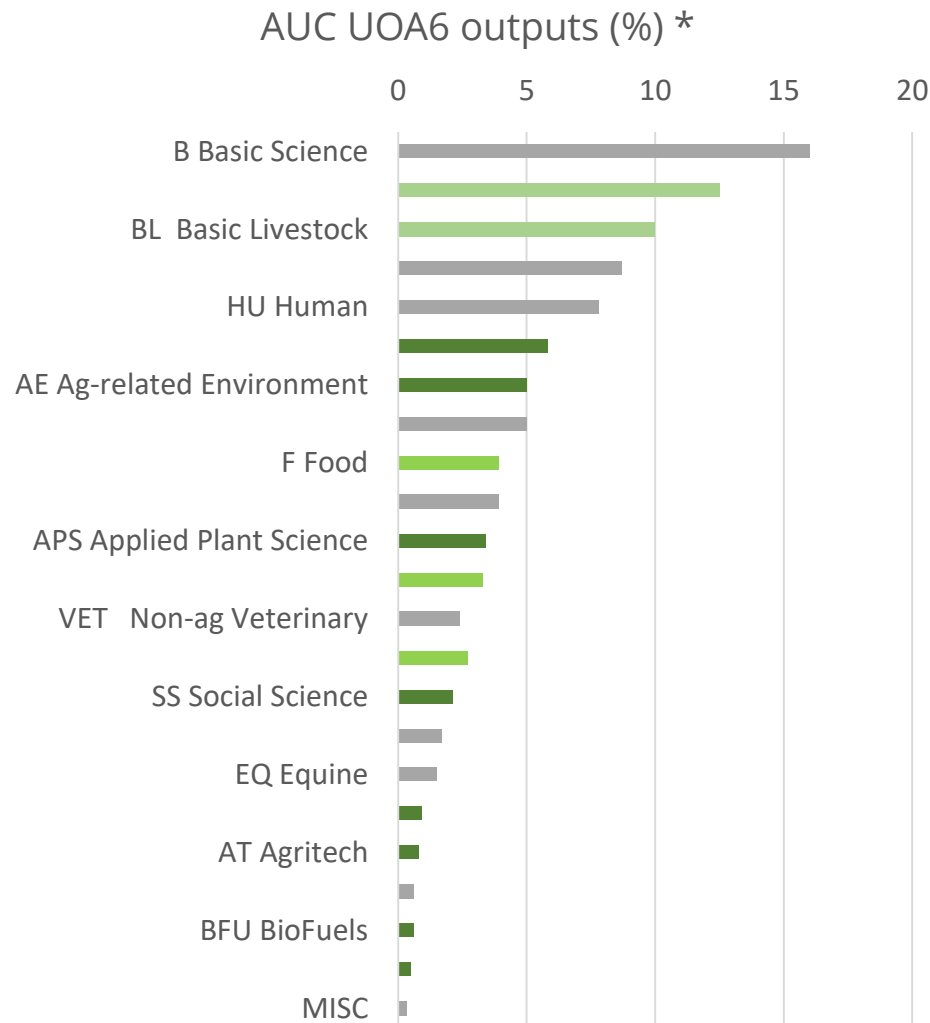
4.2. Priorities: impact-oriented, including emphasis on agri-tech & social research



Themes that AUC members described in their strategies (UOA6 REF5b) – coded & scaled by number of universities mentioning each theme



4.3. Outputs: estimated £63M/y on ag-related research, of which less than half is applied



By coding the 2063 outputs AUC members submitted to REF UOA6, we get a picture of how research activity is distributed across different themes, and how much within this 'agricultural' UOA actually relates to agriculture. While REF submissions may bias towards basic science, they provide the best overview available.

