



**AGRICULTURE & HORTICULTURE
DEVELOPMENT BOARD**

**The Data Revolution:
AHDB's role in shaping the future**



Generation10

A report aimed at helping the AHDB vision and shaping their future role with data

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Abstract

AHDB as a statutory board, funded by farmers, growers and others in the supply chain has as its defined mission to inspire UK agriculture, facilitate innovation on farm, improve productivity and market access.

It has to address the concerns and deliver value to all of its levy payers from the most technical, innovative and commercially successful, to the smallest most conservative farmers and producers.

UK agriculture is facing simultaneous challenges on multiple fronts. Brexit and the unknown policy and commercial changes this will bring; increasing demands from consumers and the value chains that serve them in respect of quality, value and traceability, more volatile markets and prices are all increasing the demands on farmers.

The digital revolution in data availability - Big Data, Artificial Intelligence (AI) and innovations such as blockchain are reshaping businesses and the competitive landscape across all industries globally. Agriculture will be no exception.

To survive and thrive in this rapidly changing environment, UK farming will have to deliver greater productivity to remain competitive in a new trade driven market environment and be able to demonstrably deliver greater quality and value to its customers.

The core challenge for AHDB is to reposition itself strategically and operationally to be able to fulfill its mission and deliver greater “recognised” value to its levy payers. Identifying and successfully implementing a strategy to drive the adoption of commercially successful innovations leveraging big data, AI and emerging technologies such as blockchain will be critical to AHDB’s success and preparing UK farming for a much more competitive future.

Central Recommendations

1

FARMER FIRST FOR FARM DATA

BECOME THE CHAMPION FOR FARMERS FAIR ACCESS & USE OF THEIR DATA AND BE THE LEADER IN COORDINATING DATA STANDARDS

2

STANDARDISE AHDB EXISTING DATASETS

IMPROVE AHDB DATA PROCESSING BY PILOT TESTING, THEN EXPAND ACROSS AHDB PLATFORM

3

SELECT PILOTS TO DEMONSTRATE

LEAD 2 OR 3 HIGH PROFILE, HIGH IMPACT PROJECTS WITH KEY CONSORTIUM PLAYERS, ADVANCING THE CORE "FARMERS FIRST FOR FARM DATA"

4

FORGE UK AG DATA ECOSYSTEM

CLOSELY ALIGN WITH AG INNOVATION CENTRES, OTHER KEY STAKEHOLDERS AND STRATEGIC INITIATIVES

Recommended Digital Mission

To create the conditions that allow farm data to flow, innovation to happen and farmers be treated fairly.

Farmers need to feel safe making their data available so that businesses and institutions can access it in an efficient and equitable manner in order to create products and services that solve real problems to the benefit of farmers, consumers and the supply chains that serve them.

Immediate Priority - Decide the digital Strategy on data

Define a clear, easily communicated AHDB strategy for its role in big data, AI and blockchain. It has to be realistic and jargon-light. It should demonstrably help to drive the development of a world class U.K. ag data ecosystem.

We believe it should be focused on the theme “**Farmers First in Farm Data**”, with AHDB becoming a primary hub to access and work with farmer data. This does not mean that AHDB builds and controls all infrastructure but it should lead a coordinated effort to develop the UK ag data ecosystem. AHDB should be the entity of reference that communicates the risks and opportunities to farmers and represents their interests to get a fair deal and value for the use of farm data.

Short Term Priorities - Next 3-6 months

FarmBench and Project Blue

Focus on successful delivery of these two key strategic initiatives that are in progress. If more resources are needed to ensure successful delivery – make them available.

FarmBench- this is a critical project and one that can be a building block for integrated “on farm” production and financial data, hosted

within the AHDB independent environment and governance structure. Successfully deployed this would be a critical step to AHDB establishing its position at the centre of a UK ag data ecosystem.

Some interviewees have raised concerns about FarmBench - so it may be worth further pilot testing before full launch and with distribution partners. Companies are ready to road test, comment and support. e.g. HSBC.

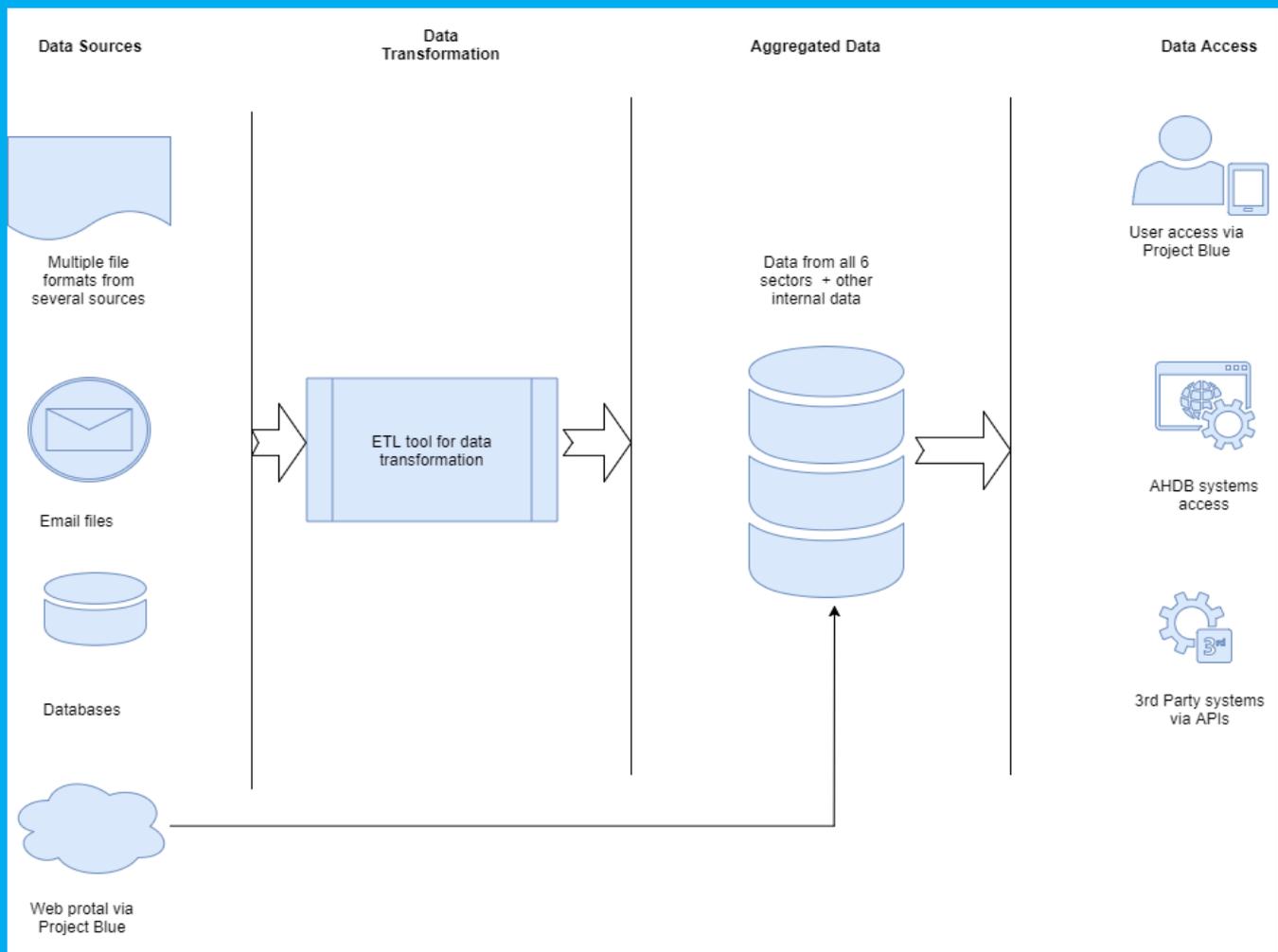
Project Blue is of equal importance for different reasons. Its key to delivering AHDB content in a more compact easy to access and consume form for those levy payers with digital access and aptitude. It is a step change improvement that can drive greater and more granular engagement with levy payers. Implementing a proactive social media strategy and possibly also the use of survey apps to solicit specific feedback on content but also project development, might be considered.

Improve internal AHDB data processing and publishing capabilities

Internally identify and implement pilots for improving the processing, combining and publishing of data sets, BI analytics and reports. Discussions indicate that the initial pilot should probably fall within Market Intelligence(MI).

Suggested area to pilot first - oilseeds and grains, then replicate across AHDB platforms.

DATA FRAMEWORK



By automating all data collection and standardising internal datasets, more resources can be assigned to other tasks. Developing adapters for transforming multiple file formats, storing all required data in a centralised database and providing APIs for data access will streamline internal data processing and remove bottlenecks

Strengthen project focus with Ag Innovation Centres with support of DEFRA

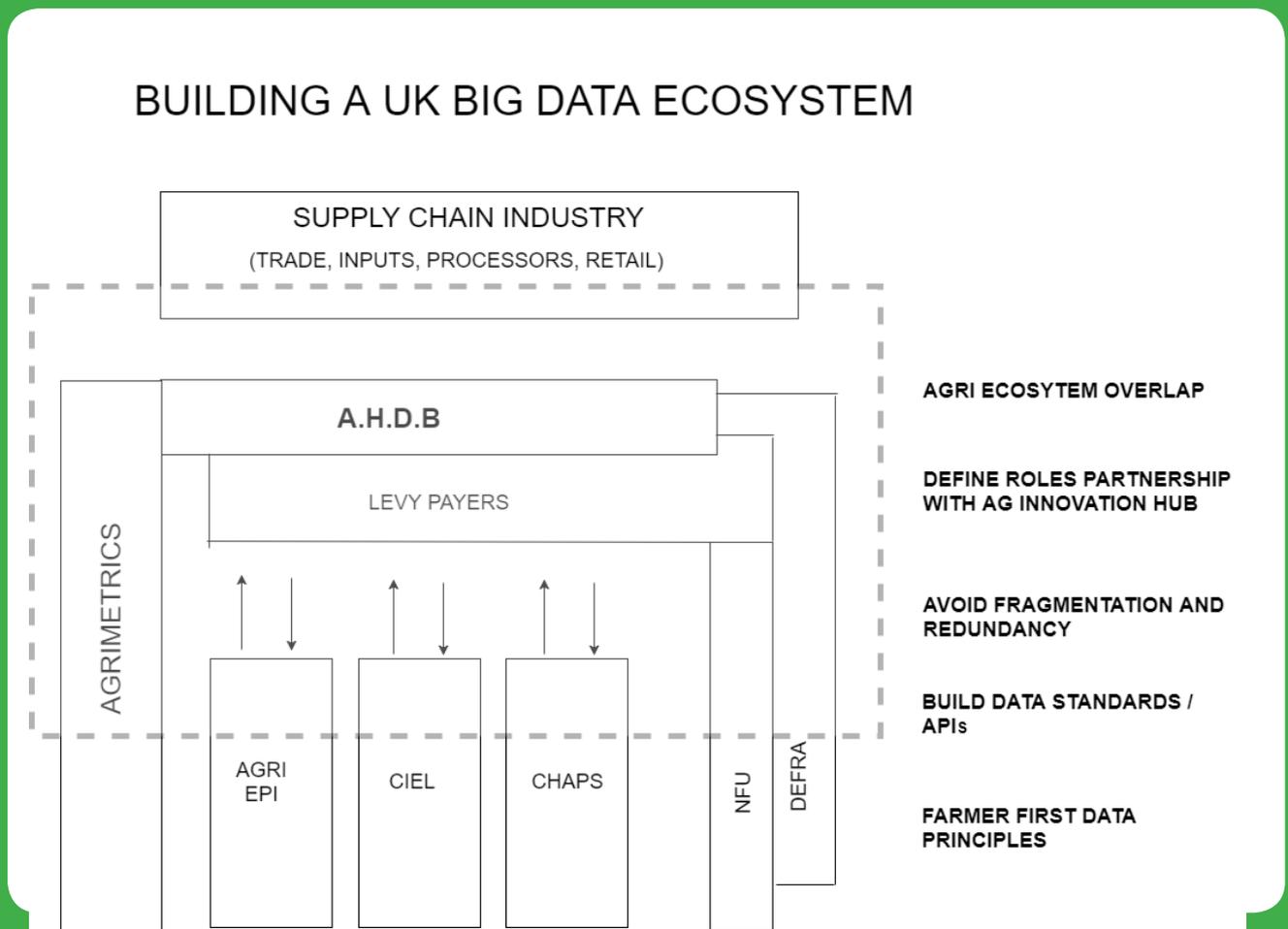
We believe the collaboration with the Ag Innovation Centres is fundamental towards creating a UK ag data ecosystem that brings together leading edge technical capabilities for data sensing etc. in Agri-Epi, CIEL(Centre for Innovation Excellence in Livestock) and Chap(Crop Health And Protection) and the potential data infrastructure of Agrimetrics. No single entity can do this themselves.

AHDB should be the lead facilitator in making this happen. It has the position, independence and access to levy payers and potential convening power to claim this role.

Drive the process through projects, moving from discussions to identified, committed projects, initially one per centre. Some projects may require working with more than one centre. Be crystal clear on project leadership, deliverables, budgets and with strong project management on timing and responsibilities.

Strengthen further by working with DEFRA Data Science and Publishing team lead by Steve Williams. They are looking to release commercially valuable data sets that can be driven into live projects e.g. Cattle Passporting Project and want to work with AHDB

Inclusion of other agritech hubs such as Agritech East should also be considered.



Formalize Project Screening and Development Process

Develop and apply the criteria and prioritisation tool for identifying and selecting high value / high impact projects and tools (see main section on page 35).

This should be finalised and rapidly tested as fast as possible, using the portfolio of project ideas already under consideration within AHDB. This or a similar process should be used to drive prioritization of work streams and scarce resources

2018 and beyond

AHDB should focus its resources on a few projects which meet the selection criteria. All of the projects listed below are either under consideration or have come from feedback directly from this research.

To initiate, we suggest some core project streams. All of them are consistent with the aim of refining and communicating the “Farmer First For Farm Data” strategy, AHDB’s positioning as a thought leader, developing the UK Ag Data Ecosystem

PROJECT 1

Lead the DEFRA mandated livestock cattle tracking risk based trading project.

PROJECT 2

Develop the Farmers First For Farm Data Principles

PROJECT 3

Scope developing early crop disease and resistance monitoring consortium

PROJECT 4

Align AHDB with an Industry Blockchain Pilot and BEIS Initiatives.

