HM Government

CENTRES FOR AGRICULTURAL INNOVATION

Review of Stakeholder Feedback

DECEMBER 2013

On behalf of the Agri-Tech Leadership Council

Contents

Introduction

Vision

The Agri-Tech Strategy, which the Agri-Tech Leadership Council is tasked with implementing, lays out the following 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"

UK Agri-Tech Strategy

In *A UK Strategy for Agricultural Technologies* published in July 2013, the Government committed £90 million to establishing several Centres for Agricultural Innovation, the first of which is a Centre for Agricultural Informatics and Metrics of Sustainability.

The purpose of this document is to set out the stakeholder feedback we have received so far during our engagement with stakeholders on the shape, purpose, and role of the Centres for Agricultural Innovation. This review aims to ensure access for all stakeholders to the same information. This comes from primarily three sources : the registrations of interest after the launch of the strategy which ran for a period of 6 weeks ; the stakeholder workshops run in October 2013; and further feedback we have received via the Agri-Tech Strategy mailbox and an online survey.

The Agri-Tech Leadership Council will continue to engage and discuss with the agri-tech sector on the Centres. They will also be looking outside the sector to find other industries which may have expertise of benefit to the agri-tech sector.

Centre for Agricultural Informatics

The Centre for Agricultural Informatics will play a key coordinating role in the future Centres for Agricultural Innovation.

The Government has committed to establishing a Centre for Agricultural Informatics and Metrics of Sustainability, at an estimated cost of £10 million. By developing UK expertise, the aim is that the Centre will become a global hub of excellence. This Centre will be the first of a number of Centres for Agricultural Innovation.

The Centre will bring in all parts of the sector, as well as expertise from outside the sector with experience in informatics and data. This may be expertise in data management and analysis. There may also be opportunities for SMEs to play a leading role alongside established companies.

Based on consultations so far, current thinking is set out below under the following headings:

- Data and Informatics;
- Sustainability Metrics;
- Bringing Together What Currently Exists;
- Business Opportunities;
- Investment Needed.

Data and Informatics

One of the key exercises around the Centre for Agricultural Informatics is to identify where the biggest and most valuable opportunities are for big data to add value. These opportunities broadly fit under the following categories:

- Collection, amalgamation and organisation of existing data
- Integration of data derived from different parts of the supply chain
- Determination of data quality and integrity
- Analysis and interpretation of data

What data to collect?

There was broad agreement that the biggest opportunity in this area was utilising the collection of as many different sets of data as possible, which may provide new

opportunities or patterns not previously seen. Some of the suggestions of data sets that may be utilised included the following:

- environmental; economic; animal welfare; soil; yields; supply chain; waste; disease severity and incidence; weather; genetic performance; breeding pedigrees; genomics; earth observation; biodiversity

By bringing together different 'data worlds', we may observe and learn from new patterns and associations that provide opportunities for business improvement or targeted experimentation and innovation. It is important to ensure an open release of non-business-critical data, with data sharing being critical to the rapid production of innovation.

It was noted however that many of the issues around data are solvable through better 'data management' rather than big data expertise per se.

Innovative Data Sources and Standards

There are several innovative ways to collect data that we could further exploit. One example identified is through making the most of the rapid increase in satellite imaging data. Another is using crowd-sourcing techniques, such as smartphone apps, to collect consumer preferences, local preferences, or even local weather data via temperature measurements – mobile technology was a recurring theme throughout stakeholder feedback received.

It was also noted that whilst having universal data standards is an ideal situation, it can be expensive and sometimes ineffective to bring them about – instead, it may be more important to focus on integrating new data into current systems using descriptive metadata and data provenance from the suppliers of data. This has the advantage of not limiting where data is sourced, and allows data creators to continue using technologies and methods in which they already have expertise. At the same time, an emphasis on standardisation where possible has the advantage of reducing overheads implicit in a free-for-all approach to data formats.

