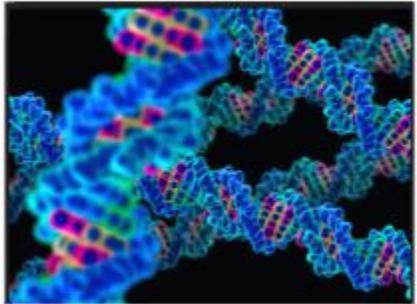


Welcome to



RESEARCH
ADVANCED BREEDING
FOOD FUTURES
TRAINING



“Policy & Regulation for Livestock Agri-Tech”

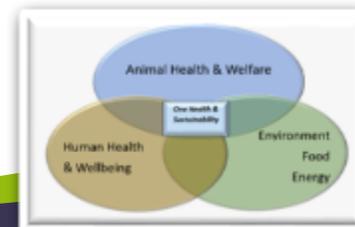
Jonathan Statham MA VetMB DCHP FRCVS

RCVS Diplomate & Recognised Specialist in Cattle Health & Production

Chief Executive RAFT Solutions Ltd & Chair Bishopton Veterinary Group

Professor of Sustainable Livestock Health & Welfare HKVS

www.raftsolutions.co.uk



Why do we need regulation anyway?



'The Custard Test'





Policy & Regulation for Livestock Agri-Tech

1. Introduction
2. Overcoming regulatory challenges for emerging technologies
 - Need for government
 - Smarter regulation
3. Policy frameworks for sustainable innovation
 - Crossing the 'valley of death'
 - Investing in Innovation

AI(Live)

HOME WHAT IS AI(Live)? AGENDA SPEAKERS REGISTRATION

14:50 – 15:30:
Policy and Regulation for Livestock AgriTech

- Overcoming regulatory challenges for emerging technologies.
- Policy frameworks for sustainable innovation.
- **Speaker: Jonathan Statham** – Chair Animal Health and Welfare Board for England

RAFT Solutions Ltd

[Not government policy]

Veterinary Sector Roles

RCVS Diplomate in Cattle Health & Production
RCVS Recognised Specialist in Cattle Health & Production



Animal Health and Welfare
Board for England

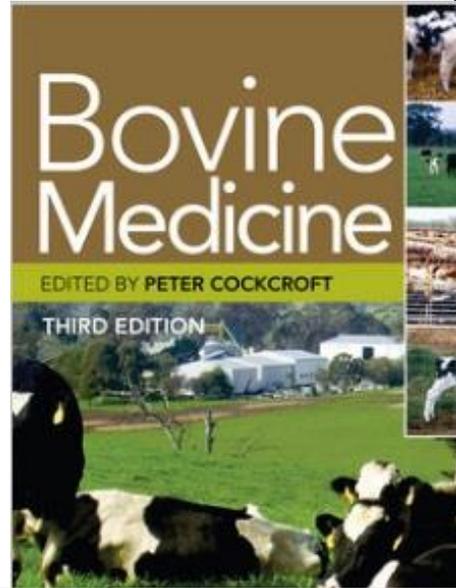
AHWBE-Chair
VMD-VPC Expert Committee
GB Ruminant H & W Group

BCVA- Past President

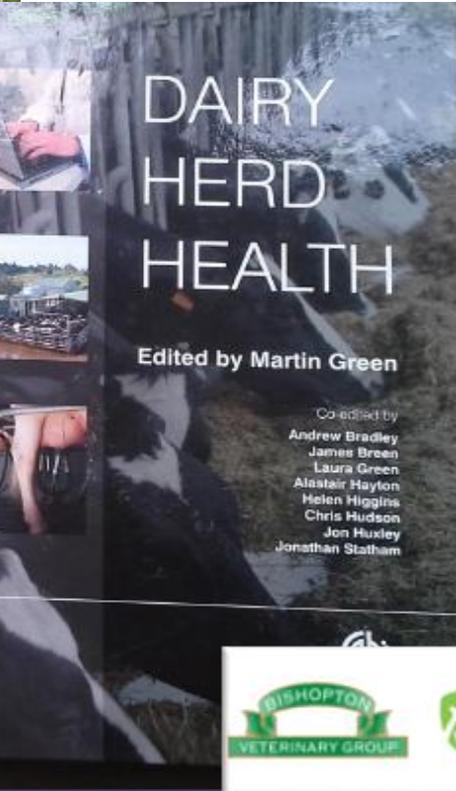


BCVA Congress 2013
Congress Programme

17th – 19th October 2013
The Majestic Hotel, Ripon Road, Harrogate, North Yorkshire, HG1 2HU



Animal Health and Welfare: Protecting and improving our reputation
The Animal Health and Welfare Pathway



in Practice was published as 10.1136/inp.1195 on 12 January 2017. Downloaded from http://inpractice.bmj.com/ on December 7, 2019 at ProQuest Learning Group/Edward Elgar Publishing. doi: 10.1136/inp.1195



Jonathan Statham MA VetMB DCHP FRCVS
RCVS Diplomat & Recognised Specialist in Cattle Health & Production
Chair Bishopton Veterinary Group
Chief Executive RAFT Solutions Ltd
Professor of Sustainable Livestock Health & Welfare
Chair Animal Health & Welfare Board for England

Bishopton Veterinary Group Founded 1943-Ripon, N. Yorks



Today's Practice was first founded by Ronald Wood in 1943.
The premises at the time were in Caxton Lodge
on North Street in Ripon.
Ronald was joined by Philip Blackburn in 1950,
followed by Neil Spedding in 1966.



Space at Caxton Lodge was limited, with the Practice occupying a room in the cellar, an outbuilding, a tiny office and a small room in which the dispensary was housed. Mr Spedding recalls that the dispensary worktops doubled up as operating tables used to carry out cat spays (prior to Neil's arrival, these surgical operations had to be referred to a Practice in Harrogate). A local GP and his young family owned and lived in Caxton Lodge but as the Practice grew, so too did the noise levels of cats and dogs receiving treatment - something which did not go down well with the residents. For this reason, no animal could be kept in overnight and alternative premises had to be sought.

What is RAFT?

Research

Advanced breeding

Food futures

Training



“Agri-tech & bio-tech Innovation in Sustainable Livestock Food”

RAFT established in October 2010

Developed by Bishopton Vet Group



www.raftsolutions.co.uk

What we do



RAFT, Bishopton Veterinary Group & XL Vets



RAFT & Harper & Keele Veterinary School: InSHAW



Innovation in sustainable livestock food production

Harper & Keele
VETERINARY SCHOOL

InSHAW
Institute for sustainable livestock health and welfare

ision Our Approach Key Areas Get Involved



Institute for Sustainable livestock Health and Welfare

IN ASSOCIATION WITH






IN ASSOCIATION WITH






MISSION STATEMENT

We aim to promote and develop sustainable livestock health and welfare and the central role of vets in delivering these goals to promote a balance across four Key Areas:



Food Security



Animal Health and Welfare



Environmental Management



One Health and Antimicrobial Resistance (AMR)



Approach

OUR APPROACH

We aim to deliver our mission through an Interdisciplinary Approach working across three main streams with inclusive collaborations:

Global Organisations & Networks



Animal Health and Welfare Board England (AHWBE)

AHWBE Strategy

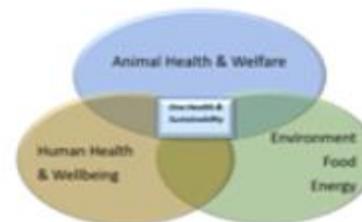


Animal Health and Welfare Board England (AHWBE)

AHWBE Vision & Strategy Autumn 2022

VISION

1. Leading thinking on a new, inclusive cross-cutting 'One Health' balance that champions evidenced high standards of animal health, welfare and sustainable productivity across government and wider society.



STRATEGY [TACTICS]

1. Support government development and signposting of a sound evidence base to measure and manage balanced animal health, welfare and sustainable productivity, within a wider 'One Health' approach for society over the next three to five years.

Policy paper

Government food strategy

Published 13 June 2022

International trade

[listening to consumers and markets to foster global markets and manage trade risks at borders using EID & LQ]

6. Manage conflicts and threats to the vision of achieving the One Health & sustainability balance through Animal Health & Welfare through providing a forum for leading consensus.