PROJECT 5

“Farming Digital Divide”
Thought Leadership

PROJECT 6

Natural Capital/Climate change
project scoping
(BEIS and DEFRA)

Project 1: Lead the DEFRA mandated livestock cattle tracking risk based trading project.

This is high profile, critical and will require a consortium across industry and innovation centres. The DEFRA data science hub wants to explore co-operating with AHDB on this project as a test case for further collaboration. It is both a cost/productivity and traceability/market access project.

Consequently, it meets all the criteria for a high profile/high impact project that addresses many of the issues that are also raised by Brexit and where the UK lags behind Ireland and other major exporters.

A well scoped and successfully delivered project is one that could and possibly should be presented to the Minister of State for DEFRA for profiling what can be done and to solicit high level support.

1. Appoint project lead within AHDB
2. Identify an initial pilot project perhaps focusing on working with a specific breed society (Aberdeen Angus, or specific abattoir / supply chain in a given region).
3. Develop the detailed business case – it's a project that delivers productivity gains to the supply chain, improves farmer insight on quality and risk based trading; creates greater traceability and transparency and therefore has a positive impact on market access and post Brexit trade opportunities.
4. Execute project risk assessment – where are the main technical and partnership risks to successful implementation – how can they be managed and mitigated?.
5. Get buy-in and support of board and use its influence and relationships to get buy in from NFU, DEFRA, etc.
6. During the initial project process design and scoping contact the key counterparts at Agri-Epi , NFU, DEFRA Data Science and Distribution, Agrimetrics, Supply chain partners in abattoirs, etc.
7. Refine, retool and confirm project timeline, budget, deliverables, accountabilities, follow up and reporting plans. Although obvious these are complex projects with multiple interfaces and dependencies so project management skills need to be world class and across all project streams.

8. Explicitly define the elements of the project that can inform the “Farmers First in Farm Data” Principles. Every project is a working example to tease out and agree how these should be framed. We would suggest running the project proposal through the Farmer First Principles at an early stage to surface any project blockers.

Project 2: Develop the Farmers First For Farm Data Principles & Prototype Rating Tool.

Use Project 1 and any other relevant projects to develop and refine the Data Principles and Rating Tool.

This is a critical project stream cutting across all sectors and every big data, AI and blockchain project that would need to source on farm data.

1. Define the initial scope of the project that should focus on rapidly delivering a “straw man set of data principles” . This work stream should frame how data is owned, stored / handled, shared / flows in any project etc in any given service.
2. Project lead should be the most knowledgeable person on GDPR and related data issues and a good communicator.
3. The objective is to develop a simple set of farm data principles and to start scoping a rating tool which helps farmers understand how different parties are using their data.
4. The principles developed should be aligned to GDPR regulation and take account of the work being done in other relevant ag data standard setting initiatives.
5. “EIP-AGRI Workshop : Data sharing for digitisation benefits in agriculture”. This is a good initial discussion process raising the relevant question. However, it is a pan European initiative aiming to create European scale legislation. (www.eip-agri.eu)
6. AHDB has the opportunity to help forge a practical set of principles derived from project level work which can run ahead of any EU or more likely UK legislation.
7. Working examples will demonstrate leadership in this field and help prove the concept through practical application.
8. This will be legally intensive work and will require specialist legal support so the requirements will need to be scoped,

budgeted and commented on. A very tight scope and tender document would need to be put in place prior to selection of the best legal service provider.

9. Alignment and potentially co-development should ideally include the NFU, Ag Innovation Centres and DEFRA data scientists for comment and validation. This is consistent with interview findings.
10. Once pilot principles have been produced it should be road tested with some key industry participants (input, machinery, trade, processing, retail), farmer levy payers and ODI/GODAN.
11. Use specific projects to road test and refine both the principles and rating tool. Practical examples are far more informative than theoretical constructs.
12. Define timeline, specific deliverables, resources, budgets and accountabilities.
13. Present to the Board for approval and to garner support. We suggest a succinct business case for doing this should be developed and presented to key collaborators in the chain and at DEFRA.
14. Access to farm data is a critical bottleneck to creating an efficient and productive UK agri data ecosystem. It will take a lot of time, collaboration, resource and persistence. It therefore needs senior support and commitment from the outset.
15. Given the growing concerns surrounding use, application of data and legal complexities across all industries; the role of an independent ag data ombudsman to arbitrate contentious test case issues should be considered.
16. This role might be best situated in the office of the Information Commissioner. Given budgetary constraints it would have to be funded.

Project 3: Scope developing early crop disease and resistance monitoring consortium

The idea was initially suggested by a leading UK farming and agronomy firm. It focuses on the challenge in cereals, sugar beet and potatoes of breakdown in effectiveness of sprays and increasing resistance to treatment

of main pests and plant diseases. This could tie in with work that Agri-Epi is doing in early warning systems linked to its data hubs at Cranfield, Edinburgh, Harper Adams and Shepton Mallet. In addition it could also highlight and address digital coverage/access issues that Agri-Epi is confronting as a key bottleneck in some of its work.

1. Define the scope of the project, which crops and diseases to pilot first
2. Do this with lead industry players and agronomists. (Velcourt, Agrii, etc.)
3. Work with Agri - Epi to define the technical data sensing requirements and if possible leverage off pre-existing work that they are doing on demonstration farms
4. Identify with consortium geographical scope of project. What areas of the country will need to be covered to get relevant coverage
5. Identify key regions locations where digital / broadband coverage is insufficient.
6. Detail the business case and project management specifics

Project 4: Align AHDB with an Industry Blockchain Pilot and BEIS Initiatives.

Given the growing number of pilot trials being implemented, mainly driven by retail, AHDB should identify one project that it can work with. We suggest that given the more advanced stage and scale of farm enterprises in horticulture, pork and potatoes and the more consolidated supply chains, these sectors might be prioritised. We also understand that AHDB via its board is in discussions with very senior business leaders and BEIS to explore how this area might be funded via the BEIS Strategy Challenge Fund

1. Review the blockchain projects and pilots that are underway or being considered in UK ag. We have identified some underway but there are certainly more.
2. Identify the key players that would be open to AHDB collaboration. E.g. the supermarkets and the BEIS discussions. Sainsbury specifically articulated that this is a strategic area of focus and they want to work upstream of the farm gate in our

interviews.

3. Develop a clear position of what value AHDB can add. We believe the role in making farm data available and creating the data standards that will be needed in APIs is critical and AHDB best placed to fulfil this role.
4. Define what the scope of ambition is - we suggest trial participation in a couple of pilot projects first, what resources, skills and capabilities are required.
5. Identify the AHDB lead for the project - ideally the senior manager co-ordinating discussions with BEIS and AHDB Board / Consortium.

Project 5: “Farming Digital Divide” Thought Leadership

Many interviewed cited the poor broadband coverage as being a critical issue in many areas of the country. Interviews with Wessex Internet, discussions with Agri-Epi and others, plus AHDB’s own levy payer survey, indicates that there is critical work to be done on shaping how these issues could be best addressed. Furthermore, highlighting the data capacity needs on farm in 5 years time to capture the benefits of the digital revolution is vital. The government should be directing “enabling subsidies” to providers that will supply connectivity that is fit for future needs, not that meets current minimum standards. Whilst AHDB cannot solve the problem it can provide thought leadership as to how this can be approached. It is a very real issue and frustration for many farmers, rural businesses and private individuals. Taking a lead role in framing the debate and proposing solutions would add huge value. Indeed the success of any ag digital strategy is predicated on resolving this major market failure

1. Scope the scale of the problem (heat maps of UK broadband coverage)
2. Work with Ag Innovation Centre and especially Agri-Epi to define future data access needs (speed, capacity requirements, etc.) that will be required to adopt digital tools anticipated in period up to say 2025.
3. Research current government schemes

and effectiveness. Is it delivering absolute minimum standards to meet their obligations?. What are the other options available?. What are the cost implications? (short run vs long term benefits of installing fit for purpose and future proofed higher capacity technologies).

4. Interview national providers (BT, EE, etc.) focusing on copper based coverage and low capacity and regional providers focusing on pure fibre connections and laying fibre optic cable in remote rural areas.
5. Consult with NFU / CLA and regional / local authorities who allocate government voucher schemes.
6. The levy payer survey also indicates only 15% of farmers have smart phones. Another bottleneck to digital uptake. What ideas, strategies and partnerships can AHDB facilitate to try to bridge this gap.
7. Idea for farmer digital training initiatives will need to be developed.

Project 6: Natural Capital/Climate Change project scoping (BEIS / DEFRA / LEAF etc)

Post Brexit UK food and farming policy and implementation are almost certainly going to change very radically from 2020 on, irrespective of which political party is in government. There appears to be growing pressure for policy and any residual agricultural subsidies to be directed to the provision of environmental and natural capital services. The current Secretary of State for DEFRA has signalled his intent to reform how subsidies are paid and to what purpose. The Natural Capital Committee chaired by Dieter Helm has made its case for their proposed 25 year environment plan and DEFRA will shortly publish their plan post consultation with NCC.

It appears very likely that subsidies would be closely linked to enhanced stewardship and the provision of services like improved soil fertility and health, biodiversity protection and enhancement, water quality, etc. These too could be linked to the U.K.s climate policy commitments under the Paris Agreement.

As yet there is little to no clarity as to how these more directed land use targeted policies could be implemented in practice. It seems inevitable

that any implementation would strongly draw on the use of big data drawn down from satellite (DEFRA - particularly cite Earth Observation Copernicus Data sets) drones and in time, possibly “on farm” sensors. In essence design implementation and management will be heavily driven by the use of big data, AI and derived Apps.

1. AHDB should start positioning itself now to be a lead facilitator and project designer of a consortium that would design the processes and tools required to execute these type of policies.
2. This will be a complex, long term and politically charged project but one vital to framing how levy payers will receive future financial support and be monitored, therefore germane to AHDB’s mission and the levy payers interests.
3. The first step should be to pull together an internal AHDB team to scope an initial pilot project. We would focus on a single sector first with potentially high leverage.
4. We think grains and oilseeds could be best to lead with due to availability of precision ag techniques and the overall percentage of UK farmland in these crops.
5. Initial project design would need to include consultation with relevant industry bodies and organisations (DEFRA, NFU, LEAF, consultation with NCC, etc.)
6. Given the potential to link this project to UK climate policy, discussion should also include alignment with BEIS and possibly a request for matched funding from the funds announced on October 12th 2017 from the Climate Finance Innovation Fund which is part of the government’s Clean Growth Strategy. <https://www.gov.uk/government/publications/clean-growth-strategy>

Implementation and Project Management Considerations

In the course of this work we have not had sufficient time or oversight to make concrete recommendations as to the overall AHDB structure, reporting and roles that should be put in place to deliver the digital strategy that is chosen.

However, to drive an effective implementation, these issues will need to be addressed early,

clearly, consistently and robustly. While this is an obvious point, it is our experience that project management and detailed follow is often overlooked and underestimated.

We have met a very committed, knowledgeable and open minded management team across the board. Given appropriate resources and support, we believe that a lot can be done within a 12-24 month timeframe.

How will big data and AI impact agriculture up to 2025 and the implications for AHDB

Given recent history in digital technology development, we believe it is almost impossible to predict which specific technologies, companies and platforms will dominate sectors and niches in the next decade. Making forecast of this nature is questionable.

However what we will predict is that in agriculture:

1. Big data, sensing/ monitoring, AI and applications like blockchain will grow exponentially
2. There will be agtech companies unknown today, that will have developed new technologies and platforms that will dominate their selected niches
3. That the issues pertaining to access, use and sharing value from farm level data will persist. The winning companies and platforms are likely to be the ones who have most successfully built business models that incentivise farmers to share data and that build trust. Farm data is air, without access to it innovation, it is suffocated.

The recommendation that AHDB’s core digital strategy and mission - to become the farmers’ champion for the fair use of farm data allowing it flow and innovation to happen - will remain valid regardless of which technologies and platforms win. Successfully implemented, it would be difficult for others to replicate.



Key findings

The data revolution and AI are happening faster in all sectors including agriculture than most people think and is likely to accelerate. This is evidenced in every interview and research source.

Farmers all over the world generally do not trust how their data is used by businesses and government. There is a strong case for developing farm data standards.

The best way to monetise or define the value of on-farm data remains unclear.

The volume of investment in digital agriculture, both VC and corporate is expanding rapidly. In 2016 it was estimated at USD 3.6 billion worldwide and the rate of investment is increasing.

Big data is a difficult strategic challenge but also a massive opportunity for UK farming and AHDB to refine its service offering and to become the farmers' champion in this digital transformation.