Real-Time Monitoring and Modelling

One opportunity for the Informatics Centre is to convert data into information in real time, especially that of weather data. For example, the real time monitoring and modelling of changes and forecasting may be enhanced through the networking of local weather stations, accessible through one single portal. Another opportunity through real-time modelling may be forecasting outbreaks of pests and diseases, based on real time tracking of disease spread, enabling decisions at a local level on prevention or treatment measures.

Sustainability Metrics

One role for the Centre for Agricultural Informatics will be the establishment of a set of sustainability metrics. These metrics will set the standard for supporting progress towards sustainable intensification of agriculture, as well helping shape and prioritise the agri-tech research agenda. There was agreement that there is a major opportunity for the UK to show global leadership on the agenda of benchmarking sustainability metrics.

What will they measure?

Sustainability metrics apply throughout the supply chains and pertain to environmental, economic, and social aspects of performance. Sustainability only has meaning when considered over long time periods so time-series of data will be essential. Stakeholders suggested a range of types of data that could contribute to defining ways in which metrics for sustainability might be derived. These metrics included:

- crops yield and quality; soil management; livestock disease severity and incidence; agronomic performance data; biodiversity; energy and resource use; financial performance; farming management practices; greenhouse gas emissions; land use; nutritional attributes

It was indicated that simple metrics defining sustainable systems would be difficult to agree, both nationally and internationally, given competing interests and demands. Data from which sustainability metrics might be derived must also not be overly burdensome for farmers or others. Communication of the benefits to be derived from sustainability metrics was considered key.

Bringing Together Existing Data

In order for the Centre for Agricultural Informatics to be successful, it must build upon what currently exists in the sector, rather than duplicate or replace existing work, projects or facilities. Some suggestions for areas that could be built on included Government data, farming networks, levy boards, private data sets, and research councils

It was also suggested that there was a need for mechanisms to deal with data sourcing and provision, including legal issues around data ownership as well as potential issues around incentivising those who own the data to share it with others. Brokering of data was brought up as an example of dealing with these issues.

There was a question on whether the focus of the Centre should be broad or narrow in the areas it addressed. If the Centre is too broad in its approach and funding sources, it would likely achieve less than if it worked on a more focussed agenda. However, if the Centre is too narrowly focussed, it risks not achieving its objective of assembling a wide array of diverse data.

Some examples of currently existing data sets and sustainability metrics can be found in Annex A.

Business Opportunities and Benefits

Further discussions of business opportunities that can arise from a Centre for Agricultural Informatics included the following points:

- Tackling big challenges
    - The perfect storm of food, water and energy shortages

    - Food waste
    - Understanding where to invest next and identifying the next issue

- Operational opportunities
    - Better informed decisions for profit-making
    - Better risk management for insurance and trading
    - More specific, tailored advice available
    - Benchmarking farms in supply chain

- Technological opportunities
    - More efficient uptake of existing technologies, including consumer technologies
    - Up scaling data models
    - Knowledge Transfer network capacity
    - Added value of joined up data sets and increased effectiveness that results
    - Interpretation of data and access by subscription
    - Harmonisation of protocols
    - Investment in making data available
    - Bringing the small and diffuse Agri-infomatics sector together with opportunities for bringing 'outsiders' into the sector

- Opportunities for a wide range of very small businesses in informatics (not necessarily in Agriculture). This is a diffuse sector and therefore will be hard to "capture" them in a single Centre.

Sustainability Metrics Benefits

A set of agreed and standard sustainability metrics may also have other benefits, the following of which were suggested:

- Business
    - Improved resilience of supply chain
    - Market transparency for farmers to understand price across markets
    - Better decision-making through better information on costs

    - Identifying ‘hot spots’ of areas which can make the biggest difference / add most value
    - Management of available finance for enterprise
    - New and emerging business models
    - Benchmarking performance
- Consumers
    - Consumer concerns / preferences taken up through these metrics
    - Better understanding of impact of food production
- Researchers
    - Opportunities for innovative groups to take up challenge
    - Universities and business collaboration
- Policy-making
    - Can inform appropriate policy development
    - Avoid burdening business with unnecessary regulation