Board members

Non-executive directors

- Jonathan Statham (chair)
- Charlotte Commins
- Gwyn Jones
- Peter Laurie
- James Russell
- Julia Wrathall

Executive directors

- Pamela Thompson-Director
- Christine Middlemiss-CVO
- Richard Lewis-CEO APHA
- Ele Brown-DCVO
- Emily Cattell-DD Evidencing and Analysis

Secretariat team: Julie Fitton and team

Reporting to Defra Ministers

Baroness Hayman and Angela Eagle



Department
for Environment
Food & Rural Affairs



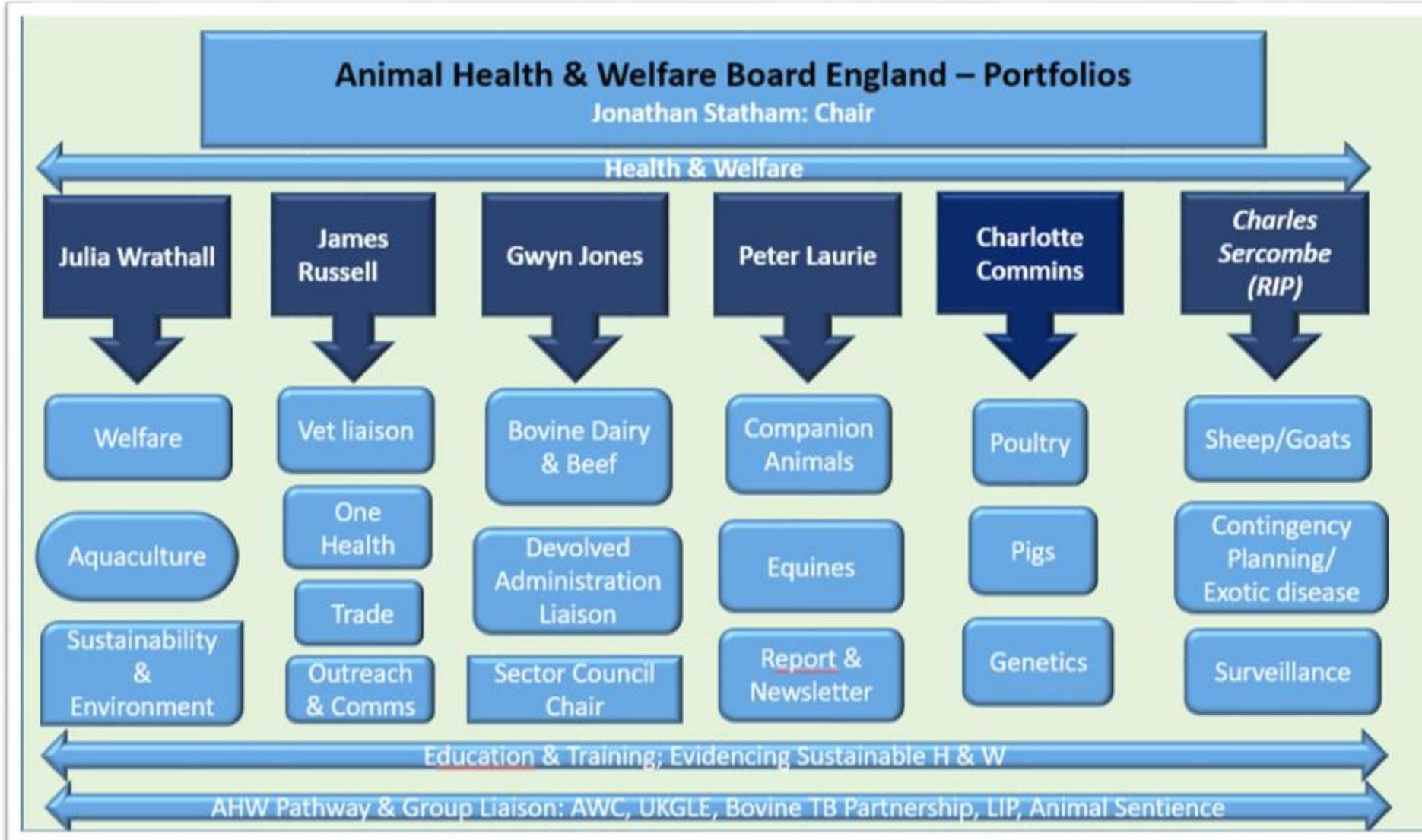
Purpose of the Board

Purpose:



Department
for Environment
Food & Rural Affairs

- To provide support, advice and constructive challenge in the development and implementation of animal health and welfare strategy and policy.
- To provide leadership, championing the ethos of partnership working between industry, animal keeping sectors and Government.
- To encourage and enable action by *all animal keepers* at individual and sectoral level to minimise threats to animal and public health and animal welfare, whilst maintaining competitiveness.
- To work collaboratively with policy teams across the Defra Group to achieve this.



Animal Health and Welfare Board England (AHWBE)

Autumn Strategy: 6 points

1. Support government development and signposting of a ***sound evidence base*** to measure and manage balanced animal health, welfare and ***sustainable productivity*** within a wider 'One Health' approach for society over the next three to five years.
2. Support government to deliver a new cross-cutting agenda by ***building connections*** to achieve a resilient balance between animal health & welfare, the environment, human health & food security.
3. Control or eradicate ***key endemic, exotic and zoonotic disease*** of kept animals



Department
for Environment
Food & Rural Affairs



4. Improve ***education/KE/Skills*** of all animal keepers/stakeholders
5. Promote the ***traceability & authentication of biosecure food*** and all kept animals in ***international trade***
6. Manage conflicts and threats to the vision of achieving the One Health & sustainability balance through Animal Health & Welfare through providing a ***forum for leading consensus***.

*Animal Health and Welfare: Protecting and improving
our reputation*

The Animal Health and Welfare Pathway



Department
for Environment
Food & Rural Affairs

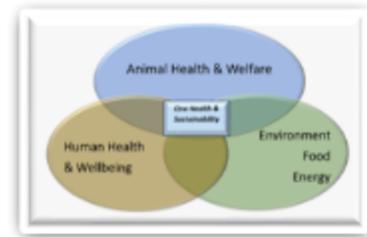


Policy & Regulation for Livestock Agri-Tech

1. Introduction
2. Overcoming regulatory challenges for emerging technologies
 - Need for government
 - Smarter regulation
3. Policy frameworks for sustainable innovation
 - Crossing the 'valley of death'
 - Investing in Innovation



The screenshot shows the AI(Live) website agenda. At the top is the AI(Live) logo, which features a stylized cow head made of a network of nodes and lines. Below the logo is a navigation bar with five items: HOME, WHAT IS AI(Live)?, AGENDA, SPEAKERS, and REGISTRATION. The AGENDA section is highlighted. Under the heading "14:50 – 15:30:", the topic "Policy and Regulation for Livestock AgriTech" is listed. Below this, three bullet points describe the session: "Overcoming regulatory challenges for emerging technologies.", "Policy frameworks for sustainable innovation.", and "Speaker: Jonathan Statham – Chair Animal Health and Welfare Board for England". A small logo for "Blue Farm/Innovate" is visible in the bottom left corner of the screenshot.



are and [Department for Science, Innovation and](#)



nding and sustainable One Health collabora used. The OIE has participated in the V (COVID-19) and OIE experts have supported development activities.

orative research activities, the animal he ng a common response to the pandemic t to support the work of human health imal health laboratories, through donat d ventilators, or through direct provision greatly contributed to support the inter e examples