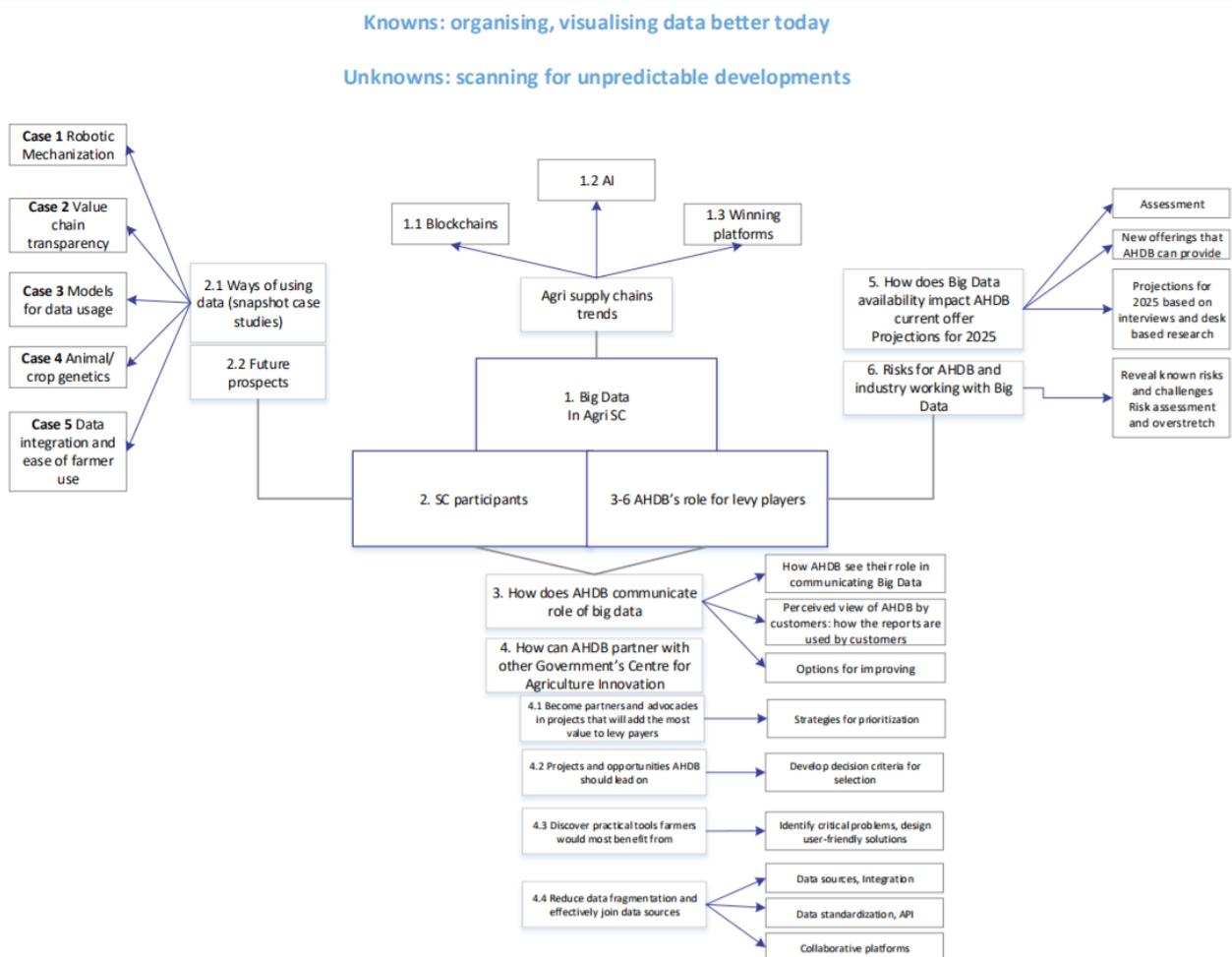
- Big data and AI are already and will increasingly transform agriculture and its supply chains. This is also true of every industrial and service sector.
- It will affect and reshape every part of value chains and is already central to major corporates at input, machinery, trading, processing and retail segments of business, who are increasing and doubling R&D spend in this area.
- Digital adeptness and adoption of easy to use tools on farm tools will be a key factor for managing productivity and capturing market access and premiums.
- It is likely to drive industry consolidation but also create opportunities for new farming entrants especially in high value niches where they might compete better on productivity, cost and quality.
- AI applications are developing much faster than previously thought possible. In highly data intensive businesses like agriculture, AI will manifest itself in better decision support tools for multiple applications as well as robotic applications.
- AI will put at risk or change the way that the role is executed many skilled occupations, agronomists, vets, etc.
- Consequently, AI will have widespread implications for the way production decisions are made, by whom and when. It is likely to change the way that on farm services are delivered too.
- Further explosion in data generation at lower cost on farm will fuel the development of AI applications, including robotics on farm and through the value chain.
- The more consolidated, larger scale and professional sectors such as horticulture, pork and potatoes will probably respond, adopt and adapt faster. In a number of cases they co-develop IP and will leverage their close relationships with retailers to drive innovation.
- Blockchain or Distributed Ledger Technology are likely to be a solution to supply chain trust issues and traceability. It is complex to implement and requires intense collaboration. The diverse nature of food and farming compared to other industries makes adoption more challenging. But big alliances are forming to pilot specific applications across many ag / food sectors. This is happening in the UK and beyond

- UK farmers are faced by multiple challenges beyond Brexit. These include profitability and future viability, ageing demographic, few digital natives, data and form filling overload and in many cases very poor or patchy access to sufficient broadband capacity. This has far reaching implications for digital roll out and how AHDB should respond.
- Farmers globally face asymmetric knowledge in data and AI relative to their suppliers and customers. This is both technical (knowledge of the technology and tools) and business – understanding of legal arrangements and contractual rights.
- This asymmetry fuels the growing lack of trust that farmers have with respect to openly sharing their on-farm data. It is a major bottleneck preventing the more widespread adoption of both existing and future technologies.
- Farmers need “a digital champion” to help them navigate issues and represent their interests as most valuable data is on farm. This is a bottleneck to unlocking the value of farm data everywhere. No sector or country seems to have solved this problem structurally.
- A race to establish dominant industry defining platforms is on. Many will try few will succeed. It is unclear if a monopoly player will evolve (e.g. a Google or Amazon equivalent for agriculture), and if so what the dominant business model will be.
- Instead, we think it most likely that leading platforms will evolve along sector and geographical axis. Consulting firms such as IBM, Accenture, McKinsey, BCG are marketing their services in this space.
- The diverse nature of farming and scepticism of farmers will be additional brake on the development of dominant platforms.
- Data protection, ownership, sharing and equitable and transparent treatment is a huge issue that many companies have been dodging or obscuring. Farmers are anxious and sceptical and this is a real block to data sharing and tool adoption.
- The General Data Protection Regulation being implemented in 2018 will have far reaching consequences and will shape how business and personal data is used and protected. This represents a major push back to the global data business monopolies and their advertising data commercialisation business models. This is starting to change their behaviour, how customers view them and what they may in the future demand in return for use of their data. This can be a major opportunity for farmers and the farming industry.

Methodology

The methodology for this research has been driven by extensive desk research, interviews with the AHDB Leadership Team, senior relevant member of DEFRA, the UK Agri Innovation Centres, “thought leaders” in digital strategy (agribusiness and other sectors) and a few selected companies that are important in UK food and farming supply chains.

Additionally, we conducted a straw poll of a small number of farmers / farming businesses to get a grassroots insight. Given the time and resources available we have been forced to focus our more in-depth research on a couple of sectors, but the approach is valid for all the sectors that AHDB covers and was consistent with the methodology map as set out in the proposal.



Case Studies

Case Study 1 – Blockchains

“Arguably the most significant development in information technology over the past few years, blockchain has the potential to change the way that the world approaches big data, with enhanced security and data quality just two of the benefits afforded to businesses using Satoshi Nakamoto’s landmark technology.”

General Definition

Blockchain is a distributed database system that acts as an “open ledger” to store and manage transactions. Each record in the database is called a block and contains details such as the transaction timestamp as well as a link to the previous block. This makes it impossible for anyone to alter information about the records retrospectively. Also, due to the fact that the same transaction is recorded over multiple, distributed database systems, the technology is secure by design.

Blockchain process flow



Problems Blockchain can solve

- Food Waste
- Food Fraud
- Fair Pricing for farmers
- Track & Trace

Roadblocks to blockchain adoption

Blockchain technologies may sound like a panacea for the diverse issues plaguing the food and agricultural sector. Yet critics argue that there are plenty of supply chain tracking solutions already in place, and that “blockchain is a solution looking for a problem.” The following needs to be overcome for widespread adoption on blockchain

- 1) Participants will have to adopt the same technology
- 2) Reliable high-speed internet access for all
- 3) Private key storing, a potential security concern, open to hacking
- 4) Differences in regulation may also prevent widespread adoption

Fair Pricing

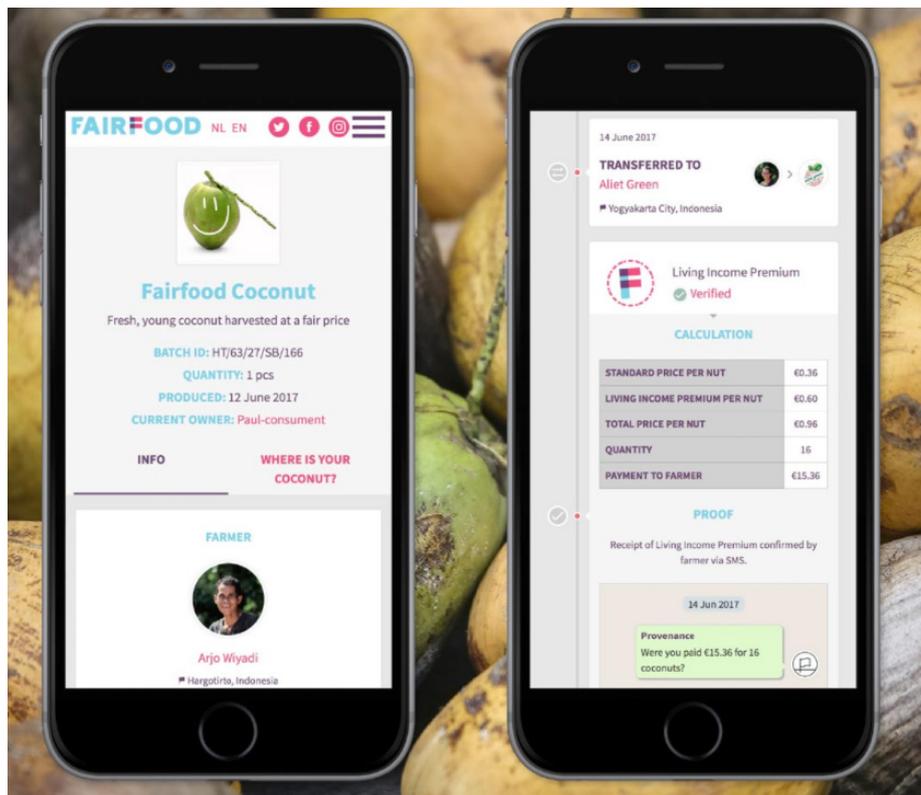


Image of PoP (Proof of Payment) webpage displaying the Living Income Premium verified by Fairfood, and powered by Provenance blockchain technology.

Background

In the regular sales processes, it's almost impossible to find out what a farmer receives for the goods he/she produces. How can blockchain technology improve financial transparency and verify proof of fair payment to agricultural workers?

Fair Pricing

The benefits of openness extend to all honest market participants. Blockchain technologies can prevent price extortion and delayed payments while simultaneously eliminating middlemen and lowering transaction fees. This can lead to fairer pricing and even help small-holder farmers capture a larger part of their crop value.

Provenance and **FairFood** collaborated with other third parties in the supply chain to trace and provide fair payment to farmers producing coconuts from Indonesia and selling in the Netherlands through blockchain technology.



The process

- A third party social enterprise company Aliet Green help set-up online farmer profiles
- 55 Farmers registered to Provenance Software via text messages
- Provenance Software connects to FairFood platform for payment verifications based on the Living Income Premium(LIP) Model by The United Nations(UN)
- Products are then collected, packaged with each farmer's tag. Aliet Green collects each package and pay the farmers directly. Each package is sent to Maersk for shipment from Indonesia to The Netherlands.
- Products Unloaded at Netherlands port sent to market for sales
- Tags on Sold products to customers can then be scanned to review farmer profile and payment received for the product
- All of the above can be traced on the blockchain openly

What AHDB can learn from this

- Engage with selected farmers for a pilot on blockchain transparencies and get real value from each product
- Work with technology industry leaders to kick start a pilot project
- Providing trust and transparency in the whole supply chain

Conclusion

Blockchain could transform the agriculture industry but without more investments, the outcome is very much in the distant future. The technology will receive plenty of chances to succeed as food security becomes an alarming challenge in the face of climate change. More investments required to help accelerate the use of precision agriculture and the application of intelligent data on a Blockchain platform with the use of Big Data

Case Study 2 – Robotics and Artificial Intelligence

Decision Support and Intelligence Systems

Artificial Intelligence		
1. IoT a. Definition b. Use Cases	2. Machine Learning a. Definition and examples b. Use cases	3. Robotics a. Definition b. Use cases

1. Internet of Things (IoT)

IoT devices include transducer that probes the various parameters of environment and crop (soil moisture and fertility, root growth, leaves growth, grains/fruit bearing, pests and diseases).The data can be collected at required time intervals by installing Wi-Fi active hot spot towers for entire field coverage or by using drones with active Wi-Fi hotspot that can scan and collect the data from IoT devices. The advancement of IoT allows sampling real-time data on farms.

This data can be fed to an Analytics platform engine making use of Artificial Intelligence, Machine Learning, Natural Language Processing and thereby create a Digital Solution to aid the farmers to address all the uncertain issues faced by farmers in the agriculture sector. Some popular

enterprise platforms:

IBM Watson Conversation Service

Google Natural Language API

Microsoft LUIS

Wit.ai

Api.ai

Inmarsat (ISAT.L)

And open source platforms: viz, Stanford's Core NLP Suite, Natural Language Toolkit, Apache Lucene and Solr, Apache OpenNLP.

Possible uses: interactive chat tool - get farmer's queries answered reinforced by machine learning techniques; Agri-E-Calculator for suitable crop selection along with resource estimation - farmer can choose the crop for the land; crop care and monitoring services; price prediction and market guidance (Based on the statistical data collected from various sources a predictive price and demand information is shared with farmers); crop load and insurance services.

2. Artificial Intelligence

Artificial intelligence are computer systems that are not simply applying pre-programmed logic and decisions, but exhibit some learning capabilities that can improve their own performance. *"The main focus of AI research is in teaching computers to think for themselves and improvise solutions to common problems"* (Makridakis, 2017).

Examples of intelligent systems include (Ngai et al., 2014):

- **Expert systems**

A computer based system that can provide information similar to a human expert. This helps reduce environmental costs, identifies appropriate processors and equipment, and provides more efficient and objective planning.

For example, fashion uses mix-and-match ES - gives systematic recommendations to customers.

- **Genetic algorithm**

Population based searching techniques that use probabilistic search methods based on ideas from natural genetic and evolutionary principles. This solves scheduling and machine layout problems, can deal with continuous change in the industry, and provides multi-solutions and optimisation techniques.

For example, can be applied to control fabric loss in fashion spreading process.

- **Artificial Neural Networks**

Computational models based on structure and function of biological neural networks. This provides answers using heuristics which are similar to the human brain. It has a robust and adaptive nature and can be modified to predict outcomes, determines quality and helps eliminating human subjectivity. Can also investigate correlations to forecast sales performance more accurately.

- **Knowledge based systems**

Rule based systems that incorporate a database of expert knowledge. Designed to assist information retrieval in response to queries and make quick and effective decisions

- **Decision support systems**

Computer based which helps decision makers utilise data and models. Identifies and solves problems and can automate tasks and can select efficient ways to reduce costs

- **Fuzzy-logic systems**

This gives approximate outcomes rather than accurate ones. Can provide solutions to problems that need to deal with approximations, uncertainty and insufficient information.

- **Hybrid Systems**

Hybrid systems combines any 2 or more of the above decision support and intelligence systems.