Suggestions for Investment

It was suggested that a virtual centre will likely need a strong ‘real’ centre in infrastructure that can host the computational hardware and expertise required. Some suggestions were raised on what may be needed to take advantage of the opportunities, including:

- The conversion of R&D data into practical application
- Long term R&D in data collection, integration, and interpretation
- Filling in gaps in data in areas such as:
    - The integration of data in mixed farming systems
    - The long tail of inefficiency in farms
    - The costs and benefits of on-farm biodiversity
- Sensors and surveillance technology to capture real data
- Establishing open data standards

- People and skills
- Database systems, such as cloud systems
- Data collection infrastructure, especially in some environment areas where collection can be irregular, or through a network of data collectors
- Scale trial sites (for replication)
- Refurbishing or upgrading facilities for imaging, data sets, and a new technology and hardware/ tool "centre"

New and alternative sources of attracting funded were suggested, such as crowd-sourcing, to enable the Centre to attract investment from private groups and individuals. Whilst it was agreed that big companies will have a role to play, there was opportunity to attract investment from smaller enterprises as well.

What business might invest in

- Making data available and in a format that can be shared with others (which usually has a cost attached).
- Making available / adapting existing business tools (e.g. carbon footprinting) through the Centre.
- Archived “real time” data that can help with further model development e.g. data from previous seasons.

Sustainability Metrics

There was common agreement that any standardised set of Sustainability Metrics should look at bringing together existing approaches and data sets from Government, research councils, private sector initiatives and current international / EU activity. Investment will be needed for infrastructure and on-going data capture to enable metrics to be explored and adopted. Metrics should be derived from data captured by real-time and sensing of relevance to quantification of ecosystem services of wide community value. This may include flood and water management, the utilisation of urban wastes, support for pollinators, and so on.

Other Points and Questions Raised

- How do we establish compatibility of data?
- Should we identify a common standard, and is so, how do we identify it?
- How do we develop a portal / open platform?
- How do we deal with the issue of data anonymity and confidentiality?

Other Points and Questions Raised

- Can we see short term benefits within 5 years?
- How should the Centre act as a business model for buying and selling data?
- How can we best engage with other data centres in other countries?