2063 UOA6 outputs from AUC members

1095 Ag-related AUC outputs in UOA6

124 Ag-related AUC outputs in other UOAs

If the distribution of outputs is assumed to approximate the distribution of research income for each university then:

£112M Annual av. AUC income for UOA6

£56M Of which for ag-related research

£25M Of which for applied ag-related research

Again, this needs caveats, but it offers a more reliable picture than the incomplete research income estimates that participating institutions were able to generate for this project.

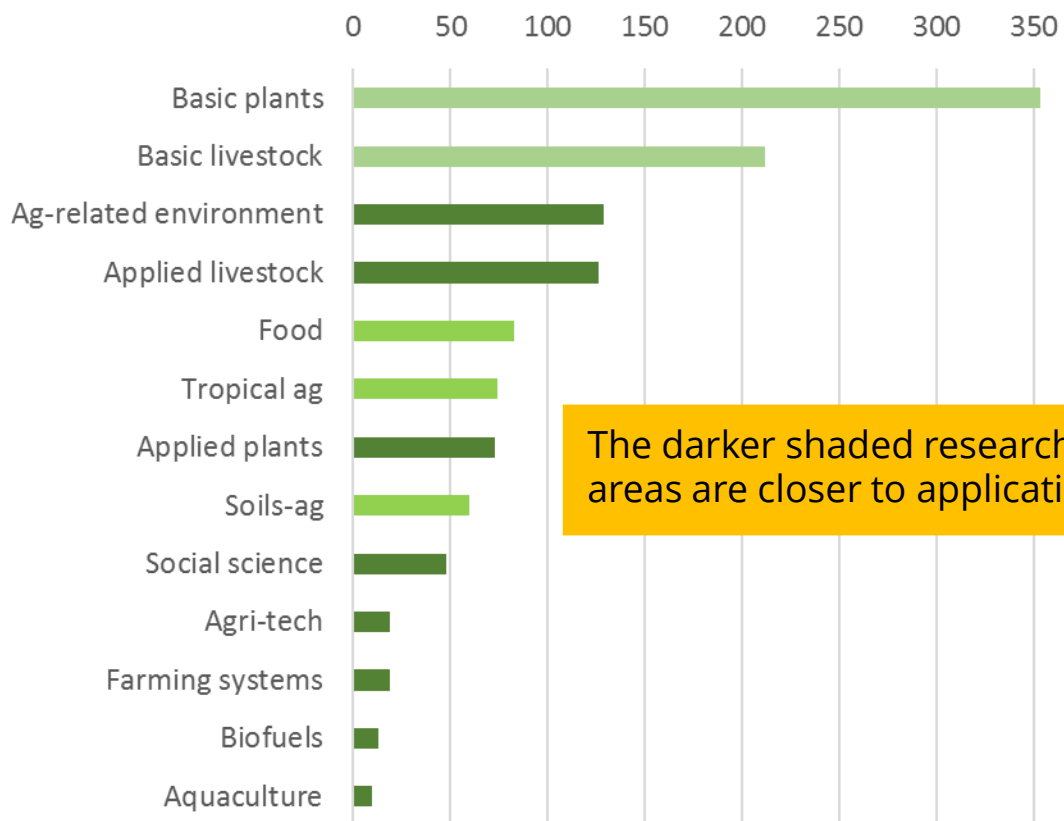
An additional issue, not shown here, is a tenth of the total income to this sector – weighted towards applied research – comes from EU public funding, currently under threat.