Machine learning in Agriculture

Farmers in many parts of India rely on rainfall for harvest and profits.

They have however, gained knowledge allowing them to predict timely rainfall and almost accurately plant crops based on their experience.

Scientists and engineers joined forces to find the right answer. An application was produced to using cloud-based predictive analytics to generate a precise date for sowing.

This app uses *Microsoft Cortana Intelligence Suite*, including machine learning and power BI, in order to produce an overview of factors that determine maximum crop yields. It gives insights on soil health, fertiliser recommendations and a 7 day weather forecast.

This application is used by 175 farmers who wait for a SMS message to start sowing. A result of this artificial intelligence is an increased yield of 30-40%. 2000 more farmers are set to join this development.

BLUE RIVER

John Deere announced on 12th September 2017 that the acquisition of Blue River technology has been completed. Deere has purchased the Sunnyvale California company to enhance leadership in precision agriculture. Deere & Company is a world leader in providing advanced products and services to farmers.

Blue River in particular is a pioneer in applying machine learning to help farmers optimise every plant in their fields by providing appropriate equipment.

Deere have begun a project 'Blue River' designed to:

- Advance machine learning capabilities
- Apply machine learning to agriculture
- Apply to agricultural spraying equipment
- Integrate computer vision and machine learning to reduce herbicides by spraying only where weeds are present
- Optimise use of inputs
- Advance precision agriculture
- Move farm management decisions from field level to plant level
- Use computer vision robotics
- Help machines detect, identify and make management decisions about every plant in the field
- Invest \$305 million in technology
- Accelerate machine connectivity and optimisation
- Help farmers reduce inputs, increase profit and care for land

RISKS

Risks of this project could relate to the:

- Satisfaction of the conditions to closing the acquisition in the anticipated timeframe or at all
- The expected benefits from the proposed acquisition will not be realised within the expected time or at all
- Business may not be integrated successfully
- Significant transaction costs
- Unknown or understated liabilities
- Effects of industry, market, general economic, political or regulatory conditions
- Future currency exchange and interest rates
- Changes in tax and other laws, regulations, rates and policies

- Future business combinations or disposals

John Deere is confident that similar technology can be used in the future on a wider range of products.

Smart machines

1. Intelligent weeding in cotton.

Sense and Decide - computer vision sees every plant and determines appropriate treatment for each.

Act - Robotic nozzles automatically target unwanted weeds as the machine passes with great accuracy and precision.

Verify & Learn - See & Spray assesses the applied herbicide, makes adjustments and learns as it goes. Technology includes a second set of cameras and the ability to automatically check its work as it operates. Therefore this software can continue improving in service to growers.

2. LettuceBot for precision lettuce thinning

Assess - visually characterise each lettuce plant. Intelligently characterises each lettuce plant based on health, uniformity of size and spacing.

Optimise yield - decide which plants to keep. Using 20 processors and advanced algorithms, lettucebot decides which plants should be kept to optimise yield. Based on optimal size and spacing, this knows which plants should be thinned and which should not.

Eliminate - Precisely remove unwanted plants. These are thinned using a concentrated dose of fertiliser reducing overuse of harmful chemicals.

3. Drones for remote sensing

Aerial sensing capabilities - Full life-cycle, high-throughput, plot-level measurements from a drone. Collects data over field plots and learn actions: how accurate, where to improve, impact machines are having. Allows See & Spray machines to operate better, faster and smarter.

ARPA-E TERRA - drone-based phenotyping as part of a program with the department of

energy to develop remote sensing platforms, complex data analytics tools and high-throughput plant breeding technology to improve sorghum as a biofuel.

Case Study 3

Data Use, Protection and Business Models

We present two brief case studies that demonstrates how different businesses in different parts of the big Ag Data and AI are managing data and data privacy. We briefly describe what appears to be the business model for data use and revenue is predicated on and highlight the response of farmers and the media. These illustrate the data ownership, protection and use challenges facing farmers and underline why the “Farmers First” concept is so important.

Business model for use of data would be a critical parameter of developing a rating model

John Deere Corporation.

It was amongst the most active early and scaled innovator in on farm machinery digital controls, GPS, precision agriculture and data services which will extend to machine learning generated applications on tractor(full automated tractors, etc.)

It is a company with a world class reputation and tradition for customer service driven by strong and committed distributor agency network worldwide but strong local ties in the farming communities it serves. It has a great brand heritage and legacy.

Yet it has fallen foul of all the key issues identified in this report with respect to digital services, access to and use of farm data and establishing a huge deficit of trust with its loyal customers.

The negative response to the way that it initially harvested on farm data from its customers,

without their fully appreciating the implications of what was being done with data, provides a sobering lesson in the perils of data driven products.

As a consequence of class actions by farmers with respect to data issues in the US, John Deere has been obliged to be much more transparent and open about what data and how it uses data and what protections the data provider has recourse to. Items 1 & 2 below.

However, despite this positive response to these issues the firm remains mired in negative publicity about what their data / digital strategy imposes.

We expect these issues to persist and become more essential to address as greater understanding of data protection, the rights of customers and the economic equity of what is shared becomes more evident.



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This overview discusses data and related end-user application services offered in Australia, Canada, New Zealand and the United States. Please note that these Business Data Principles and linked answers to the Frequently Asked Questions are purely informational summaries of our practices. The policies and provisions that govern our use of data and personal information are stated in our customer contracts and our [Privacy and Data page](#).

1. Data Services

We provide a data and related end-user application services to support your and our business needs.

- We are committed to applying our core values of integrity, quality, commitment and innovation to data management as it becomes a more important part of your and our businesses.
- Your participation in these services will help us provide current and future data services to enable your and our businesses.
- These services are offered by our agriculture, turf, construction, forestry and power systems equipment businesses and not others. [For the policies of John Deere Financial and John Deere Insurance Company refer here.](#)

[Refer to our Frequently Asked Questions for more details.](#)

2. Data Types

We differentiate business data into machine, production and other data.

- Machine Data generally relates to how your equipment is functioning. Examples include fuel consumption, implement, basic crop category, bale counts, machine health indicators, vehicle diagnostic codes and engine performance.
- Production Data generally relates to the work you do with the equipment and the land on which the work is performed. Examples include field task details, crop variety, trees or crop harvested (yield), and agronomic inputs applied.
- Other Data are data that we identify for special handling. Examples include variable rate prescriptions, user-entered notes and user-formatted reports.

[View a detailed explanation of our data type categories.](#)
[Refer to our Frequently Asked Questions for more details.](#)

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EXPAND ALL

COLLAPSE ALL

▸ WHY SHOULD I ALLOW JOHN DEERE TO USE MACHINE DATA INTERNALLY?

▸ WHY SHOULD I ALLOW JOHN DEERE TO USE PRODUCTION DATA INTERNALLY?

▸ WHY SHOULD I ALLOW JOHN DEERE TO ANONYMIZE MACHINE OR PRODUCTION DATA AND SHARE IT EXTERNALLY?

▾ DO THESE DATA USAGE CHOICES APPLY TO SHARING DATA FROM YOUR ACCOUNT WITH JOHN DEERE DEALERS?

No, these Data Usage choices relate to you sharing data from your account with John Deere — not directly with your dealer.

See "Why should I allow John Deere to use Machine Data internally?" for the limited case in which John Deere may share this data with dealers.

If you have granted us permission to anonymize and share your data externally, we may also share that data with dealers.

Your choice to share the data from your account with one or more dealers is separate from your choice to share it with John Deere. Choices related to sharing data with dealers can be made [here](#).

About 488,000 results (0.67 seconds)

We Can't Let John Deere Destroy the Very Idea of Ownership | WIRED

<https://www.wired.com/2015/04/dmca-ownership-john-deere/> ▾

21 Apr 2015 - It's official: **John Deere** and General Motors want to eviscerate the ... of modern tractors farmers receive "an implied license for the life of the ...

A right to repair: why Nebraska farmers are taking on John Deere and ...

<https://www.theguardian.com> ▸ Environment ▸ Farming ▾

6 Mar 2017 - Farmers like fixing their own equipment, but rules imposed by big ... A right to repair: why Nebraska farmers are taking on **John Deere** and Apple genuine Apple parts and that the repair was done to the right specifications.

Why American Farmers Are Hacking Their Tractors With Ukrainian ...

<https://motherboard.vice.com/.../why-american-farmers-are-hacking-their-tractors-wit...> ▾

21 Mar 2017 - A dive into the thriving black market of **John Deere** tractor hacking. ... **John Deere** Electronic Data Link drivers: This is software that allows a ...

John Deere's Digital Transformation Runs Afoul Of Right-To-Repair ...

<https://www.forbes.com/.../john-deeres-digital-transformation-runs-afoul-of-right-to-r...> ▾

30 Apr 2017 - Farmers in the market for mechanized farm equipment may not like ... **John Deere** is now in hot water with the 'Right to Repair' movement for ... Salient to this article: **Class 21**, covering a variety of types of motor ... "Access to information that would allow changes to a machine's data-management systems ...

Missing: aetien

Farmers turn to black market for John Deere software | Daily Mail Online

www.dailymail.co.uk/news/article.../Farmers-turn-black-market-John-Deere-software.ht...

22 Mar 2017 - Online black markets for cracked **John Deere** firmware have sprung up in ... version of **John Deere's** diagnostic software is offered for sale.

DTN Progressive Farmer

This business was created by the merging of DTN an intensive data service specialised on weather and market data and Progressive Farmer the leading US farmer magazine: Think Farmers Weekly. Until early 2017 it was owned by Schneider Electric a French Multinational Energy firm.

In its last financial year it had revenues of USD 213 million, over 600,000 clients or USD 35.5 per active subscriber. It deploys an aggressively pitched premium model with advanced services that are charged. It emphasizes the strength of its community and makes subscribers feel that they are part of a real community of likeminded businesses. See image 1.

It provides great depth and breadth of data access and editorial copy so it is attractive to farmers who tend to be price sensitive. However, given that the primary revenue model, is we believe, from advertising and data sales of permissioned data, users are the product. Image 2 advertising pop ups are frequent whilst browsing.

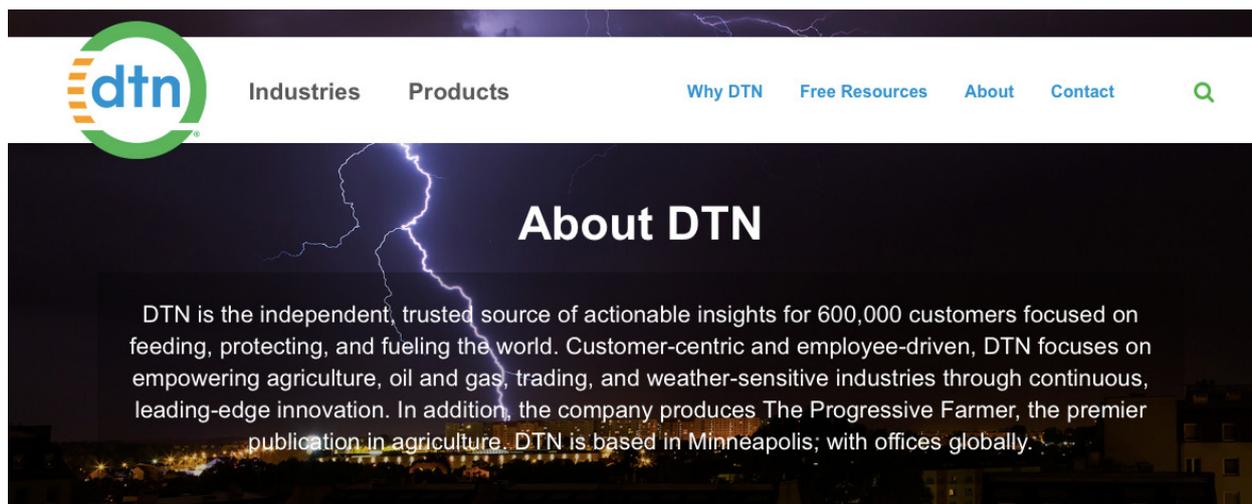
Their data privacy policy is difficult to find and has very weak protection. As with many new media digital publishing businesses they can change the operating rules unilaterally without any consultation. Image 3

The business was put up for auction in late 2016 by Schneider as being non-core. We know at first hand one of the private equity businesses that reviewed information memorandum and valued the business for acquisition. They withdrew early from the bidding process for this principle reason. Their initial research strongly indicated that farmers are difficult to upsell to, especially with respect to data services that they believe in this form should be free.

In other words building high value paid for services off the back of a business whose customers traditionally are price sensitive, was deemed a difficult proposition at a targeted valuation in the range of USD 500-600 million. So our information source withdrew.

The business was finally sold for USD 900 m to the private equity company based in Switzerland called TBG AG (Thyssen Family Office). This price was 4.5 x revenues and 17x EBITDA. Given PE firms will target returns of 15% over a five year holding period the investment strategy will be an aggressive revenue growth per subscriber target and growth in new subscribers.

The business model places very strong pressure on applying the minimum data protections possible and maximising the commercialisation of farm business data, whilst at the same time, demonstrating the high value of aggregated and individual farm data.



The screenshot shows the DTN Progressive Farmer website. At the top left is the DTN logo and 'The Progressive Farmer' text. To the right is an advertisement for the STAMPER 4x4, highlighting 'COMES WITH 80HP AND A WORK ETHIC' and a 'COMPARE MODELS' button. Below the navigation bar (HOME, MARKETS, NEWS TOPICS, WEATHER, PERSPECTIVES, RESOURCES) is a large banner titled 'WHICH WEED ARE YOU FIGHTING?' featuring an Enlist logo. The banner includes a photo of a man with a beard saying, 'We saw instant curling the next day.' and two images of weeds labeled 'WATERHEMP' and 'PIGWEEED'. A call to action says 'See how Darin won the fight against common ragweed' with a play button icon. A Dow AgroSciences logo is also present. At the bottom of the banner, there are small news snippets: 'Producers Required to Pay Cash Deposits on Imports' and '2018 VIKING VIEPS'.



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Privacy Policy and Terms of Use

DTN, LLC (hereinafter "DTN") respects individual privacy and values the confidence of its customers, employees, business partners, and others. DTN strives to collect, use, and disclose personal information in a manner consistent with the laws of the countries in which it does business and has a tradition of upholding the highest ethical standards in its business practices.