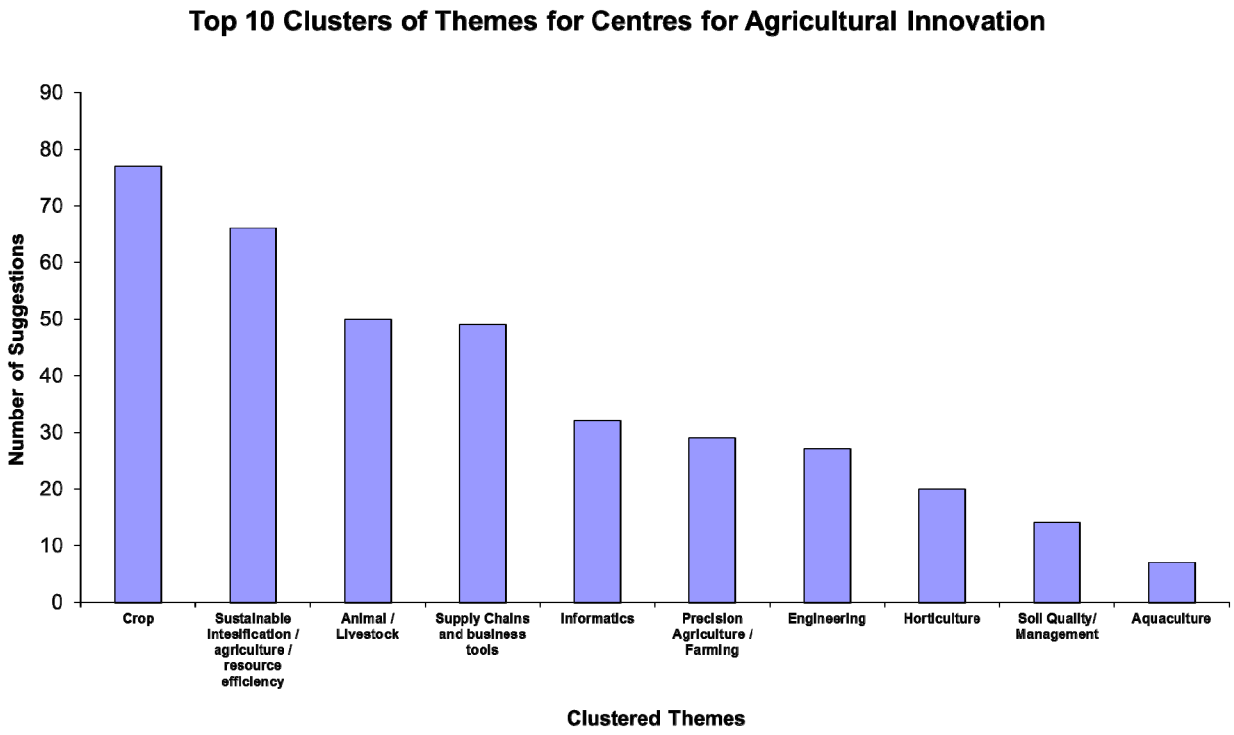
Next Steps

The Agri-Tech Leadership Council will consider this review of stakeholder feedback, and use it to inform further discussions on the shape and design of the Centre for Agricultural Informatics and Sustainability Metrics. A sub-group of the Leadership Council will be formed to look specifically at the Centre for Agricultural Informatics, which will have further discussions with industry and the sector. An announcement of the specification of the Centre for Agricultural Informatics will be made in 2014.

Centres for Agricultural Innovation

The Centres are likely to be focused on key sectors, technologies and skills to help agricultural business develop, adopt and exploit new opportunities in terms of products, practices, and processes.

In the registrations of interest submitted to the Agri-Tech Joint Unit, various topics for centres were suggested. These emerged mostly along sectoral / science discipline lines, as shown in the graph below, and further details can be found in Annex B.



The Leadership Council discussed this, and suggested that the Centres should address "Grand Challenges".

Using Leadership Council inputs with various other reviews and inputs from Industry on priorities for research, the following thematic challenges were presented to around 300 stakeholders at the 21st and 25th October workshop sessions. These challenges were seen as opportunities for the sector to come together in new ways.

1. *Industry resilience*: How can the UK industry become resilient to and avoid exacerbating environmental change?
2. *Boosting Productivity and Nutrition Sustainability*: How can improvements in livestock and crop production systems improve productivity in both quantity and in nutritional quality?
3. *Farming Systems*: How can efficient crop and livestock production systems support and benefit from the structure and functioning of agro-ecosystems?
4. *Food and supply chains*: How can producers better meet the changing needs and opportunities arising in their supply and food chains?

5. *Future Global Markets*: What are the greatest opportunities for global exploitation of UK agri-tech?
6. *Big data and metrics*: How can Big Data be used to boost productivity and provide metrics by which to assess the comparative sustainability agricultural products and production systems?

This section of the review deals with the first five of these. The Centre on Agricultural Informatics and Sustainability Metrics received very strong support and is discussed earlier in this review.

Summary of feedback

- A number of differing views and degrees of confusion were expressed at both events.
- Not all participants were in favour of the cross-cutting challenges as themes for the Centres, feeling there would be important additional questions that sectoral-based centres should address.
- Some delegates expressed the view that fewer, larger centres may offer better value for money and co-investment opportunities, with some of the themes (e.g. global markets) being cross-cutting for all of the centres.