Overcoming regulatory challenges for emerging technologies

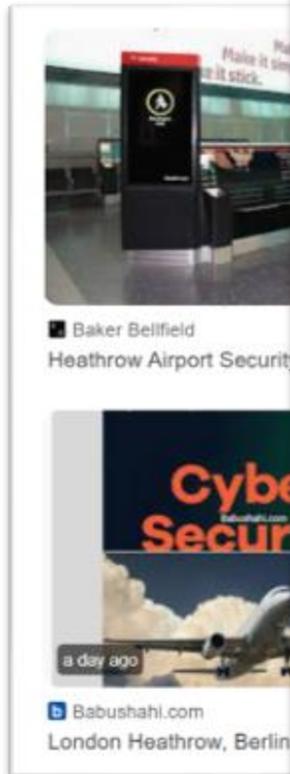
A need for government

Smarter regulation



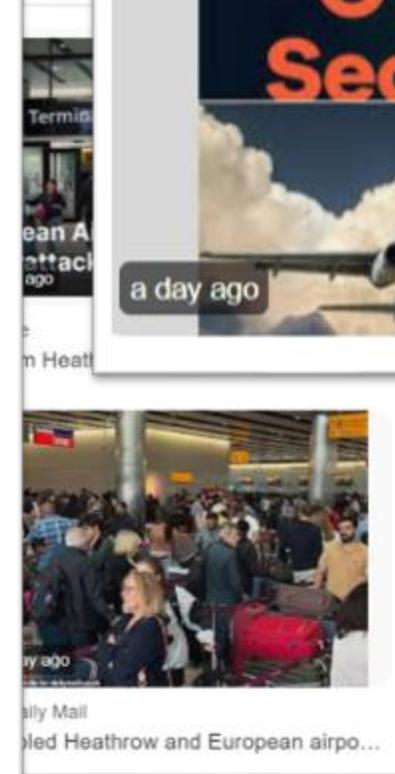
- National Security/Cyber security
- Food
- Energy
- One Health
- Precision breeding GE
- Veterinary medicines
- Net zero & environment

Cyber security-airport systems



High-level themes (why regulation matters)

- **Animal welfare & ethics** — tech must meet legal/ethical standards for humane treatment (housing, handling, painful procedures).
- **Biosecurity & disease control** — devices and practices that affect pathogen transmission (e.g., automated feeders, sensors, transport tech) are subject to strict rules and reporting.
- **Food safety & traceability** — provenance systems (RFID, blockchain) must integrate with food safety regimes and official identifiers.
- **Veterinary medicines & inputs** — drugs, vaccines, probiotics, and some feed additives require approvals and prescription controls.
- **Genetics & biotech** — gene editing, cloning, and transgenic animals hit the most regulatory scrutiny and often special permitting.
- **Environmental compliance** — nutrient management, emissions (GHG, ammonia), waste and water use are regulated and may drive technology adoption.
- **Data governance & privacy** — who owns sensor/animal data, consent, allowed uses, and cross-border transfer rules.
- **AI/automation liability & safety** — automated decision systems (feeding, culling, breeding decisions) raise questions about accountability and standards.
- **Cybersecurity & critical infra** — connected systems controlling gates, pumps, medications need resilience and compliance with industry standards.



A Government ban...unwanted regulation..



BBC

Nepal parliament set on fire after PM ...



YouTube

Nepal's prime minister resigns after ...



... BBC

Nepal: Army patrols Kathmandu as Gen Z...



... BBC

Social media ban lifted after 19 killed ...

Regulation for consumers and public good?



Lack of regulation...corporate responsibility?



rogue trader Nick Leeson ...



Financial markets & FinTech

The image displays a grid of ten social media posts, each featuring a different image or video thumbnail related to Nick Leeson and the Barings Bank collapse. The posts are arranged in two rows of five. Each post includes a source icon, the source name, and a truncated title.

- Post 1:** The Guardian. Title: Barings Bank goes bust. Thumbnail: Newspaper front page with the headline.
- Post 2:** Mint. Title: Nick Leeson, who brought down Ba... Thumbnail: Nick Leeson in a suit.
- Post 3:** Bloomberg.com. Title: Nick Leeson, Former Rogue ... Thumbnail: Nick Leeson in a white shirt.
- Post 4:** Nick Leeson. Title: Nick Leeson Biograph... Thumbnail: TIME magazine cover featuring Nick Leeson and the text 'EGO & GREED'.
- Post 5:** CMI. Title: Nick Leeson: Poor Management C... Thumbnail: Nick Leeson speaking at a podium.
- Post 6:** Front Row Speakers. Title: Nick Leeson | Front Ro... Thumbnail: Nick Leeson speaking at a podium.
- Post 7:** The Guardian. Title: rogue trader Nick Leeson broke the ba... Thumbnail: Nick Leeson in a blue shirt.
- Post 8:** Forex Club. Title: Nick Leeson - o corretor que derrubo... Thumbnail: Nick Leeson in a yellow and black striped shirt with the text 'ROGUE TRADER' overlaid.
- Post 9:** Thinking Heads. Title: Nick Leeson - Thin... Thumbnail: Nick Leeson speaking at a podium.
- Post 10:** InfoMoney. Title: O colapso do Barings Bank 25 anos ... Thumbnail: Nick Leeson in a yellow and black striped shirt with the text 'EGO & GREED' overlaid.

Financial crash 2008-sub-prime mortgages

Bertonomics - WordPress.com
Sub-Prime Mortgage Crisis – Bertono...

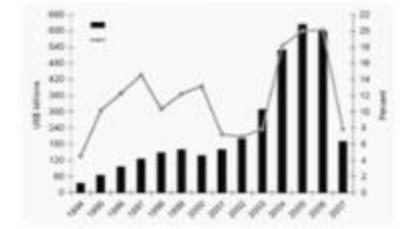
The Adventures of Acco...
The Credit Crisis, Illust...

getmoneyrich
Subprime Mortgage Crisis: The Cause...

BBC
uk_us_share_index_786.gif

Stephen Hicks
Subprime mortgag...

Corporate Finance Institute
Lehman Brothers - Overview, Histor...



ResearchGate
subprime mortgage lending volumes ...

Michael Roberts Blog - WordPress.com

StreetFins

International Monetary ...

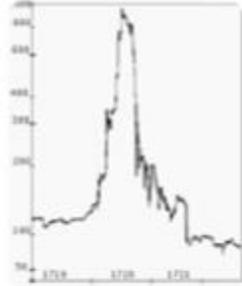
Wikipedia, the free encyclopedia

Reddit

History –South Sea Bubble-Isaac Newton 1720



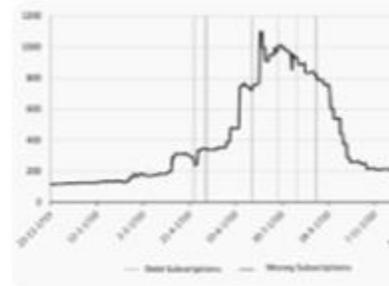
Historic UK
The South Sea Bubble of 1720



Wikipedia, the free ...
South Sea Compa...



en.wikipedia.org
The South Sea Bubble - Wikipedia



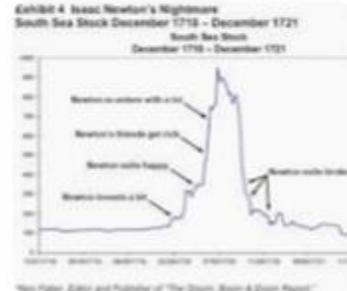
Economic History Society
The South Sea Bubble 300 Years ...



InvoiceInsure - simple and affordabl...
South Sea Bubble ...



Harvard Business School
The South Sea Bubble, 1720 ...



The Fifth Person
Newton's South Sea Bubble ...



Tate
The South Sea Bubble, a Scene i...



The Telegraph
How (not) to invest like Sir Isaac Newton



Historic UK
The South Sea Bu...

Technology & information...trust

The image displays a grid of 10 news thumbnails, each featuring the Cambridge Analytica logo (a brain with a network of nodes) and a headline. The thumbnails are arranged in two rows of five. The first row includes thumbnails from Wikipedia, Financial Times, The Conversation, The Guardian, and NBC News. The second row includes thumbnails from Boston Review, El Pais, BBC, Vox, and Financial Times. Each thumbnail shows the Cambridge Analytica logo in various contexts, such as on a smartphone, a laptop screen, or a person's profile.

Source	Headline
Wikipedia	Cambridge Analytica - W...
Financial Times	Cambridge Analytica under fire as ...
The Conversation	Cambridge Analytica used our sec...
The Guardian	Cambridge Analytica in ...
NBC News	Cambridge Analytica's effectiveness ...
Boston Review	Cambridge Analytica Is Dead, Lon...
El Pais	Cambridge Analytica e a nova...
BBC	Netflix Cambridge Analytica film ...
Vox	The Facebook and...
Financial Times	Cambridge Analytica probe finds no ...

Censorship & Control



— Alliance For Securing Democracy
Russian State Media Ban: Making a ...