* F, TA, SOS(A) are assumed to be 50% basic, 50% applied

4.4. Outputs: basic plant science is biggest focus; diverse institutions work on each theme

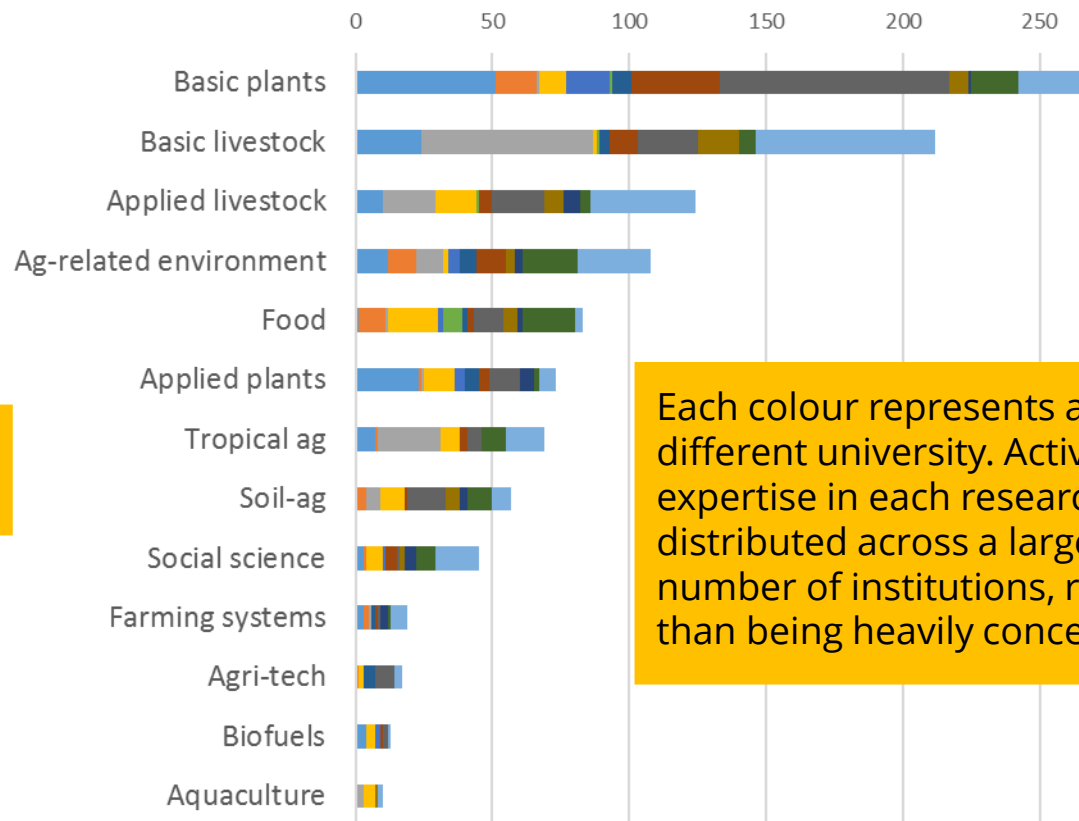


AUC ag-related outputs in all UAs (number)



The darker shaded research areas are closer to application

AUC UA6 outputs by institution (number)



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.