Issues relevant to all centres

Principles

- The Centres must tap into the knowledge that is already available in the UK and abroad, mapping the UK's strengths and weaknesses. They should not replicate expertise, but should instead build on it.
- They should have a systems approach e.g. ensure different disciplines/sectors sit together to learn/innovate from each other. Strong collaboration between the Centres will be vital.
- They must not try to do too much – the Centres cannot be good at everything. Furthermore, where another country already has a leading advantage, concerns were raised about the reasons behind replicating it if other countries already have that advantage.
- There is a big opportunity for skills development i.e. ensuring that the agri-tech sector can attract the talented workers needed for the future.
- Consumer knowledge/understanding drives a lot of 'industry' decision making – there is a big role here in educating / sharing knowledge with consumers.
- The Centres should engage with the bulk of farming, and engage with as wide an audience as possible. Mechanisms such as social media were suggested as ways of keeping large audiences involved.
- There was a general consensus that the entire supply chain will need to be engaged to make the Centres a success.

Funding

- It was suggested that there should only be a few centres. £90m was considered to be rather a small sum to spread around 4 to 6 centres – the focus should be on a smaller number. Potential industry investors inferred that they were only likely to invest in scaling-up existing organisations, and in something in which the best minds were together e.g. along a systems approach.
- There was a large concern that the UK agriculture industry was insufficiently large to be able to find the resources to match the £90m of Government investment – instead, we might need fewer, more focussed centres that look abroad to secure suitable co-investment.
- Big industry was likely to invest in the 'pre-competitive' stage only.

Process

- Concerns were raised about the fragmenting of the sector that comes from an emphasis on competitive processes.
- There was also a lot of opportunity to link and build with international centres, such as the EU Knowledge and Innovation Centres.
- There was a lot of discussion on whether the Centres would be 'real' or 'virtual', or a mixture of both. It was considered likely that the model would be different depending on the theme the Centre was based around.
- How the Centres would be managed was a dominant issue. Who would handle the funding, whether it would be managed by independent or interested parties, and how the process of governance would work.

Feedback on individual themes

Industry resilience

How can the UK industry become resilient to and avoid exacerbating environmental change?

- There was considerable discussion about whether this centre should include economic, environmental and social resilience, and whether one centre could cover them all.
- The environmental resilience aspects seemed most distinct, with social and economic aspects being seen as more cross cutting themes within all centres.
- Opportunities on the environmental side included innovation in drought, pest, disease and flooding tolerance, as well as maintaining soil quality. Research into "tipping points" where systems may undergo very significant change in a short time was suggested. Genotype/environment interactions would also be important.
- The Centre may need to be regionally specific in its approaches to deal with different aspects of environmental change.
- This would require a multidisciplinary approach, with most of the innovation coming from the intersections between disciplines. Modelling, environmental science, biological science, geography and economics would all be important disciplines for such a centre.

- Research could lead to industry benefits such as more secure supply chains, new agrochemicals, new crops (and protein sources)and new crop/animal genotypes.
- Industry were likely to invest in specific issues e.g., water supply, rather than in resilience *per se*, but if this centre became world leading, it was suggested it might also attract investment from foreign governments.

Boosting Productivity & Nutrition Sustainability

How can improvements in animals and plants and their husbandry protect and boost productivity in both quantity and in nutritional quality?

- It was noted that this challenge would require much more than innovation to solve it – looking at regulation, skills, consumer behaviour (waste and quality preferences would all be important).
- What each sector sees as most important would differ (e.g. improving quantity or quality) but it was agreed that overall this was a very important challenge to address – more, better food.
- Focussing on environmental productivity and economic productivity may not lead to the same outcomes. Increases in yields would always need to be checked against their environmental impacts.
- It may also require farmer education to focus them on what in the long term their land is best suited to deliver, rather than what in the short term is economically most profitable to grow.
- It was hard to see synergy between the research and industry needs of the livestock and crop sectors.
- A wide range of scientific disciplines would be needed, from precision farming/husbandry to genetics, pathology, and informatics.
- It was important to look outside the agri-tech sector - much can be learnt from the biomedical sector, and accurate, long term weather forecasting could deliver more than genetic improvements.
- The greatest need was for more collaboration and coordination between labs and disciplines – with a few exceptions (weeds) we already have the science base.
- The sector would benefit from efficiencies derived from putting nutrition into the raw materials, not at the end of processing. There would be further benefits from waste reduction (on farm, during processing and in the home).
- Farmers themselves and their supply chains could benefit from more efficient farming systems, mechanisation etc. leading to bigger yields.
- This could also help to boost the British content of supply chains where there is currently excess demand.
- This would have to be a long term investment, and Government may have to lead the way, getting more industry input as the concept is proven.
- It may be best to set this in the international science context, and focus on areas where the UK already has considerable strengths, rather than trying to do everything. In this case coordination between centres would be critical.