Reuters
Russia Today loses fight against EU ban ...



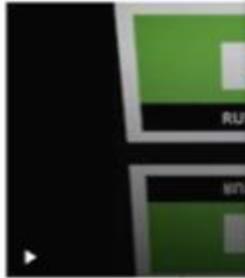
President of Russia
Visit to Russia Today television ...



Reliable news from Latvia - LSM
Russia Today not welcome in Latvia ...



EUvsDisinfo
RT (Russia Today) as guerrilla activist ...



Radio Free Europe
The Two Faces Of RT: ...



Tech regulation?...Theranos...Elizabeth Holmes



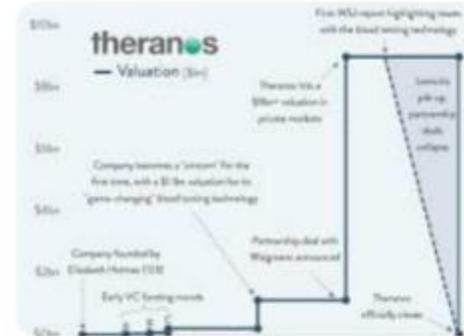
LinkedIn

The Theranos scandal was entirely ...



STAT News

Theranos should be a wake-up call. It ...



UPF-BSM

Case Study: Theranos and Elisabet...

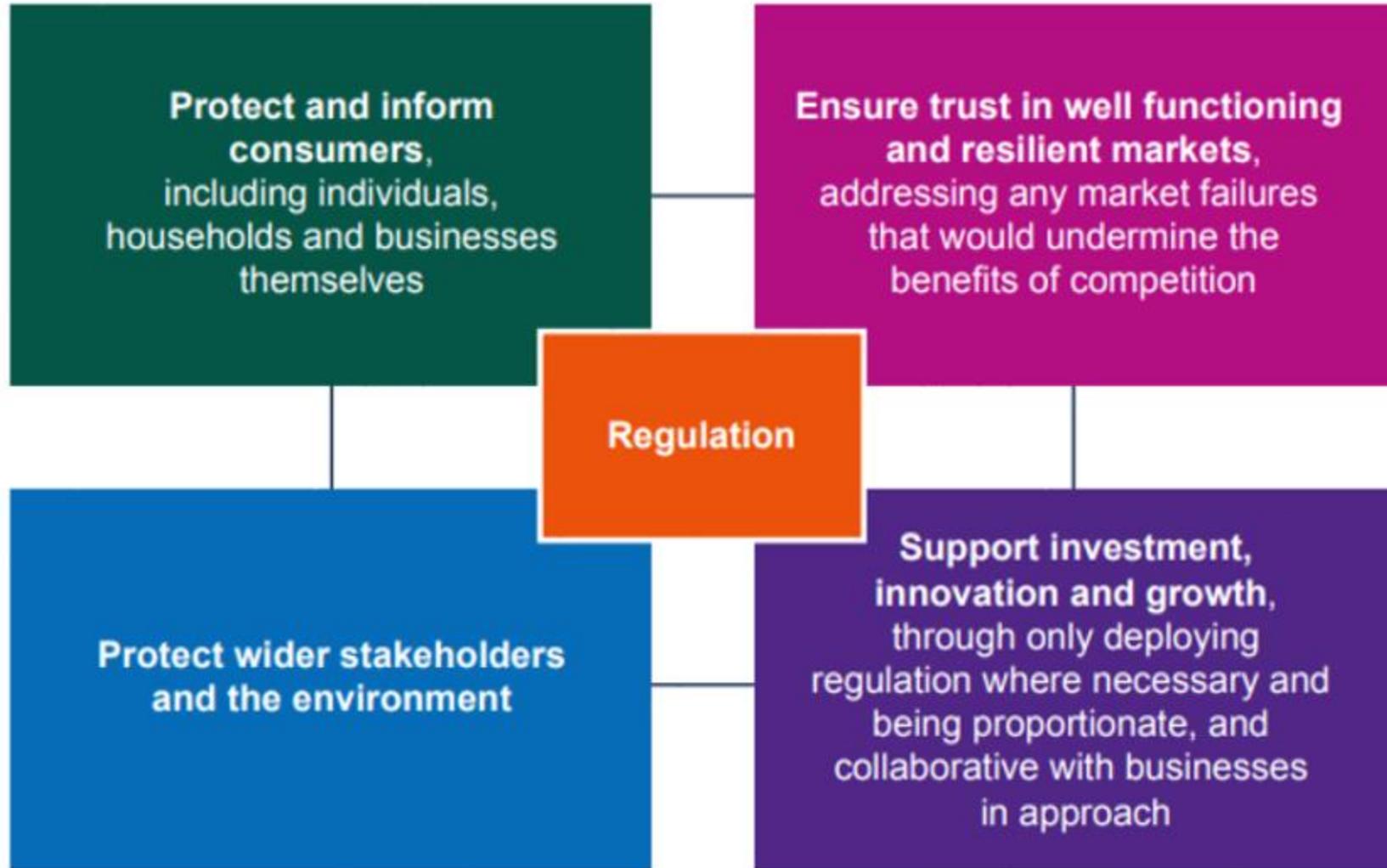


JURIDIC FALGUTIA, EFFICIENT BUSINESS

For one Arizona woman, Theranos found abnormally high levels for six tests. Hospital tests two days later were normal. Theranos says variation across labs is commonplace and can be caused by medicines and diet.

Test	Theranos result	Hospital result	Normal range*
Calcium	9.3	9.2	8.8 - 10.0
Protein, total	5.7	6.8	6.1 - 8.4
Alkaline phosphatase	44	100	29 - 149
Alanine aminotransferase	8	25	0 - 47
Aspartate aminotransferase	8	34	0 - 54
Glucose	73	99	70 - 103

Figure 2: The purpose of regulation



- *The UK's regulatory landscape is frequently held up as an example of international best practice. However, billions of pounds of regulatory costs have accumulated piecemeal on businesses, with some studies suggesting that the impact of red-tape costs could be as high as 3-4% of GDP, or £70bn in 2023 prices.¹ 45% of all businesses see regulation as a burden on their success.*
- *They are also increasingly telling us that the regulatory landscape is too complicated, slow and burdensome, with over 100 bodies involved in regulation and limited clarity on roles and responsibilities*

Smarter regulation:

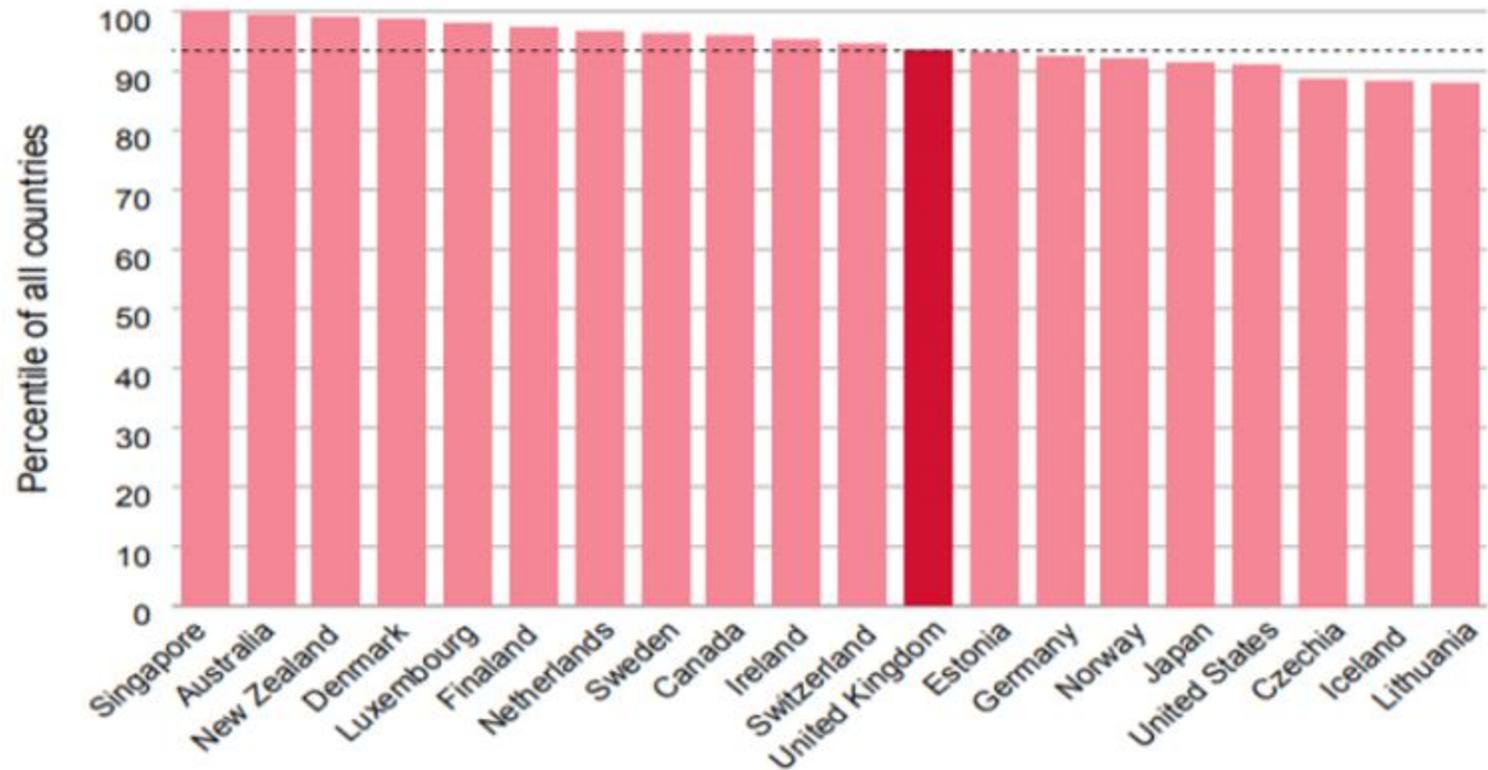
Delivering a regulatory
environment for innovation,
investment and growth