When you connect to or access this website (hereinafter the "Site"), you agree to be bound by the general terms of use set out below, as well as any specific terms mentioned on certain pages within this Site, as updated from time to time. Your access and use of this Site is subject to all applicable international, federal, provincial, state, and local laws and regulations. If you do not agree to these terms, you should leave this Site immediately.

Privacy Policy

Handling and Use of Personal Information

DTN collects personally identifiable information on a voluntary basis for the purposes of: providing customized content, subscription service registration, demographic compilation, and marketing and promotional campaigns. When information is required that uniquely identifies you as an individual (name, address, phone number, etc), you will have the opportunity to "opt-out" of any promotional marketing, except when you specifically request marketing or promotional information.

Case Study 4

Digital Dependence and Disruption Risk

One aspect of the digital revolution that is often underestimated and overlooked is the risk of digital dependence and the loss of human knowledge. The practical consequences of this can be devastating in event that there is a critical interruption or dislocation in the provision of a core digitally driven process.

Already over the last 10-15 years as farm machinery has become much more digitally controlled using advanced circuit boards, the ability for farmers to repair machinery in emergency situations has been all but removed as an option. This is true for any of the major machinery manufacturers, for whom supplying servicing and repairs has become a more significant and “tied” revenue stream, where the farmer is hostage to the agent. We know that farmers already dislike this, it is likely to become more acute. (see John Deere / Blue River example

All major manufacturers are extending this to integrated precision ag technologies using GPS and now AI algorithm driven decision tools. This increases the dependency of the farm business in across a multiple range of services and skill sets. In arable farming this will include crop disease and pest identification and selecting with agronomists the appropriate fungicide or pesticide treatment. Of course the benefits of increased efficiency, labour productivity and lower cost of production is the rationale for adopting digital technology.

However, what are the potential consequences in situations where the technology platform is disrupted?

We have a well sourced example from the U.K. health service sector, which cannot be named for obvious reasons. It however, is a very graphic illustration of the type of challenges that can be encountered.

Many hospitals now used AI algorithm driven decision assisted tools for prescribing and then

recording complex drug cocktails for patients with very serious illnesses. The medical staff enter the details of the illness (in an increasing number of cases the initial diagnosis will also have been AI driven) , the patient’s specific situation - age, weight, symptoms, resistance, allergies, etc.

The optimal drug program (mix, dose, rate, etc.) is then determined and program initiated and digitally recorded. This has the benefit of faster, more granular and efficient prescription and administration.

All good until the system is disrupted. When this happened recently in a leading hospital the impact and learning was unexpected and required both short term rapid response but also strategic consideration.

The ability of the on call medical staff to override and work round the system was severely compromised. The majority of active staff (and those under the age of 35) had poor knowledge of the drug impact, dose and optimal combination of drugs to treat the patient. This expertise had been atrophied by the reliance on the AI tool. Decision making had been given over and what was discovered that most staff simply did not have the appropriate level of knowledge or that lack of use had reduced the confidence with which they could apply it.

No paper backup records or drug charts were in place so the staff and patients were faced with an immediate and critical situation. The solution was to rapidly call in as many experienced senior staff and doctors, who still had the specific knowledge and decision making capability to re-prescribe within the short time frame available.

The post mortem of this outage revealed three strategic issues that need addressing:

1. No digital system is 100% fail safe. From the outset there needs to be a robust disaster recovery set of procedures and in extremis a non digital crisis procedure.
2. How does an industry train, retain detailed and technically critical knowledge for decision making in the long-term when

increasingly decision making is being yielded to data and AI driven processes?

3. What implication does this have for service / product design, life cycle support and dependency.

Implications for AHDB in this respect are clear.

For any digital project - be it big data, AI or blockchain related:

1. the disruption risk needs defining
2. the most critical point in the process flow and the consequences identified
3. a disaster recovery or non-digital work around documented and available

The more strategic risk for farmers though is systemic and economic dependence on a data / AI provided platform. If a major global machinery / digital platform with alliances with major seed and agrochemicals suppliers and possibly farm management and accounting systems (e.g. as is the case with John Deere and Gatekeeper) becomes the supplier of choice, then the farmer also has a great risk of becoming captive.

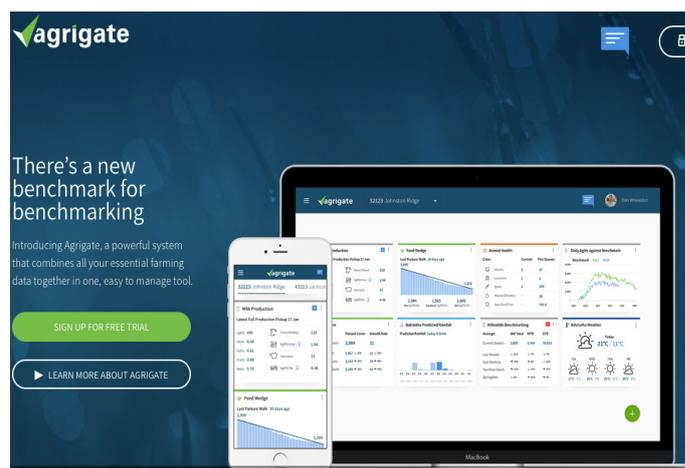
The investment, training and switching costs all become very significant. The dependence on a few suppliers, who have asymmetric knowledge power in terms of scale and pricing power leave farmers open to economic abuse.

These factors further underline why farmers and farming are sceptical and concerned about the use and application of their on farm data and why a farm data champion is required.

Case Study 6 – Fonterra / LIC Developed Dairy Management Platform

Agrigate is an integrated farm data management tool covering production, financial, health, weather feeds. It has automated uploading of all the relevant data sets, so the farmer is not tied up loading, importing and standardizing data into the main analytical framework.

Agrigate



It is a co-operation between Fonterra (Source the data hub for Fonterra) and LIC - the Livestock Improvement Corporation and a number of data partners from across the agri / input industry who provide their data feeds directly to the platform.

It is a world class example of a collaborative digital / data service being developed and delivered on farm. It is still in advanced Beta but feedback is that uptake is strong.

The farmer has control over how the farm data is published and used with a clear privacy explanation. They have good, transparent data protection protocols, simple to understand.

It is visually appealing and intuitive to use and is a monthly subscription pay for service NZ\$30 / month. This means the business model is not predicated on selling the farm data and profiling to advertisers or major corporations. The data driven transaction and functionality is transparent and understood.

Fonterra, LIC and farmer incentives are all aligned. The objective being to improve the productivity, profitability and competitiveness of NZ dairy farming.

We have included a couple of screenshots below but we would recommend viewing the website and also the marketing film. Interestingly the sample farmer used is not a young digital native but a mature, grey haired farmer. The implicit message being

this technology is open and easy to use for everyone.

It is the type of platform functionality that FarmBench might want to consider as it evolves.



<https://www.agrigate.co.nz/>

Key Observations confirmed by the research

- The digital revolution and Brexit challenge create the opportunity to rebase the way AHDB develops and delivers much of its work and to become the champion for levy
- “Farmers First in Farm Data” Critical to fully unlocking Big Data, AI & blockchain potential on farm. There is a growing trust deficit in data use that needs addressing
 - AHDB has some key strategic assets at its disposal; knowledge, people, partnerships & levy payer network
 - Good insight as to the specific issues and opportunities to grasp
 - A senior management team open to and willing to change
 - Industry desire for pilot projects but low

“perceived” levels of traction

- Urgent need for closer co-operation with the Ag Innovation Centres etc and defining where the risk of overlaps, fragmentation etc need to be resolved.
- AHDB – due to its data heritage, farmer access and potential convening power is uniquely placed to play a leadership / aggregation role in creating an efficient UK ag data and digital ecosystem.
- Identifiable market failures that AHDB can help address in respect of digital innovation.
- Strong ideas and projects in hand but implementation and project management critical
- Clearer criteria for prioritisation of “must implement” projects and overall project coordination.
- More focus on levy payer engagement
- Confirmed need to focus on fewer higher impact deliverables, free up resources and address perceptions about delivery of value.
- In parallel AHDB should refine its current offering and decide what it should not pursue.
- At its best, the innovation work with active farmer groups on specific work streams in any of the specialist areas is highly appreciated and valued but this we suspect is concentrated around “active & engaged” farmers.

Discussion of Researched Questions

How does AHDB Communicate the Role of Big Data

The question is more how should AHDB communicate the role of big data, AI and blockchain in UK agriculture?

Currently, although much reflection and a number of big data related projects are under way, there appears to be little communication happening from AHDB to its levy payers in this space. When one looks at the daily and weekly flow of information and debate about how big

data is changing agriculture and the potential for AI and the data protection and theft fears general press – this is a big omission.

Make it real and demonstrate the financial value

The way to a farmer's heart is through their wallet. AHDB has to find simple persuasive ways via delivery of case studies and projects that demonstrate value and financial benefits to their levy payers. Showing how a data driven innovation produces a 15% return on investment will capture their attention.

Make it accessible

Explain in plain English from a source they trust the what, why, how, when and by whom of these technologies.

Address the trust deficit in sharing farm data

A universal problem facing the development and deployment of big data driven tools is the massive mistrust that farmers have in the way that their data will be used commercially by business or perhaps worse by Government departments. Farmers and even mid-sized companies in the chain, face real problems of asymmetry of expertise knowledge and access to valid legal advice. There is no entity that we have been able to identify anywhere in this work that is independently farmer-funded and with appropriate skill set and industry knowledge to fulfil this role.

A number of international companies we have spoken to in this study have identified this issue as the key issue preventing faster development and uptake of technology. The sector head for Supply Chain Finance and Strategy at Rabobank stated that “Anyone that can effectively solve this problem will create great competitive advantage for its farmers.” A fact underlined by AGRI-Epi who are working on a commercial and confidential project in Australia funded by Rabobank.

Another senior person from U.K. agriculture with great expertise in agricultural law, corporate governance and farm data said *“Every commercial company active in collecting and using farm data either digitally or by traditional methods, that claims to be farmer*

friendly, is to some degree a wolf in sheep's clothing”.

When farmers give their private farm data they need to know with confidence what they get back and on what terms with full transparency.

As a first step we would advise that AHDB ascertains from any data partner or research provider how the farm data / information is obtained, who is it used by, what revenues are generated. Is farmer fully aware of this – as opposed to the firm being simply legally compliant.

To be taken seriously. It is very revealing and important for building trust with farmers.

Not a single person we spoke to argued that farmer lack of trust was an issue that could be ignored, nor disagreed that independent representation of farmer interests was a good idea. Most endorsed the idea that potentially AHDB could fill this role in some measure. The question of course is how?

Consequently, we believe that the initial hypothesis of “Farmers First For Farm Data” and the need for this to be addressed has been confirmed by this research and our past experience in this field. The case studies and desk research support this hypothesis.

This concept and positioning should be at the centre of any vision and strategy that AHDB develops for taking thought leadership in this space and successfully facilitating digital innovation in UK farming and food.

This is not just applicable to UK farm data but all areas of personal and business data – and is embedded in the thinking that underlies the GDPR legislation.

“We might want to think much more carefully about three things. First, the extent of information that we reveal and all the myriad ways in which it can be used. Second, whether the products and services we receive in exchange for our data are worth it, or whether the terms of the exchange should be reconsidered. And third, how governments may shift the rules of the new digital playing field, and what that will mean for capitalism in the 21st century.”
Rana Forochar

How does AHDB see their role?

During the course of these interviews, it was clear to us that the senior management team is very aware and open to the change of emphasis, focus, capability and delivery that big data, AI and “blockchain like technologies” are almost certainly going to impose on agriculture. Brexit and what ensues will further accelerate change. What appears to be unclear though is the role, focus and resources that it should choose as an organisation to best serve its levy payers in this critical field.

The key to unlocking the observed determination of the leadership team will be in setting a clear overarching strategy for this area and then driving it into the organisation, which will entail making choices. Obviously delivering some early wins with successful projects implementations that can be broadly communicated would be of huge help.

The challenge of melding six organisations into one and the way that the mandate is framed around levy payers for each sector having the final say on how their levy is used, makes refocusing and changing the projects and priorities harder. This is especially for cross cutting themes. The fact that AHDB has to cater to such a divergent group of farmer levy payers by sector, scale, sophistication and education- all with forthright views – further complicates the process.

Perceived views of levy payers and other counterparts

There is a general recognition amongst the few levy payers we spoke to directly, that AHDB does important pre-competitive work in the field of innovation, but that in most cases the link between payment and value adding benefit is not apparent and therefore in many cases questioned?

E.g. a cereal farmer said “Despite all we are told about the marketing work AHDB does, I cannot see it in my contract price anywhere.” Another said “I never really read the AHDB /

HGCA grain and market reports – I get that straight from Openfield whom I sell to or via other internet hosted sources.”

Virtually every farmer we spoke to said they never really get the chance anymore to read most of the AHDB prepared reports they are sent. They don’t have or make the time.

On the recent AHDB Brexit report, of the dozen or so farmers we spoke to, only one had read it and most of the rest were not aware that it had arrived. The issue as to this perception of producing output that is not useful, or might be but is not in a form that is digestible or actionable. This is absolutely critical for AHDB to address in greater granularity. Note this was only a snap survey of farmers, but they were drawn from the more technically advanced and commercially successful in AHDB’s member base. We suspect that this issue is more widespread than might be acknowledged and should be addressed in much more depth.

Other organisations both commercial and research based expressed a similar range of views. All see the need for AHDB and that the industry requires world class pre-competitive innovation work facilitated and then efficiently disseminated. However, most questioned and some pointedly - how efficient AHDB currently is at making best use of its most knowledgeable assets, driving projects from inception to delivery and working with its broader stakeholder network. At the same time, they are very aware that if it were to disappear, UK agriculture would suffer as a consequence and it would not be replaced. In short, there is goodwill but greater focus and delivery is demanded.

Some quotes from industry and partners

“There are some great people at AHDB but my frustration is that they are not doing enough to really focus on the big issues for which there is market failure in my sector – early warning systems for specific diseases and pre-commercial work of critical crop diseases for which resistance is building up fast in wheat, potatoes and sugar beet.”