Efficient Farming Systems

How can efficient crop and animal production support and benefit from the structure and functioning of agro-ecosystems?

- There was considerable discussion about whether this should be a theme across all other centres, with research or communication focussing on sectors, or whether it was a centre in itself.
- Much of what is needed was known already - success would hinge on effective knowledge exchange, partnership projects and two-way communication with farmers and their supply and outward food chains. Testing, demonstration, quality assurance and impartial verification of innovative methods would all be important. There was also an opportunity to learn from global high performers and across the organic/conventional divide.
- Any such testing and development would have to be location-specific.
- Environmental Metrics were a key opportunity, from global to local, looking across the whole production chain, and getting access to data on environmental impacts.
- A centre addressing this challenge could also look at developing entirely new farming systems (although they would have to be economically viable) – there may be significant opportunities within protected cropping systems.
- This would call for an interdisciplinary centre with engineers, geneticists, breeders, agronomists, soils scientists, sensors and data analysis experts all being needed. Social science for behaviour change and to address barriers to innovation would be needed as would environmental economics to value changes in environmental impact.
- There was also a key need for this centre to reach outside agri-science into sectors such as the automotive and space industry for engineering and sensing solutions.
- There were business opportunities in exploiting big data and existing genetics, and in improvements to different parts of the system, e.g., precision diagnostics, novel protein crops or crops with improved photosynthesis, new sensors or machinery etc.
- There were also business opportunities in the system itself, from exporting standards of sustainability to create points of difference and a market lead, to novel business models for land use, and novel IPM or landscape scale farming techniques. There were also benefits in improved record keeping and data logging.
- It was noted that there were also considerable public good benefits here, and that farmers may be more able to see and act on these than big multinationals.
- A key risk with a centre on this topic was the industry structure, with many small players to be involved, e.g. farmers, small sensor or IT firms.
- Investment was needed to bring specialists together and avoid competition between academics, to create spaces for a two-way flow of information, linking to existing networks e.g. demonstration farms and advice schemes, and to upgrade labs, glass, and field sites to enable proper testing of novel methods.

Food and supply chains

How can producers better meet the changing needs and opportunities arising in their supply and food chains?

- Much of the discussion was based around the issues of connecting the whole "food network" (as opposed to food chain) together to make it work better, although this was considered too large a problem for a single centre, with real difficulties in deciding what the priorities for focus should be between e.g. waste, efficiency, nutrition, and quality.
- Only very limited discussion of novel raw materials for the food chain.
- Key difference is the consumer-facing angle of this challenge – a centre would need to be driven from their perspective – provenance, integrity, quality, shelf life and authenticity of food, focussing on what could be done with UK crops would all be important. These are different priorities from those along the supply chain.
- It would be needed to be geared up to deliver some very short term "wins" in this fast-moving area, not just focus on long term issues.
- It would need a range of research, from biological to social, including experts in economics, marketing, food technology, logistics etc. Much of the expertise needed was felt to exist in the UK already, but it should also look outside the food sector for further expertise e.g., on supply chains. Also non agri-tech science would be important – improved weather forecasting could save huge amounts of e.g., salad waste.
- It would also need a strong consumer communication and social science capability as it would be dealing with consumer-sensitive issues such as GM or intensive rearing of pigs.
- There were industry opportunities in quality assurance of products, reducing waste or reusing it, and in new technologies for measurement and diagnostics that would work along the supply and processing chain. There was strong benefit for retailers and processors from this centre.
- It was also noted that there were many other non-industry players who would have an interest in this centre, e.g. Nuffield scholarships, the Sustainable Food Trust, WRAP, FAO.
- Overall it was felt that infrastructure in this area in the UK was already good, but bringing people together would be beneficial and cross-sectoral learning would be very positive.
- There was felt to be a need for feasibility study funding of novel technologies in this area.