May 2024



Smarter regulation: Delivering a regulatory environment for innovation, investment and growth

Figure 1: Top 20 countries by regulatory quality



Source: Daniel Kaufmann and Aart Kraay (2023). ['Worldwide Governance Indicators, 2023 Update'](#), (Accessed on 07/05/2024).

■ UK Regulatory Roadmap for Livestock Agri-Tech

Core Regulatory Bodies

- Defra – Animal health, welfare, environment
- APHA – Disease control, biosecurity
- VMD – Veterinary medicines, feed additives
- FSA – Food safety, traceability
- Environment Agency – Emissions, waste, permits
- ICO – Data protection (UK GDPR)

Key Regulatory Areas

- Animal Welfare Act 2006 & farmed animals regulations
- APHA notifiable disease reporting requirements
- VMD approval for medicines & diagnostic devices
- Food traceability via livestock ID systems
- Environmental permitting (emissions, waste, water)
- Data protection under UK GDPR & DPA 2018

Risks & Opportunities

- Risk: Misclassification of product (VMD delays)
- Risk: Unverified claims → Trading Standards action
- Opportunity: Defra & UKRI innovation grants
- Opportunity: Demand for Net Zero & welfare tech

Action Checklist

- Classify product early (equipment, software, veterinary)
- Embed welfare safeguards & APHA reporting compliance
- Draft farmer data agreements (UK GDPR aligned)
- Check environmental permits for emissions/waste
- Run validated trials with UK vets & farms
- Engage Red Tractor / RSPCA Assured for credibility

Quick Win Strategy

- Pilot in sandbox with Defra/APHA engagement
- Demonstrate welfare, disease & sustainability alignment
- Apply for Innovate UK / Defra scaling grants
- Position as enabler for Net Zero & traceability goals

Core Regulatory Bodies

- Defra – Animal health, welfare, environment
- APHA – Disease control, biosecurity
- VMD – Veterinary medicines, feed additives
- FSA – Food safety, traceability
- Environment Agency – Emissions, waste, permits
- ICO – Data protection (UK GDPR)

Key Regulatory Areas

- Animal Welfare Act 2006 & farmed animals regulations
- APHA notifiable disease reporting requirements
- VMD approval for medicines & diagnostic devices
- Food traceability via livestock ID systems
- Environmental permitting (emissions, waste, water)
- Data protection under UK GDPR & DPA 2018



Quick Win Strategy

- Pilot in sandbox with Defra/APHA engagement
- Demonstrate welfare, disease & sustainability alignment
- Apply for Innovate UK / Defra scaling grants
- Position as enabler for Net Zero & traceability goals



Department for
Business & Trade

Smarter regulation:

Delivering a regulatory
environment for innovation,
investment and growth

- **Principle 3: Avoid unnecessary risk aversion.** Regulators will inevitably need to balance risks when making decisions, but internal culture should always challenge excessive risk aversion for the good of delivering the best outcomes. Regulators should note the UK's science – and risk-based application of the precautionary principle, as set out in the Environmental Principles Policy Statement, issued under the Environment Act 2021.

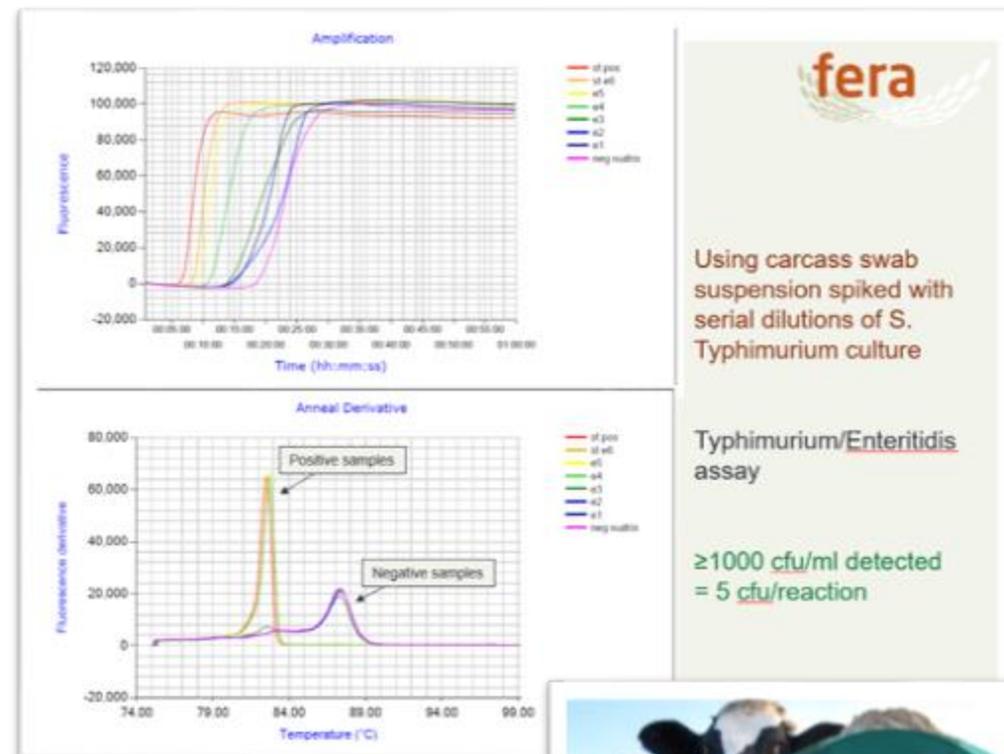
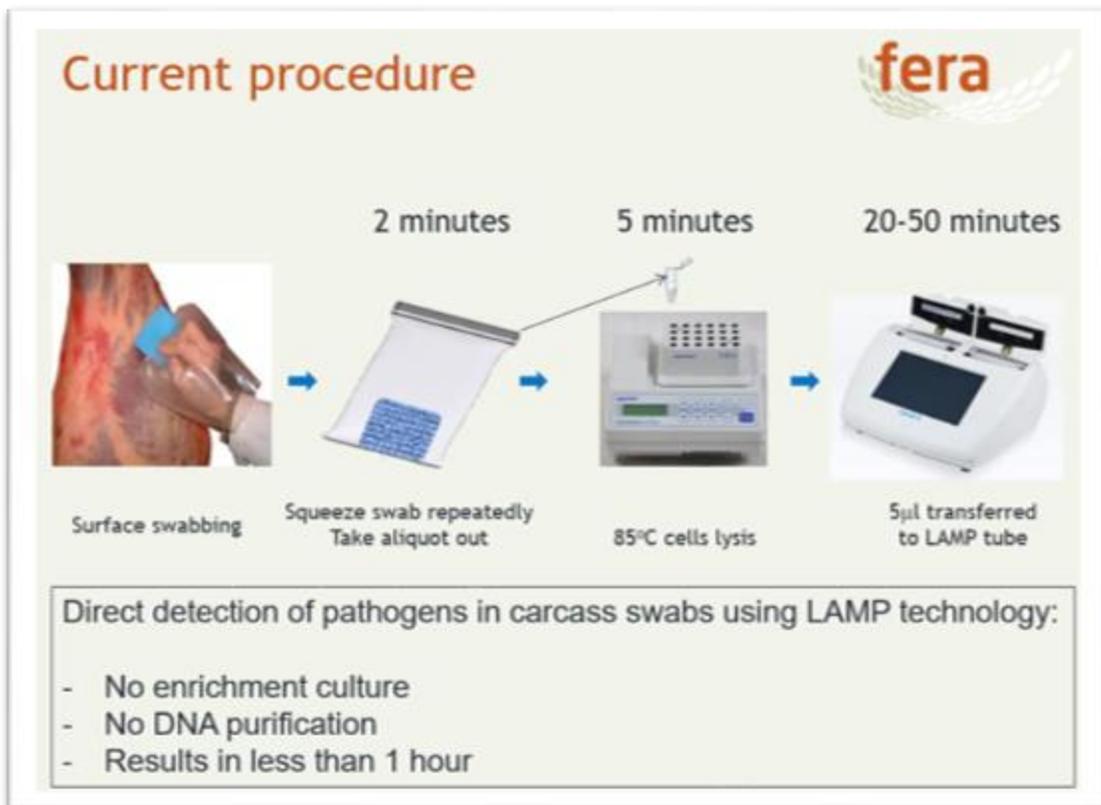
RAFT Solutions Ltd