Leading Agronomist

“They need to recognize that many of their farmers are really struggling now and will be much more after Brexit. AHDB must be more sensitive to this end” **An industry leader**

“We would love to work on real projects with AHDB as part of a consortium that used data solve some of the toughest challenges we face in traceability and authentication of product. Big data cutting through everything we do and all our core deliverables. The problem is we do not seem to be able to find a way to isolate a project”. **Senior executive in a major UK food company.**

“AHDB and its former independent constituents has delivered a huge service to UK farming over the decades. It would be huge loss and waste if we lost it. So we have to fight for it but AHDB has to be able to demonstrate delivery of real value and good cost management in return” **very respected large scale farmer**

“AHDB plays a critical role and we want to work with them. But they don't do a good job on making content appealing and digestible. Their management appears top-heavy.” **senior executive in finance sector**

“A word of caution FarmBench is a good idea but farmers on the whole are resistant to benchmarking and sharing data. It needs road testing and the lessons from DairyBench which was previously launched and failed need learning and reviewing. Levy payers and partners remember this.” **Agricultural consultant**

“If FarmBench requires a lot of data input from farmers –it probably won't happen in a way that is successful. All these tools need to be intuitive as possible. If AHDB can help build this into any big data, AI related development project then that will be a big positive outcome.” **U.K. based corporate and active partner / sponsor of AHDB work**

The quotes above might seem harsh and almost certainly do not reflect the truth but it is the perception that is important. No doubt this is a cause for concern and Project Blue is an important step in addressing this issue.

Options for improving

We believe that many of the core things that AHDB can do to improve the perception of its value add are under consideration or in implementation, but we would reinforce the following

Improve Digital Content and Distribution

Successful implementation of Project Blue and improving the way levy payers can access and consume output is critical. A stepwise upgrade is underway, but getting the message out and usage up is a separate challenge to producing the digital interface and supporting software.

Even world class publications like The Economist have struggled to get their digital strategy right, because they were thinking like traditional hard copy content companies. They completely revamped their online strategy and started thinking about which “key influencers” and distribution partners they could work with to expand the digital access.

In a time-poor world even farmers may be more prone to open up a piece if it is endorsed by someone they find interesting or respect beyond their immediate farming prowess. It may seem trite but you want a champion for 50+ year old farmers to become digitally more adept, get John Jeffrey to do

a “YouTube” tutorial film you host, and why not have it sponsored by a bank committed to UK agriculture or mobile network?. Do the same with women influencers connected to agriculture. This could be proposed to corporate sponsors.

Demonstrate that AHDB is acting on feedback

Be prepared to get the message out that you are listening and acting on feedback more proactively. Levy payers want the AHDB to succeed but they want to see that they are being heard and frankly speaking, we suspect, that you are sharing their pain. Assuming that each sector critically reviews its activities and then prunes some back – with input from levy payers; communicate this clearly and link to what you will be focusing on and why.

Learn Lessons, Solicit feedback & Sense Check Projects

Use levy payers and partner companies more proactively to identify and sense check projects that can deliver perceived value to the levy payers that can be evidenced. Major initiatives should be trialled / piloted prior to full launch. Use major partners who can distribute and spread the word to give feedback on the product or service.

We strongly recommend that FarmBench is road tested with partners and levy payers prior to full launch.

Learn from other industry levy boards internationally

Look carefully at other examples of industry good organisations that have had to refocus their efforts and make them more responsive and value driven. The NZ organisations are a good example of this after the Wool Board Levy was withdrawn. Those remaining had to seriously change to retain levy payer support. Mark Young at CIEL is a good source of information and contact on this subject.

Implement digital projects that demonstrate real value

The single biggest way to drive value and change perceptions is by driving a few great projects that make a discernible difference and that address the burning dual issues of improved productivity & traceability / market access. AHDB’s recent *Brexit scenarios – an impact assessment* – underlines how critical this will be for farms to survive the probable margin and income squeeze that will result from Brexit.

Engage with levy payers more directly

A huge amount of innovation comes from the farm, find better ways to engage this. This could include more workshops and open days on demonstration farms (resources allowing) but also an online community using a research wiki to get feedback, etc. and farmer focused innovation challenges.

How can AHDB partner with Centres for Ag Innovation?

Put simply it can partner best by doing well targeted projects. Identify critical projects mainly of a pre-competitive nature that can add real value to both direct levy payers and the supply chain up to and including consumers.

During discussions with the Centres in almost all cases we have encountered an openness and willingness to engage with AHDB but in some cases a frustration that discussions have led to more discussions and no tangible project to work on. In the case of Agrimetrics this is a feeling that is held in both parties.

Yet there is good work being pursued by Agrimetrics with WRAP in reducing waste in the potato value chain. AHDB is aware and positively acknowledges this work and is in discussion with Agrimetrics. We recommend that explores :

a) how the findings and developments of this work could be communicated to levy payers more

broadly,

b) how the learnings and outputs could be deployed in other AHDB sectors – suitability for a cross cutting theme,

c) aligned to data protection, usage issues and the Farmer First concept.

Rapidly agreeing on and executing specific projects is more productive than negotiating long term strategic agreements.

The exception to this might be with Agrimetrics, where there is a potential overlap between which organisation should have primacy in managing, consolidating and publishing what data sets or analytics to which audience.

This is a critical issue which cannot be solved in this study but is germane to resolving in order to:

a) reduce data fragmentation and increase development of uniform data standards and APIs

b) avoid unnecessary overlap, duplication and financial waste (parallel benchmarking projects)

c) create the foundation conditions for an effective UK big ag data ecosystem

d) demonstrate to levy payers and government that investments being made are not siloed but collaborative where it makes sense.

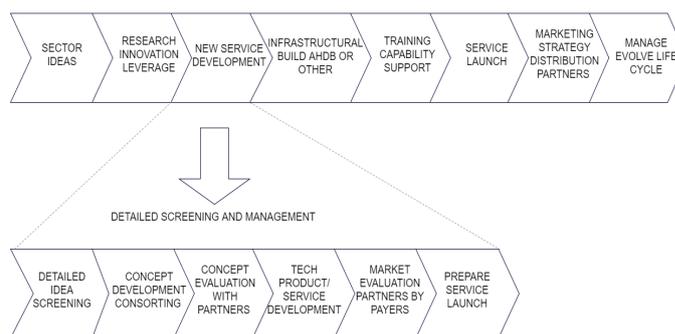
Three additional questions to be addressed:

- What partners and advocates in projects will add most value to levy payers?
- What projects and opportunities should lead on?
- Discover practical tools farmers could most benefit from?

We believe that all three of these linked issues are best addressed by defining and implementing a simple but clear model for identifying, prioritizing, resourcing and running projects

Recommended High level Process Flow for Collaborative Service Development:

PRODUCT/SERVICE SCREENING AND DEVELOPMENT PROCESS



Detailed considerations for each stage

1) Idea Generation & Screening

- Work closely with farmers and value chains players serving or buying from them to identify a real and burning problem that needs solving.
- Understand the detail of what that problem is and how it negatively impacts their daily work or on-going performance
- If it could be solved will it make the users life better because the process is simpler, quicker, more efficient and intuitive and makes or saves them money. If a project cannot meet these criteria it is likely to be a failure and a resource sink.
- What partners, data and infrastructure will be needed to pilot this at reasonable cost and which partner has the greatest capability in this area?
- What is the quick and dirty business case and return on resources look like?
- Can the financial value be estimated from developing the service or product - cost savings, efficiency gains, waste reductions, market access
- Where do the hidden project bottlenecks and killers lurk –e.g. late stage non-permission for data sharing, GPRD issues?
- Can they be resolved and agreed upon up-front and not after the work has been done?
- If successful in pilot can it be successfully scaled

2) Concept Development

- How will the pilot be run, by whom, with what timeline and budget?
- How do we make delivery and team accountable to deadlines?
- Which partner in the consortium is best

placed to lead and drive the project and do they have the skills and resources available to do so successfully

3) Concept Evaluation

- a. Test with user groups, refine and really work hard to understand if and how they will make use of this innovation
- b. Does it involve early stage technology risk – if so how big is that risk?
- c. Is it readily accessible and does it actually add value – is it intuitive and are they actually going to use it?
- d. If not how can it be adapted?
- e. If the outcome is uncertain - kill the project fast and efficiently yet retain the learning.
- f. Don't allow unviable or low impact projects to be carried and to consume scarce resources

4) Technical Product Service Development

- a. What are the key technical components and infrastructure required?
- b. What are the data standardization and APIs requirements and who is best placed to coordinate them?
- c. Where can they be sourced and is this best done?
 - i. internally using existing AHDB capabilities
 - ii. contracted in but managed directly by AHDB
 - iii. outsourced to a consortium partner but with contracted agreement
- d. What are the critical technical and service delivery risks, are they properly mitigated?

5) Market Evaluation

- a. Verify / re-verify attractiveness to target user base.
 - b. Confirm / test the response and commitment of project partners - especially those with distribution responsibilities.
- 6) Service or Product Launch
- a. What is the rollout strategy and should AHDB lead or support?
 - b. Are the resources available and appropriately targeted?
 - c. Are distribution leads or partners fully coordinated with shared plan and agreed responsibilities?
 - d. What training support tools etc are needed and how can they be provided?
 - e. How will we respond to problems and

provide effective back up?

Projects that AHDB should lead on

We recommend that AHDB seek to lead projects that address a specific upstream market failure with no direct short term commercial application. Typically the project would be highly reliant on access to and sharing farm data; deploying new data technologies coming out of Ag Innovation Centres and or addressing a regulatory reporting requirement that AHDB is suited to develop.

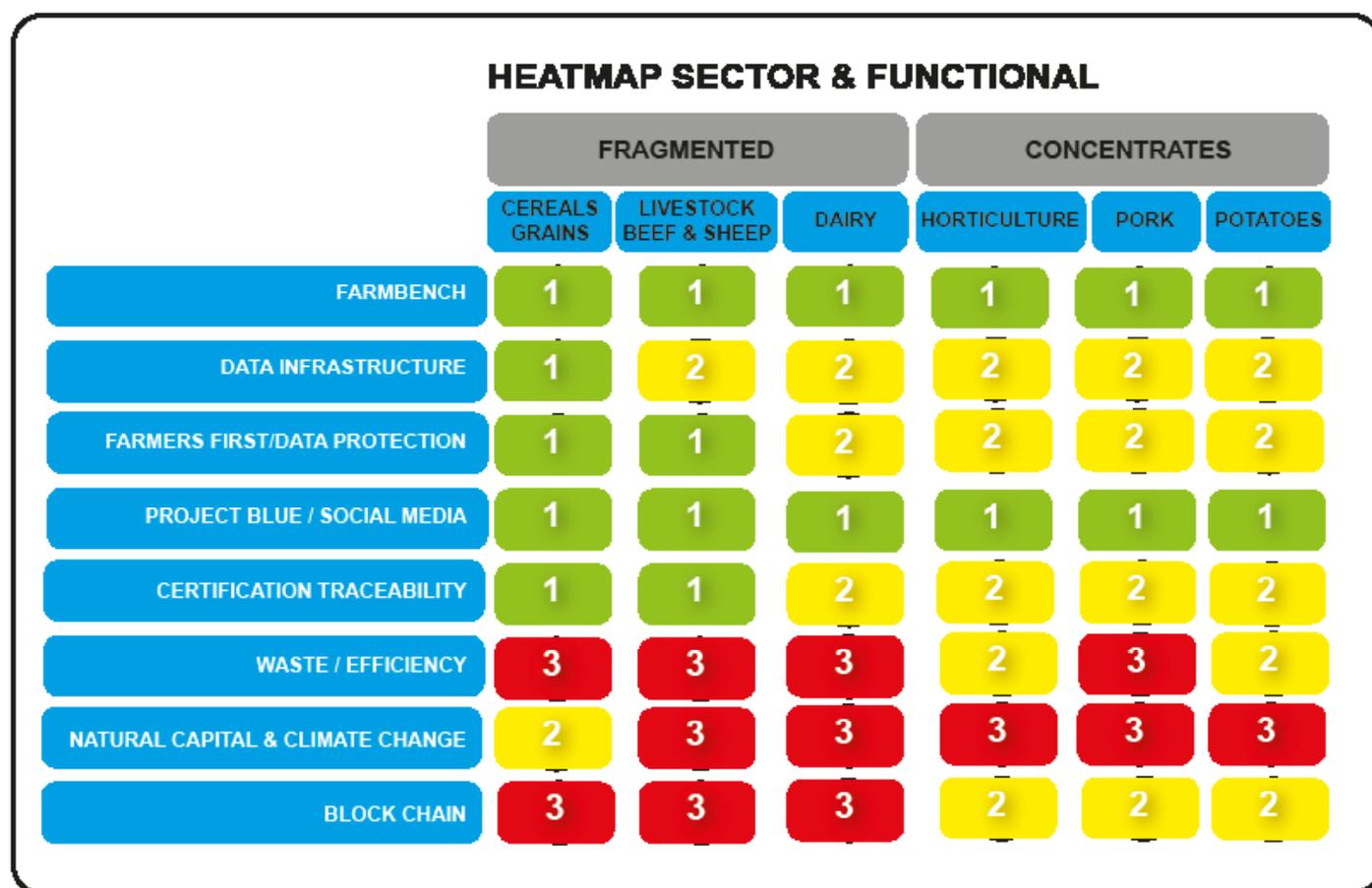
Projects that AHDB should support but not lead

AHDB should play a subsidiary role in projects which are close to market commercially driven and lead by business, but that need the establishment of data standards and APIs from on farm data to be successful E.g. block chain pilots driven from the retail and processing end of the supply chain.

We do not see AHDB as having a core function of being an app developer or necessarily manager of overarching big data infrastructure providers required to implement any specific project. This should probably be defined on a case by case basis and will depend on the technical brief and respective capabilities of consortium partners.

For any given project supporting data infrastructure, the best placed consortium member by capability, resource availability and experience should be the provider, so long as the pricing model and contractual arrangements are equitably negotiated.

Projects and offerings that AHDB could facilitate



1: Highest Priority 2: Near Term 3: Longer Term

We note that every person we spoke to in the Leadership Team had well based ideas as to where data, big data and related AI and blockchain opportunities for innovation for their sector or discipline lie. The challenge is to prioritise and successfully execute the most impactful ones first.

Above we have put together a simple heat map to indicate the priority of projects that have resulted from our discussions and research. It is a first analysis that reflects the recommendations that we have made.

However, care and discipline should be applied when deciding to add new projects in order not to dilute execution focus and effectiveness.

The potential impact of Big Data, AI and Blockchain to 2025 and beyond

The overwhelming evidence from both research and interviews is that the quantity of on farm data sensing across all forms of production is going to increase dramatically over the coming 5-10 years.