Future Global Markets

What are the greatest opportunities for global exploitation of UK agri-tech?

- The topic was only discussed on the 21st Oct workshop, with fewer delegates expressing an interest in it than in the other challenges.

- It was largely agreed that this was an important cross cutting theme that should be a component of all centres: they must each have the capacity to drive and respond to change in global markets.
- It was noted that this should be about export of both products and knowledge/technology, both of which could bring significant economic benefit.
- Any such capability would therefore need the input of economists, trade experts, market assessment, information management. It should make the most of existing information, such as that already collated from DfID, UKTI, and so on.
- It should play to UK strengths, both in the science base (such as crop protection, precision farming, animal and plant genetics) and industry strengths such as food safety and quality.
- There were further economic benefits possible from tackling big issues such as pre/post harvest losses and through exporting our technology to improve the quality of imports.
- Capital investment for this area did not seem very important; investment in people and the space to make connections between parts of the sector were seen as more important.

Other Suggested Themes

There was opportunity for stakeholders to suggest other themes for the Centres. These are some of the recurring ones.

- Mechanisation.
- Food Security.
- Sustainable Production.
- Aquaculture / Wild Capture Fisheries.
- Climate Change.

Some suggestion was made that the themes of the Centres may be dependent on the number of Centres. For example, there could be one Centre to cover all of agriculture, or separate centres on crops and animals.

Many more very specific themes were suggested in the registrations of interest around specific projects - for example, a Centre around tackling Blackgrass was suggested by several groups. However, others felt such a specific project was too narrow and more suitable for a particular project than a Centre for Agricultural Innovation.

The main divide in setting the themes for the Centres appears to be between sector-based centres or theme-based centres.

Next Steps

The Agri-Tech Leadership Council will consider the stakeholder feedback, and use it to inform further discussions on the themes for the Centres for Agricultural Innovation. The Agri-Tech Leadership Council is considering publishing a statement that will communicate their current thinking about the Centres for Agricultural Innovation.

Annex A – Suggested Examples of Existing Agri-Informatics Data

- Government data
    - Defra, including the Farm Business Survey
    - Met Office
    - Environment Agency
    - National Ecosystem Assessment
- University departments
- Industry data
- Research Council Institutes and Centres – BBSRC, NERC (CEH and others), ESRC
- AHDB
- EC funded projects
- OECD collected data
- EUROSTAT
- Royal Veterinary College
- SEWEB project (SEPA / EU data portal on land use)
- LEAF sustainability metrics
- Global data sets (e.g. FAO)

Annex B – Suggested Themes

Top 10 from Registrations of Interest

Clustered Theme	Number of Suggestions	More Information
Crops	77	Crop improvement and husbandry, including genetics and breeding, and pest, disease and weed control in field systems
Sustainable Intensification / resource efficiency	66	Agro-ecosystems, inputs and outputs, including energy, water, nitrogen and phosphorus management, and interactions with climate change, biodiversity and other ecosystem services
Animals / Livestock	50	Animal improvement and husbandry, including genetics, grassland systems, protein production and disease control
Supply Chains and business tools	49	Supply chains and business tools, including food safety and traceability, and post-harvest technologies.
Informatics	32	Informatics
Precision Agriculture	29	Precision agriculture, including information systems, farm system management, predictive and risk management tools.
Engineering *(Overlaps with Precision Agriculture)*	27	Engineering, including sensor technologies, controlled environments, mechanisation and automation of farming systems
Protected Cropping Systems	20	Protected cropping systems, including controlled environments, clean tech, automation, and fresh produce production
Soil Quality/ Management	14	Soil quality and management, maintaining and enhancing the long term resource.
Aquaculture	7	Aquaculture

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