research | advanced breeding | food futures | training

UK
Agri-Tech
Centre

CP1089

Examples of agri-tech



fera

An Integrated Platform for Rapid Testing of Pathogens in the Meat / Poultry Supply Chain

Innovate UK project 101736





Research in Sustainable Health & Nutrition Mastitis diagnosis ...



EMA Categorisation of antibiotics for use in animals for prudent and responsible use

Category: Avoid	Category: Restrict
<ul style="list-style-type: none"> Antibiotics in this category are not authorised as veterinary medicines in the EU. Should not be used in food-producing animals. Must be given to companion animals under exceptional circumstances. 	<ul style="list-style-type: none"> Antibiotics in this category are strictly reserved for human medicine and use in animals should be restricted to indicate the risk to public health. Should not be used unless there are no alternatives in Companion [] or [] that would be clinically effective. Use should be based on environmental acceptability, safety, and/or quality.
Category: Caution	Category: Prudence
<ul style="list-style-type: none"> The antibiotics in this category have alternatives in human medicine. The active substances in this category have no alternatives in human medicine. Should be controlled only when there are no alternatives in Companion [] that would be clinically effective. 	<ul style="list-style-type: none"> Should be used in food production, whenever possible. Use should be based on the cost-benefit, with other therapy options.

For antibiotics in all categories:

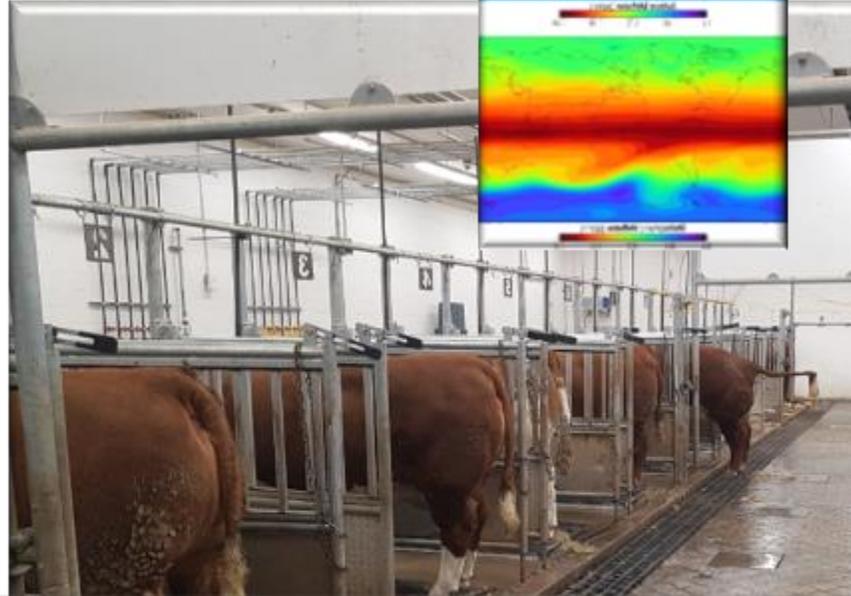
- Antibiotics use, mainly from treatment animals, and control should be avoided.
- Group treatment should be restricted to situations where individual treatment is not feasible.
- Check out the European Commission's guidance on prudent use of antibiotics in animals: <http://ec.europa.eu/food>



LAMP & Auto-pure robot

Sustainable Beef Herd Health-Canada

WCVM Saskatoon 20th January 2020 (-35 °C)



UKRI funds for dairy and beef fertility research

UK Research and Innovation (UKRI) has awarded £400,000 for research into higher cattle fertility and breeding productivity in UK and Canadian dairy and beef herds. The project will be delivered by an agritech and biotech consortium led by Ripon-based **RAFT Solutions**.

The project aims to reduce wasted genetic potential, while improving sustainability and cattle farm financial results. It will "transform genetic progress, through the adoption of precision technologies, diagnostics, advanced breeding and big data, leading to more sustainable livestock production and export opportunities", says RAFT's Jonathan Statham.

This transatlantic initiative has parallel financial support from Canadian government funding body IRAP for a Canadian partner, Bow Valley Genetics. It also involves XL Vets practices in UK and Canada, and the Universities of Guelph and Saskatchewan.

In practical terms, the project's aims include higher conception rates and thereby fewer breeding cycles, says Mr Statham. He says this will come about through screening for higher quality semen and embryos, thereby delivering the promise of genomics by producing more calves that join the herd with better health and fertility.