This will be driven by a low absolute unit cost of putting sensors on farm and a dramatic increase in use of sensors to monitor different parameters of production and track its impact along any given value chain. It will drive both productivity improvements and market access, certification and regulatory reporting. The development of farm level sensing technology with environmental metrics measured and assessed has significant implications for development of agricultural policy and payments for delivering ecosystem services (natural capital)

In the UK, Agri-Epi is working to a tight timeframe across its network of demonstration farms and data hubs to create increasingly digitised production units generating multiples of output data

compared to what is generated today. By 2025 this type of data sensing and connectivity could be widely distributed across the top 10-20% of UK farmers who are consolidating UK farming. A trend likely to accelerate post Brexit

For an arable farm this could incorporate data streams for soil temperature, nutrient availability, plant growth development, moisture, disease / pest infestation down to the m2. It could be even more precise than this if one considers the levels of refinement that John Deere's Blue River acquisition is targeting - identification and treatment of individual "AI" identified weeds within a broad acre arable crop.

In livestock there is going to be an explosion of data from individual animals - with health monitoring, feed efficiency, product quality all being reported in real time. so the best farmers will increasingly measure, monitor and manage "smart cows" at a granular level - and not the aggregated herd performance.

This type of development can be expected not only across every part of agriculture production but also along the value chains of food production and distribution. A leading UK retailer we interviewed stated that the intelligent use of big data, AI and technologies such as blockchain - is critical to the delivery of all their five core business objectives. It is not something nice to have it is going to be embedded in all the business processes, which is why they are running multiple blockchain and traceability pilots. At the base of this lies access to and collaboration on farm data, the creation of data standards and APIs.

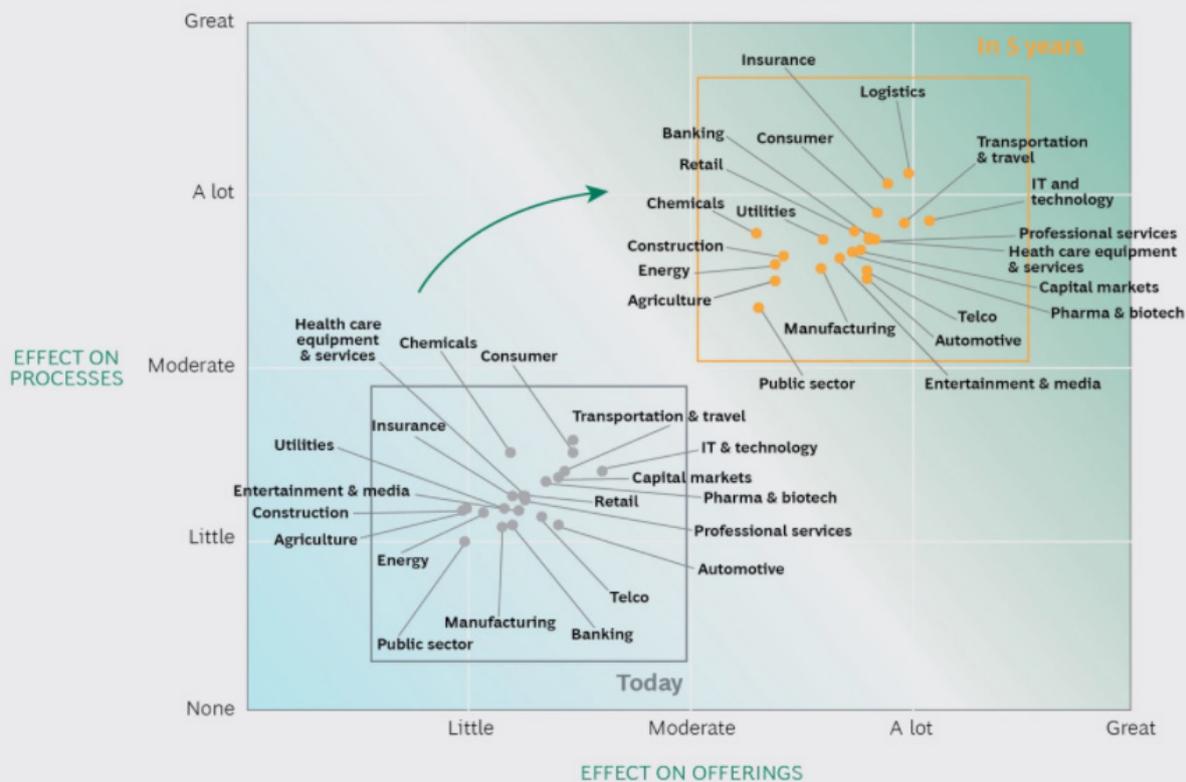
These are trends that will be replicated across all industrial sectors. See BCG - MIT Sloan School Research chart below from their recent publication "Is your business ready for AI?" , which was the result of interviews with 3000 executives across industries and geographies. Today only one in five companies has an articulated AI strategy and only one in twenty has any extensive use of AI in its product and service offering. The chart below indicates that this situation will change dramatically over the next five or so years as investment scales and the race to achieve competitive advantage ensues. Even agriculture, which ranks relatively low compared to other sectors is forecast to experience both rapid changes on both processes within the industry and product offerings and services made.



EXHIBIT 1 | Expectations Run High for AI's Effect on Business Across Industries



WHAT EFFECT WILL THE ADOPTION OF AI HAVE ON YOUR ORGANIZATION'S OFFERINGS AND PROCESSES TODAY AND IN FIVE YEARS?

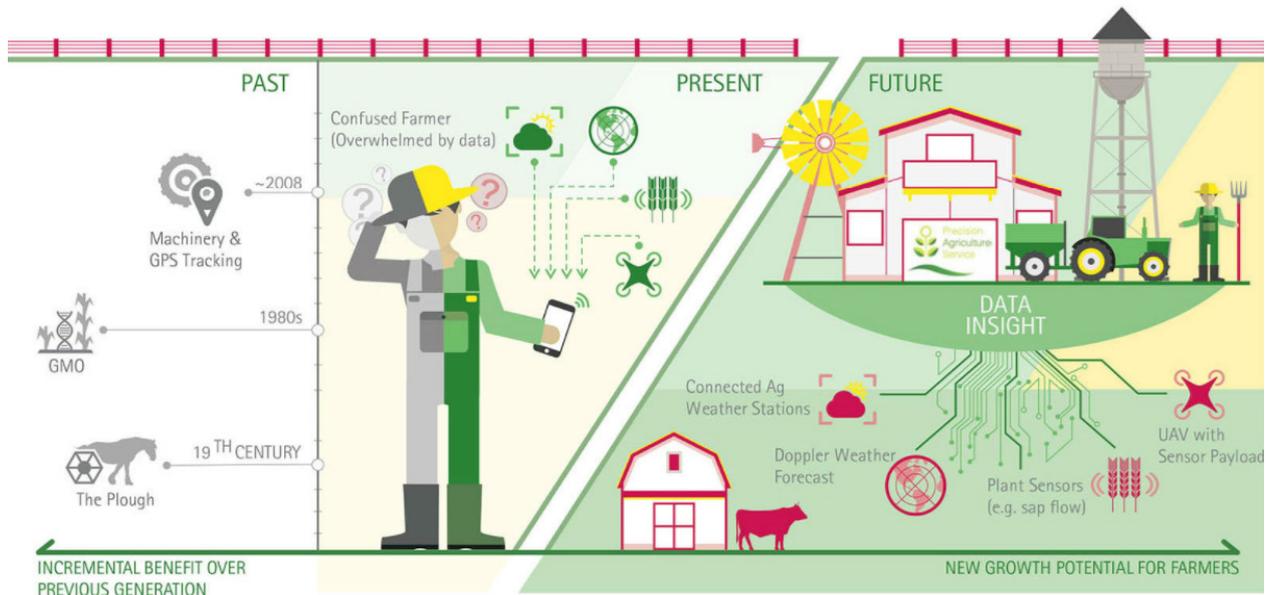


Source: Joint BCG-MIT Sloan Management Review survey on the impact of artificial intelligence on business, 2017.
 Note: Average of all respondents per industry, based on a five-point scale.

A recent report by Vanson Bourne titled “The Future of IoT in Enterprise” interviewed more than 100 agritech businesses. 62% already claimed to be deploying Internet Of Things (big data / AI) type products with another 27% planning to do so within the next 12 months. Over the next five years the R&D spend on this area is indicated to rise from 5-12% of annual cost budget.

AgFunder reported that global agtech investment in precision systems reached USD 3.2 bn in 2016. The trend looks set to accelerate further as more sensing technology and algorithm driven decision making tools are applied to livestock industry, high value horticulture and tropical agriculture. We suspect that these figures are under-estimated because it is hard to capture investments being made in “non ag” technology companies that are entering the market. Hitachi from Japan which is working on robotics in small tractors, pest and disease monitoring technologies for glass house growing systems and is quietly seeking to buy early stage agtech companies with specific

A good representation of how these trends will come together and what it means for farmers is given in the graphic below from an Accenture Report: Digital Agriculture Improving Profitability. In order for big farm data to become effective and broadly used, farmers have to move from a position of being swamped by multiple streams of disaggregated data to a situation where data collection is automated, integrated and analysed using AI tools to enhance critical decision making processes in all aspects of their business from production to marketing and traceability.



These trends appear to be irreversible and accelerating.

Ten years ago it would have been difficult to foresee the impact that the introduction of smartphones and android systems would have globally on every sector, company and how competitive advantage is defined. The speed at which, not only companies like Google, Facebook and Amazon have grown and created platform monopolies (ex China) but also companies such as Airbnb, Uber, etc. have changed the rules of competition is almost impossible to predict.

Applying this analogy to agtech today it is equally difficult to predict what technologies, companies and platforms will be successful and dominate sectors and niches in the next decade.

However we will predict that in agriculture:

1. Big data, sensing/ monitoring, AI and applications like blockchain will grow exponentially
2. There will be agtech companies unknown today, that will have developed new technologies and platforms that will dominate their selected niches
3. That the issues surrounding access to, use of and sharing value from farm level data will persist. The winning companies and platform are likely to be the ones who have most successfully built business models that incentivise farmers to share data and that build trust.

Implications for AHDB

Given AHDB's mission within UK agriculture it has a critical role to play in helping facilitate the transition to digitally driven platforms. Virtually every innovation is predicated on farmers being willing to make their data available and being treated equitably for doing so.

We believe that an independent farmer funded organisation would be best positioned to fill this void. AHDB is best placed to do so and should focus its digital strategy on becoming the organisation that facilitates access to UK farm data at the centre of a UK ag data ecosystem.

AHDB's mission should be to create the conditions that allow farm data to flow, innovation to happen and farmers be treated fairly. It should also identify the critical problems and issues that need to be solved and to build the collaborative partnerships and data sharing standards that needs to be executed.

Farmers need to feel safe making their data available so that business and institutions can access it in an efficient and equitable manner in order to create products and services that solve real

problems to benefit the farmer.

This will probably require a substantial shift in culture and organisation over the coming years and the development of new skills and capabilities, to compliment the deep industry knowledge and networks that already exist within the organisation.

Risks for AHDB of working with big data, AI and related technologies

Given the trends apparent and confirmed in this research the biggest risk to AHDB is in not working with big data, AI and related technologies. Lack of engagement will almost certainly lead to redundancy and irrelevance.

The biggest risks we can identify for AHDB working with big data and AI are:

1. Over stretch - attempting too many things in too many sectors simultaneously.
2. Losing focus on what really delivers value to farmers and levy payers in big data / AI.
3. Making big bets - taking on tasks beyond existing capabilities, picking technologies, etc.
4. Competing in overlapping areas of digital infrastructure or app development (not clearly defining the collaboration with Ag Innovation Centres and other partners).
5. Not being disciplined in ruthlessly screening projects to assess value add, practicality and ease to deliver to levy payers.
6. Not evolving the organisation and its human capital to digital strategy selected.



Collaboration with G10

Generation 10 would be honoured to collaborate further with AHDB in a number of the detailed project streams identified.



generation10

Improve internal AHDB data collection, processing and publishing capabilities

G10's experience and track record in this field is a core area of expertise. It was identified as the most likely area of initial collaboration during our initial meetings in April.

E-livestock and grain passporting and AHDB Industry Blockchain Pilots

G10's track record in creating data standards and linking APIs in commodity supply chains and building smart apps for supply chain traceability is suited to the development and deployment of these project areas.

Formalize Project Screening and Development Process

Assist with the development of the screening process of pilots, projects and offer guidance on the priorities/deliverability balance.

Develop the Farmers First For Farm Data

Principles & Prototype Rating Tool.

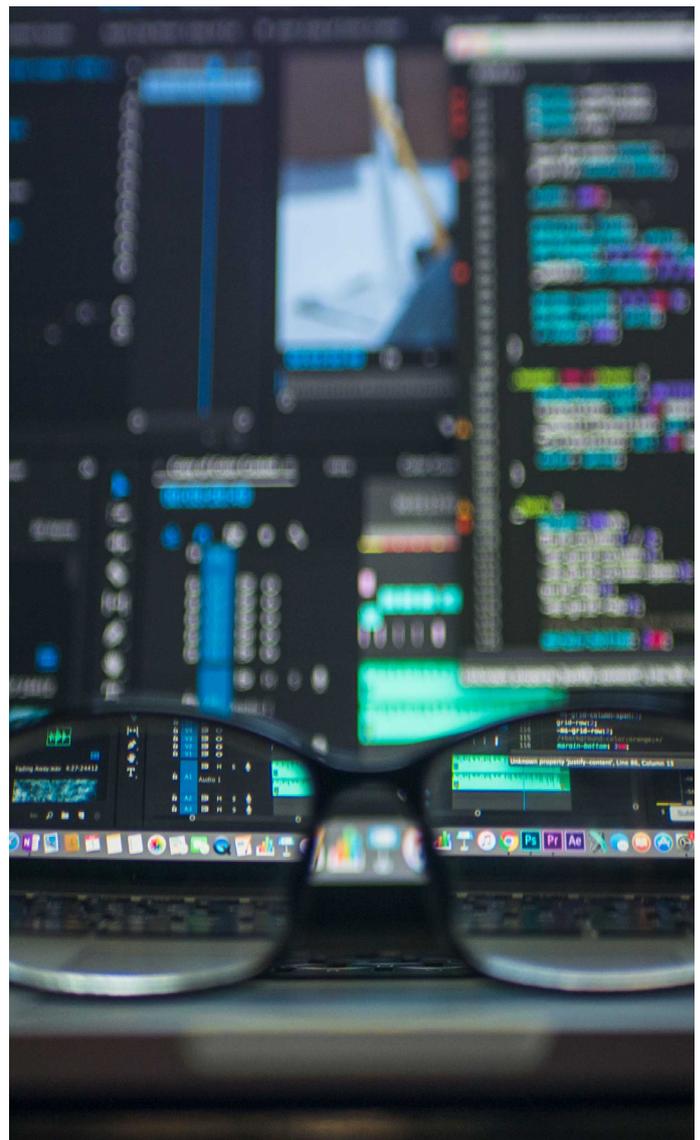
Assist with the development of both the data principles and creating a prototype rating tool with test cases to be piloted. We have experience in creating data principles for farm data sharing with farm data and commodity supply chains.