4.5. Outputs: AUC members occupy diverse places in the research landscape

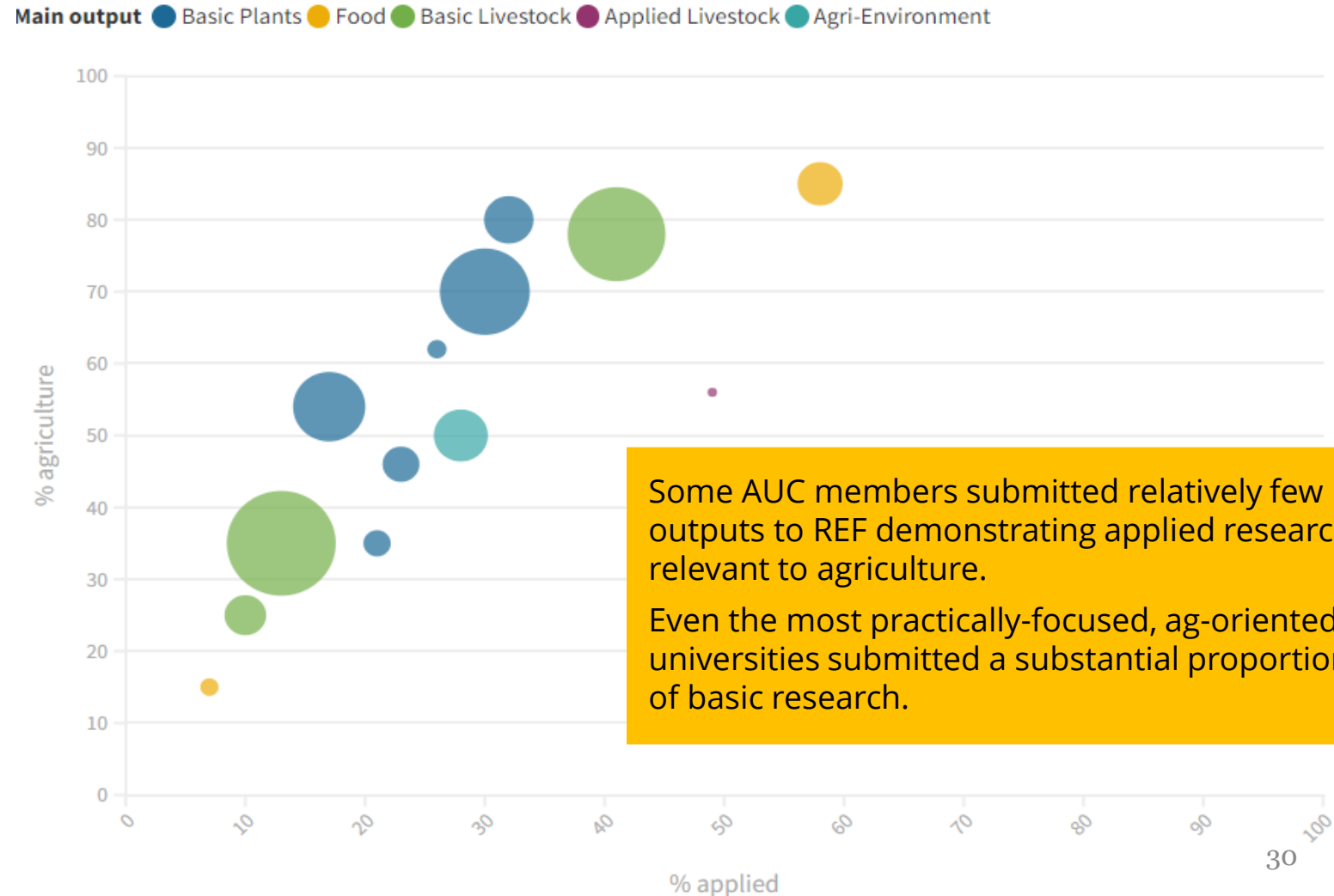


AUC REF UOA6 output by university

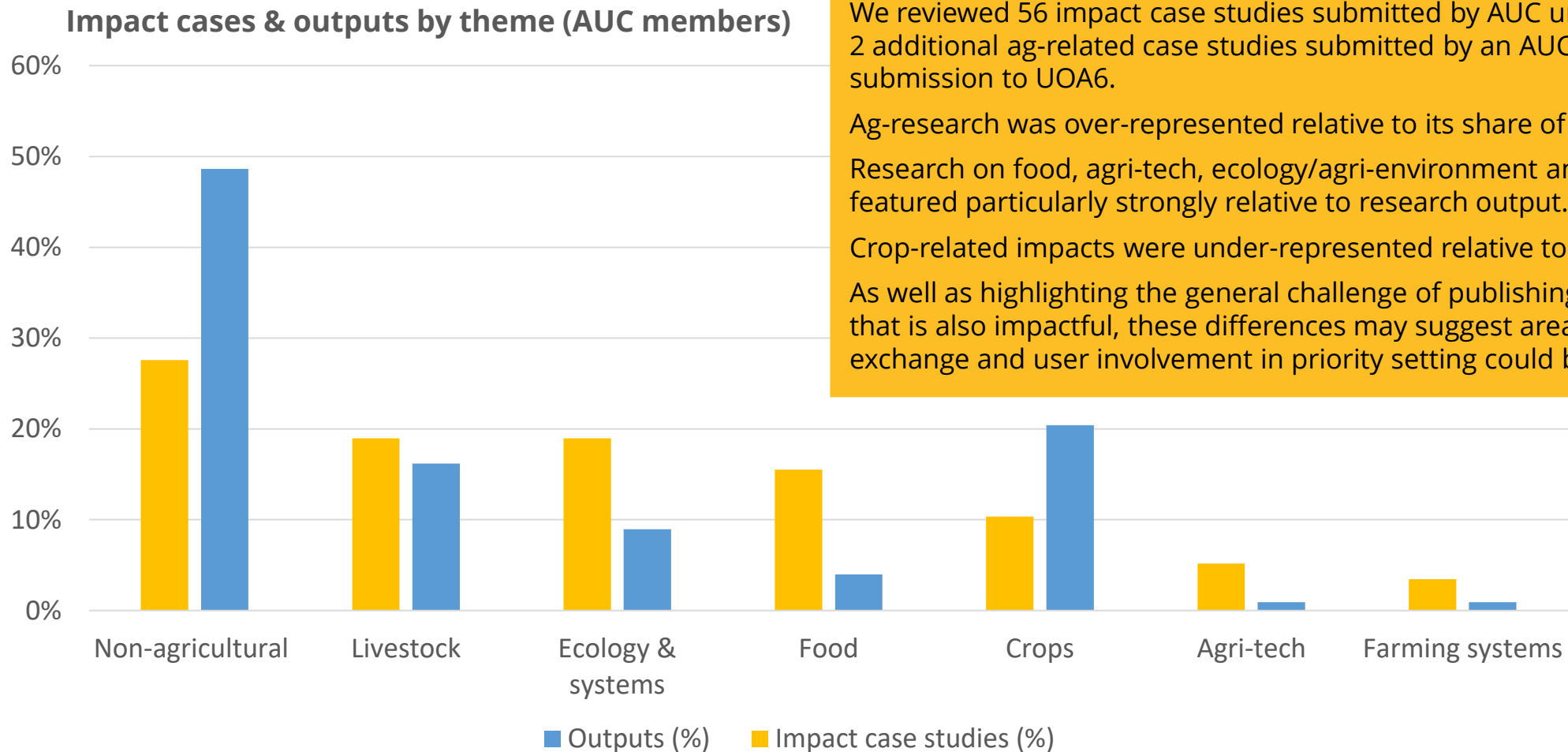
Bubbles are scaled by estimated ag-related research income, and positioned by percentage of UOA6 research on agriculture (y-axis) and percentage of UOA6 ag-related research that is applied (x-axis).

The bubbles are shaded according to the main output area from each university, showing how basic plant of livestock science was the leading submission type for most institutions.

In the interactive version [here](#) you can hover each bubble to see the numbers.



4.6. Impacts: environmental, food & agri-tech punch above their research weight



We reviewed 56 impact case studies submitted by AUC universities to UOA6, plus 2 additional ag-related case studies submitted by an AUC member that made no submission to UOA6.

Ag-research was over-represented relative to its share of research outputs.

Research on food, agri-tech, ecology/agri-environment and farming systems featured particularly strongly relative to research output.

Crop-related impacts were under-represented relative to plant/crop research.

As well as highlighting the general challenge of publishing world-class research that is also impactful, these differences may suggest areas where knowledge exchange and user involvement in priority setting could be increased.

End.

Principle author: Prof. Tom MacMillan, with Prof. Jo Price,
Dr Kate Pressland and Oli Dye.
Project by CEIA on behalf of AUC UK, funded by Elizabeth
Creak Charitable Trust.



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