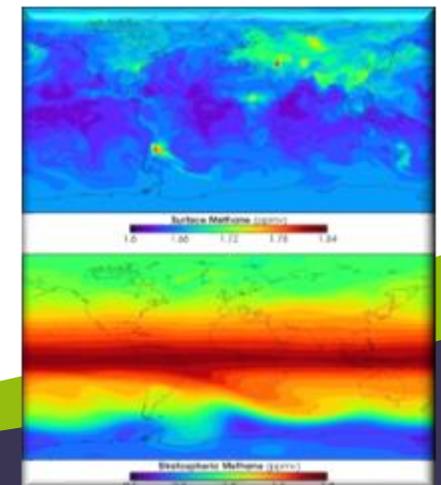
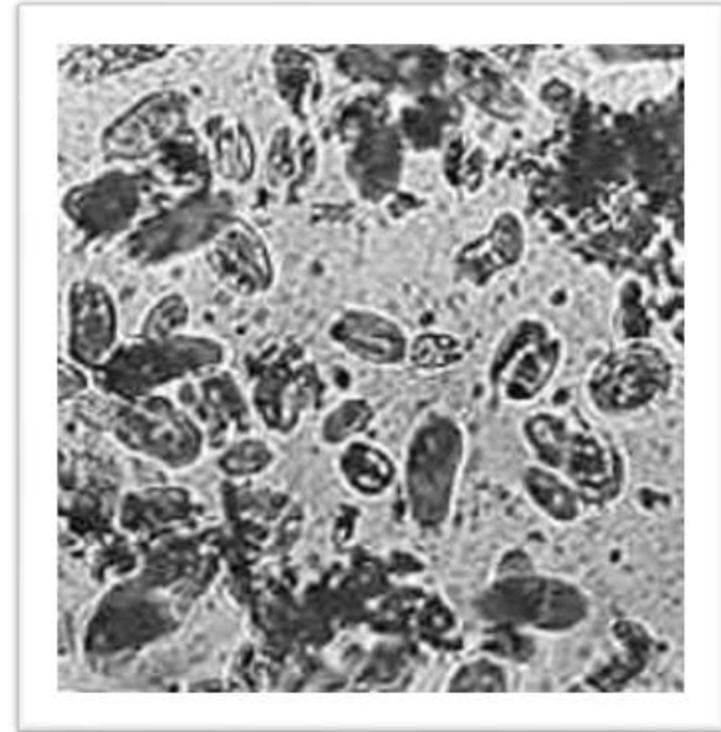
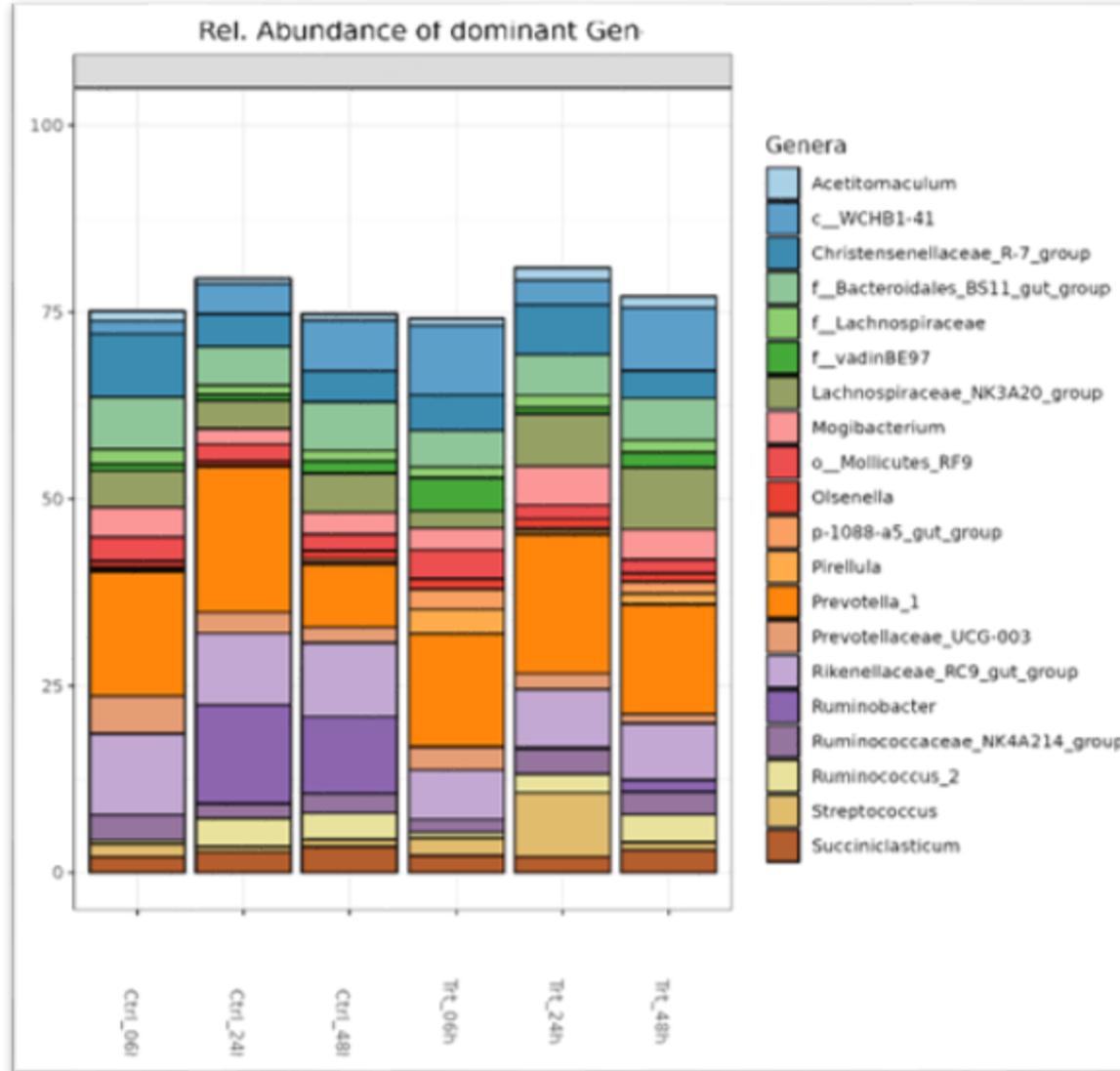
The funding is awarded through UKRI's 'UK Canada: enhancing agricultural productivity and sustainability competition'. The competition format brought together UK and Canadian companies, through on-line and in-person events, to identify and build project concepts in sustainable

agriculture. RAFT Solutions' UK project partners are Atentis (stem cell transport), Distara Biomedical (semen quality marker) and Dyrveal UK (mobile semen testing) with Bow Valley Genetics in Canada and XL Vets practices in UK & Canada including Kirkton Veterinary Clinic & Row Valley Livestock Health.

In addition to RAFT Solutions, six other UK winners are Arden Biotechnology, Devonish, Precision Decisions, Airborne Robotics, Clarify Biosolutions and RS AQUA. With each, Canadian partners will receive funding support through the National Research Council of Canada Industrial Research Assistance Program (NRC IRAP).

Rumen Supplements

- 3-NOP?
- Seaweed?



Food , Energy, Nitrogen



The Future: Precision Farming (PLF)

J. Dairy Sci. 104:405–418
<https://doi.org/10.3168/jds.2020-19195>
 © 2021 American Dairy Science Association¹. Published by Elsevier Inc. and FASS Inc. All rights reserved.

Milk losses and dynamics during perturbations in dairy cows differ with parity and lactation stage

L. Adriaens,^{1,2,3*} I. van den Brulle,⁴ L. D'Amers,⁵ J. M. E. Statham,⁶ K. Geerinckx,⁷ S. De Vliegher,⁸ S. Piepers,⁹ and B. Aermouts¹⁰
¹Department of Biometrics, Biometrics Technology Cluster, KU Leuven, Campus Geel, Klonhofstraat 4, 2440 Geel, Belgium
²Department of Biometrics, Mechanization, Biostatistics and Sensors Division, KU Leuven, Kasteelpark Arenberg 30, 3001 Leuven, Belgium
³RAFT Solutions Ltd., Mill Farm, Studley Road, Ripon HG4 2QR, United Kingdom
⁴Department of Reproduction, Obstetrics and Herd Health, M-team and Mastitis and Milk Quality Research Unit, Ghent University, Coupure links 133, 9000 Ghent, Belgium
⁵Provincie of Antwerpen, Hooibeekhoeve, Hooibeekdijk 1, 2440 Geel, Belgium

ABSTRACT

Milk yield dynamics during perturbations reflect how cows respond to challenges. This study investigated the characteristics of 62,406 perturbations from 16,604 lactation curves of dairy cows milked with an automated milking system at 50 Belgian, Dutch, and English farms. The unperturbed lactation curve representing the theoretical milk yield dynamics was estimated with an iterative procedure fitting a model to the daily milk yield data that was not part of a perturbation. Perturbations were defined as periods of at least 5 d of negative residuals having at least 1 day that the total daily milk production was below 80% of the estimated unperturbed lactation curve. Every perturbation was characterized and split in a development and a recovery phase. Based hereon, we calculated both the characteristics of the perturbation as a whole, and the duration, slopes, and milk losses in the phases separately. A 2-way ANOVA followed by a pairwise comparison of group means was carried out to detect differences between these characteristics in different lactation stages (early, mid-early, mid-late, and late) and parities (first, second, and third or higher). On average, 3.8 ± 1.9 (mean ± standard deviation) perturbations were detected per lactation in the first 305 d after calving, corresponding to an estimated 92.1 ± 133.3 kg of milk loss. Only 1% of the lactations had no perturbations. On average, 2.3 kg of milk was lost per day in the development phase, while the recovery phase corresponded to an average increase in milk production of 1.5 kg/d, and these phases lasted an average of 10.1

and 11.6 d, respectively. Perturbation characteristics were significantly different across parity and lactation stage groups, and early and mid-early perturbations in higher parities were found to be more severe with faster development rates, slower recovery rates, and higher milk losses. The method to characterize perturbations can be used for precision phenotyping purposes that look into the response of cows to challenges or that monitor applications (e.g., to evaluate the development and recovery of diseases and how these are affected by preventive actions or treatments).
Key words: perturbation, milk loss, lactation curve, precision phenotyping

INTRODUCTION

Milk yield and production performance of dairy cows are the result of both genetic and environmental factors. In the past decades, substantial progress has been made in terms of genetic predisposition for milk yield through dedicated selection and via the increased use of advanced breeding tools such as AI and sexed semen (Weigel et al., 2017). More recently, the introduction of genomic tools for quantifying each animal's production merit has also improved genetic progress (Fleming et al., 2018). The improvement of management and environment have also contributed to a better production performance. These changes include optimization of feed and nutrition; monitoring of health, reproduction, and welfare; better veterinary practices, housing, and climate control; and improved milking routines (Rajala-Schultz et al., 1999b; Bach et al., 2008; Balaine et al., 2020).