“Farming Digital Divide” Thought Leadership”

Assist with a detailed action plan to position AHDB in this subject matter.

Natural Capital/Climate change project scoping (BEIS and DEFRA)

We would deploy our experience in structuring these complex projects with multiple data streams in order to refine and scope an initial project proposal.



Appendices

Appendix 1 Big Data Apps

<p>AGCO's Agcommand</p>	<p>This is a proprietary platform - helps minimise downtime and run operations more efficiently.</p> <p>Features include:</p> <ul style="list-style-type: none"> - Vehicle and engine information determines when machines are idle, stopped or in need of service - Identify problems with real-time alerts - Prioritised notifications - Improve overall machine health, value and eliminate guess work - Enhance fleet security and reduce theft - Coverage where needed - Fully accessible via web browser <p>AgCommand tool can provide intelligence to improve performance, logistics, uptime and efficiency in the machine</p>
<p>John Deere's Farmsight</p>	<p>Enables individual remote monitoring of machines to ensure preventive maintenance, optimal fuel consumption and output performance. This also gives detailed information about agriculture for better decision making.</p> <p>Machines are fitted with JDLink wireless technology which are online at all times and can be monitored remotely using a computer device or smartphone. This allows the user to control the machine from any location, and provides information on the machine's location, instrumentation and control systems.</p>
<p>Monsanto's FieldScripts</p>	<p>Designed to boost on-farm productivity with more sustainable agriculture systems. The farmer will provide certain inputs, such as field boundaries, yield data and fertility test results to their seed dealer.</p> <p>The exclusive data analysis has been developed to examine soil, environmental parameters and others, to create management zone recommendations. Using the seed-by-environment data, the company will deliver a variable rate seeding prescription by yield management zone and recommend the best hybrid for each field.</p>

Open Application Programming Interfaces (API's)	This is a publicly available application programming interface with a set of definitions, protocols and tools for building application software. Created to make it easier for developers to use certain technologies in building applications, whilst simplifying programming.
Open Standards ISOBUS (International Standardization Organisation Binary Unit System)	<p>Allows customers to use one display that works with different tractors and implements. The first worldwide standard for dated communication between tractors, displays, implements and farm management software.</p> <p>For manufacturers that use their own proprietary solutions, can now use a plug and play solution instead of using a special adaption for every combination of tractor and implement.</p>
Farmobile - Passive uplink communicator PUC	<p>Farmobile connects to equipment systems through a diagnostic cord. An antenna sends data out, so someone can follow along in real time with planting or harvest progress. Aims to collect data for farmers which is short and simple to setup and easy to use.</p> <p>Brings together a complete electronic field record of the commodity variety, population, planting date, harvest date, total production, average yield and average moisture. Can track data for corn, soybeans, sugar beets, potatoes, wheat and other crops.</p>
IsoBlue project	This acquires data through the development of an open-source hardware platform and software libraries to forward ISOBUS messages to the cloud and develop smartphone applications. http://www.isoblue.org/
Open Ag Toolkit (OpenATK)	<p>Makes it easier to manage farms by improving the way farmers are able to collect and used data. OpenATK is a simple open-source mobile app that can sync across everyone in a farm though existing cloud services.</p> <p>Gives the ability to manage agriculture, track progress, plan fall tillage, decide which fields to spray first, etc. The aim is for the software to adapt to each farm.</p>
Trello	An internet based cloud storage that shares data between workers. Shows what is in progress, who is working on what and where.

FIWARE	An independent open community, which provides a simple set of APIs that make developing smart applications easier.
FIWARE acceleration programme	Promotes the take up of FIWARE technologies. Their aim is to boost new and promising FIWARE ideas, products or services through funding, mentoring, training and networking.
Smart AgriFood	Aims to boost the application and use of future internet ICTs in the agri-food domain. Will increase the competitiveness of the European agri-food domain. Will affect a number of SMEs in the agri-food domain throughout Europe.
Flspace project	<p>Business-to-business collaboration platform that works like a social network. Aims to develop and validate novel future-internet-enabled solutions, by exploiting, incorporating and validating the GEs. It is simple, secure and easy, and can:</p> <ul style="list-style-type: none"> - Get in contact with partners, collaborators, suppliers and others - Negotiate collaborations - Detail contracts - Exchange data - Manage intercompany business processes - Deliver and use value-added services - Avoid cumbersome and tedious e-mail exchanges
The Securities Exchange Commission (SEC)	Using big data to monitor financial market activity for banking and securities. Using network analytics and natural language processors to catch illegal trading activity in the financial market.

Appendix 2 Agricultural Tech Startups

<p>AgFunder - farm technology startups</p>	<p>Subset of Agrifood tech market - raised \$1.13 billion (56% increase)</p> <ul style="list-style-type: none"> - Ag biotechnology - on-farm inputs for crop and animal af including genetics, microbiome, breeding, animal health. - Farm Management software, sensing and IoT - Ag data capturing devices decision support software, big data analytics - Robotics, Mechanisation and equipment - on-farm machinery, automation, drone manufacturers, grow equipment - Novel Farming Systems - indoor farms, aquaculture, insect, algae and microbe production - Agribusiness marketplaces - commodities trading platforms, online input procurement, equipment leasing used by farmers - Bioenergy and biomaterials - on-farm ag waste processing, biomaterials production, anaerobic digesters - Farm to consumer eCommerce - online platforms for farmers to sell and deliver their produce direct to consumers
<p>Farmers Business Network (FBN)</p>	<ul style="list-style-type: none"> ● One of agtechs earlier and best funded startups ● Recently changed main business model to an online marketplace ● Helps farmers produce chemicals at cheaper, more transparent prices ● Provides potential new customers ● Roughly 3500 farms in US ● Agronomic Intelligence - access farming's most advanced analytics driven by the combined intelligence of millions of acres ● Smarter buying - FBN Directs manufacturer - direct input prices and radical price transparency to drive thousands of dollars ● Profitable marketing - new opportunities to sell your crop
<p>Monsanto Growth Ventures</p>	<ul style="list-style-type: none"> -Invested \$6.5 million -400+ facilities in over 60 countries -Worlds largest plant breeding and field testing research pipeline -17+ Billion invested in R&D annually -Supports a robust Venture Scholar Program, which: <ul style="list-style-type: none"> ● Helps capitalise on new talent ● Develops the next generation of agriculture technology leaders ● Learn about venture capital; industry ● Study latest agricultural innovations ● Learn skill set to start up business ● Assist in scouting new investment opportunities ● Managing an active portfolio

<p>Cultivian Sandbox</p>	<ul style="list-style-type: none"> -One of agtech's first venture capital funds -backed equipment leasing platform HarvestPort in its \$4.25 million Series A -Invested in Cultivian Ventures - first funded and leading food and agriculture focused venture fund in the US. -Have invested in 20 companies -Help build next-generation food and agriculture technology companies -driven by demographics, globalization, sustainability pressures, new energy sources and concerns about foods safety and security. -investing in innovative food and agriculture technology companies who are commercialising the necessary solutions and actively collaborating with strategic partners -aim to improve animal health and protein production, crop production, food technology and safety, sustainability and water technology. -crop production: <ul style="list-style-type: none"> • Seed technology and genetics • Fertilisers and crop protection • Robotics and automation • Precision agriculture -invest \$5-15 million each portfolio company over the lifetime of the investment -will invest in seed through late stage companies -prefer to lead new investments and often syndicate with other
<p>Calysta</p>	<ul style="list-style-type: none"> -creating future fit food, high value fish, livestock, and pet nutritional products to improve global food sustainability and security. -creating new pathways to sustainable food using novel biological processes -converts low cost methane into high value products - Calysta's technology enables the low-cost, small scale conversion method without the need for expensive upgrading steps, while simultaneously producing a high-quality, sustainable animal feed component. -FeedKind protein - sustainable substitute for fishmeal and soy protein concentrate -contributes to growth of the aquaculture industry -benefits: <ul style="list-style-type: none"> • Low ecological impact • No demand on wild caught fisheries • No agricultural land use • Low water consumption • No pesticide or fertiliser use • No competition with resources needed for human food • Additive to human food chain • Reduces greenhouse gas emissions -technology improves utility of current products

<p>AGERpoint</p>	<ul style="list-style-type: none"> -produces nut and citrus orchard management software using satellite data -builds precision LiDAR systems -designs applications which helps growers understand what their crops need -tools provide detailed information for growers to make correct decisions -product offers: <ul style="list-style-type: none"> • Management support for plant stock, fields, harvests and labour • Maps features of growers plank stock <ul style="list-style-type: none"> □ Precision location within 1cm □ Height □ Trunk diameter □ Canopy size □ Canopy density
<p>Mavrx</p>	<ul style="list-style-type: none"> • Allows farmers visualise their entire fields in an instant • Highlight areas that need more care • benchmarking crop performance • Automated crop health alerts that guide your scouts and quantify what's at risk • Monitor applications with pre and post treatment surveys • Identify field deficiencies caused by uncontrollable factors • Direct lab integrations to get results fast and increase turnaround time • Prioritise fields needing work



Climate FieldView

The FieldView Drive is a hardware device that can be plugged into equipment, capturing both machine and field data. It can connect to an iPad via Bluetooth, monitoring and displaying data wirelessly. FieldView visualises data ar planting, sprayer and yield maps all through the year side by side. Yield can be analysed by hybrid, soil type, or field. A crop performance report can be generated on a tablet to determine how different agronomic practices impact yield.

Benefits:

- Collects and analyses field data
- Makes data driven decisions to maximise your return.
- Measures performance
- Connects in real time
- Can upload historical data
- Can share critical information with partners
- Monitors progress
- Compare maps side by side
- Prioritise scouting activities
- Clear field insights

Data in one place

Makes field data management simple. Collect, store and view data in one digital platform that can be accessed anywhere.

Data connectivity - stream directly from your equipment, manually upload historical data or easily transfer from another system

Data visualisation - see harvest, planting and sprayer maps build in real time. Finds equipment issues in the field and addresses problems.

Uncover valuable insights

Imagery and performance analysis tools to uncover insights from your unique field data.

Crop performance analysis - analyse performance by soil type, field and field regions so best seed can be chosen for next season. Compare maps side by side to see field variability.

Field health imagery - consistent high quality field satellite imagery to identify issues early and protect yield. See fields with imagery that can help identify issues early and prioritise scouting.

Optimise your inputs

Manage variability and maximise yield by building a customised plan for each field, using variable rate planting prescriptions and nitrogen monitoring tools.

Variable rate seeding - saves time and improves productivity by using historical field data and proprietary field testing results. Generate planting scripts tailored to unique yield or profit goals, and customise to preference.

Nitrogen monitoring - tools to help monitor available nitrogen in the field to take action and prevent yield loss. Monitor using customisable zones, spot potential shortfalls and easily edit.

Company name	Person	Company name	Person
AHDB	Diane Prescott	CHAPS	Chetan Parmar
AHDB	Tom Hind	GS	Jacob Kirwan
AHDB	Phil Bicknell	Haygrove Soft Fruit	Angus Davison & James Waltham
AHDB	Dhan Bhandari	NFU	Helen Ferrier
AHDB	Bill Parker	Agrimetric	Dave Flanders
AHDB	Martin Grant-ley-Smith	CIEL	Mark Young
AHDB	Jane King	DEFRA	Tim Mordant
AHDB	Chris Gooderham	Velcourt	Keith Norman / Jason Scott
AHDB	Richard Laverick	Sainburys	Beth Hart
AHDB	Matt Catlin	Savills	Phil Gredy
AHDB	Simon Oxley	Food Lawyer	William Neville
AHDB	Steve Tones	DEFRA	Steve Williams
AHDB	Jo Tuck	NFU	Minette Batters
AHDB	Mick Sloyan	FARMERS	10-15 Levy Payers
AHDB	Rob Clayton	MIT	Andrew McAf
AHDB	Mick Brown		

AHDB Questions

How important is AI, Blockchain and Big Data in AHDB?

How is this impacting your daily business line now(next two years) and in the mode to longer term?

How prepared are AHDB for this challenge?

How prepare are the levy payers to understand & respond?

What are Levy payers' views on AHDB?

If one thing needed to be done to advance AHDB, what would it be?

How is your relationship with government centres for agriculture (DEFRA, AGRIMETRICS)?

How do you currently communicate with Levy payers?

What is your current digital strategy?

What is your current data landscape e.g. how do you collect and aggregate data?

We like the 'Strategic Farms' initiative, how is it progressing so far?

Another initiative is 'FARMBENCH', how easy is it for farmers to sign up?

Industry Questions

How important do you think big data and AI in U.K. agriculture today?

How prepared is your business for big data and AI?

Where do you see it having the greatest impact in your business and in your supply chain?

Do you currently have access to or manage large volumes of data?

Who owns the data and how are data privacy issues managed?

How prepared do you feel that UK farmers and food businesses for the challenges of big data and AI?

Do you identify an issue of mistrust of how far level data is used within the farming industry?

How important is this issue to resolve and manage? Is it a bottleneck in developing products and services for farmers and the supply chain?

How do you view the opportunities and challenges provided by technologies such as blockchain?

Are you taking part in blockchain pilots if so how and with what expectation?

What is your experience of working with AHDB on collaborative projects?

In what ways do you think AHDB could improve its performance to the levy payers and create pre-competitive collaboration?

Is your organisation open to pre-competitive collaboration and what type of projects would be of interest?

Can you cite examples of world class / market leading innovation in ag big data and or AI?

What is distinctive about this?

Do you think UK farming and the food industry would benefit from data principles governing data sharing that protects the farmers farm data interests?

What type of organisation would be best suited to playing this role?

Could AHDB because of its independence and farm levy payer position fill this role?

If there was one thing that your business should focus on big data and AI over the next 5 years what would that be?

How important will big data, AI and blockchain be in UK agriculture be by 2025?

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AHDB's role in shaping the future



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