Milk production is crucial for a dairy farm's profitability, and a substantial part of the economic challenge is linked to losses of milk yield and quality due to health issues (van Soest et al., 2016, 2019; Liang et



PRACTICE ABSTRACT

Sensor systems availability in dairy farms

Potential tools for innovative cow selection

Problem
 The need for resilient and sustainable animal production systems implies improving resilience and efficiency of cattle against environmental challenges. The advanced herd management technologies already installed on dairy farms could provide relevant phenotypic data on individual cows. However, despite enormous potential, there is little knowledge on the actual distribution and type of sensor technologies present on dairy farms.

Solution
 Thanks to the collaboration with the regional breeders' association (ARVA), a large survey was performed on dairy farms of the North East of Italy in 2017. Information on both the type of sensor systems installed and parameters recorded were collected.

Outcome
 The survey covered 964 dairy farms rearing 65,375 dairy cows, mainly Holstein (72%), Brown Swiss (7%), and Simmental (6%). The herd size ranged from 10 to 662 cows, with an average of 68 cows. Nearly 40% of farms were equipped with sensor systems to measure individual milk yield, against 15% recording behavioural parameters, such as oestrus and rumination. As shown in Figure 1, the proportion of farms with sensor systems for monitoring cow behaviour increased with herd size. Collars and pedometers were the most common devices (55 and 44%, respectively), whereas ear tags were found only in 1% of farms. Behavioural parameters such as activity or rumination were recorded only in a small proportion of farms (Figure 2). Consequently, individual behaviour data are available only for 2 to 29% of the dairy cow population.

Practical recommendations

- Information from sensor systems for monitoring cow behaviour is extremely useful to monitor real-time cow health and has huge potential for the development of precision farming in dairy cattle, such as resilience and efficiency.
- Aside from poor distribution of such systems in the dairy sector, data quality is of fundamental importance for developing innovative algorithms for selecting more resilient and efficient cows.
- Proper use, regular maintenance of sensor devices together with regular updating and backup of data are key strategies for maintaining data quality.

Keywords
 Sensor systems
 Dairy cows
 Behavioural parameters
 Activity

Author(s)
 Isabelle Lora, Gaetano Costi, Flaviano Gottardo and Gianpaolo Valentini

Publication
 A survey on sensor systems used in Italian dairy farms and comparison of performance of similar farms equipped or not with sensors under review

Figure 1 Distribution of sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 2 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 3 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 4 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 5 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 6 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 7 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 8 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 9 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 10 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 11 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 12 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 13 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 14 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 15 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 16 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 17 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 18 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 19 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 20 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 21 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 22 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 23 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 24 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 25 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 26 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 27 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 28 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 29 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 30 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 31 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 32 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 33 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 34 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 35 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 36 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 37 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 38 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 39 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 40 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 41 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 42 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 43 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 44 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 45 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 46 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 47 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 48 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 49 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 50 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 51 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 52 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 53 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 54 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 55 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 56 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 57 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 58 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 59 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 60 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 61 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 62 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 63 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 64 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 65 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 66 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 67 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 68 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 69 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 70 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 71 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 72 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 73 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 74 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 75 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 76 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 77 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 78 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 79 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 80 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 81 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 82 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 83 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 84 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 85 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 86 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 87 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 88 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 89 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 90 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 91 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 92 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 93 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 94 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 95 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 96 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

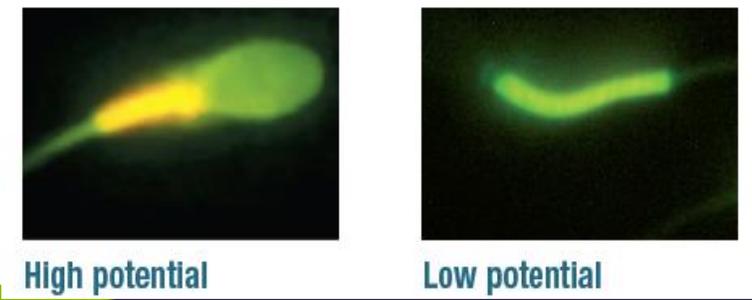
Figure 97 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 98 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 99 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Figure 100 Parameters recorded by the sensor systems for monitoring cow behaviour in Italian dairy farms (overall n = 964)

Received July 1, 2020.
 Accepted September 3, 2020.
 *Corresponding author: lus.adriaens@kuleuven.be



What is PLF? Why use PLF?

Definition:

- Precision livestock farming =PLF
- real time monitoring and management systems, alerts.
- information from PLF systems *enhance* farm management

- Why use PLF?
 - Sustainability-WASTE of Energy and Food
 - Labour saving
 - Health & Welfare societal concerns

- Identification of sensors that can give information over **RESILIENCE** and **EFFICIENCY**



Body weight, BCS



Feeding, rumination

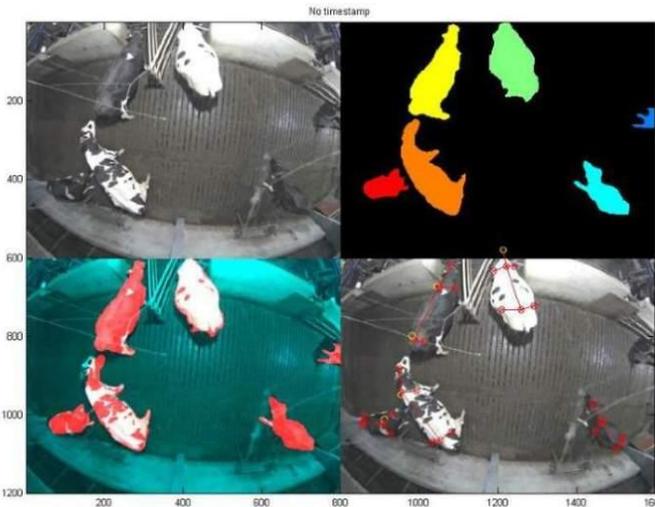


Activity, behaviour



Milk yield, milk parameters, T²

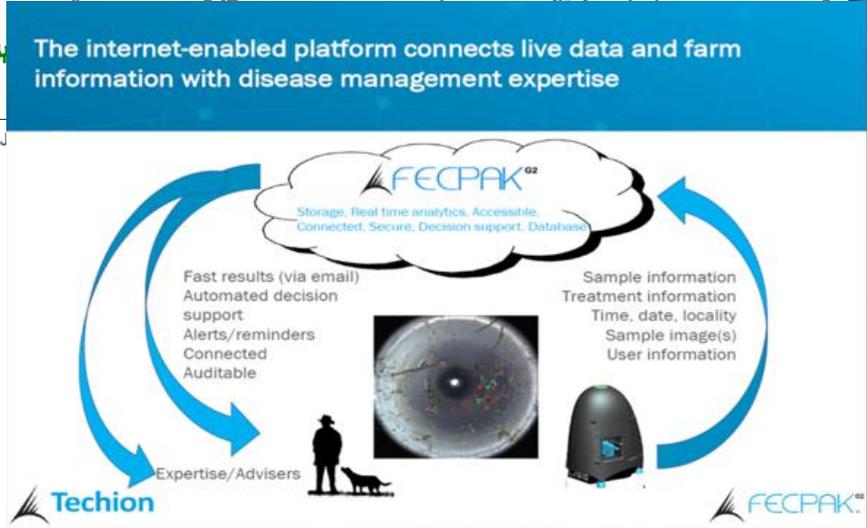
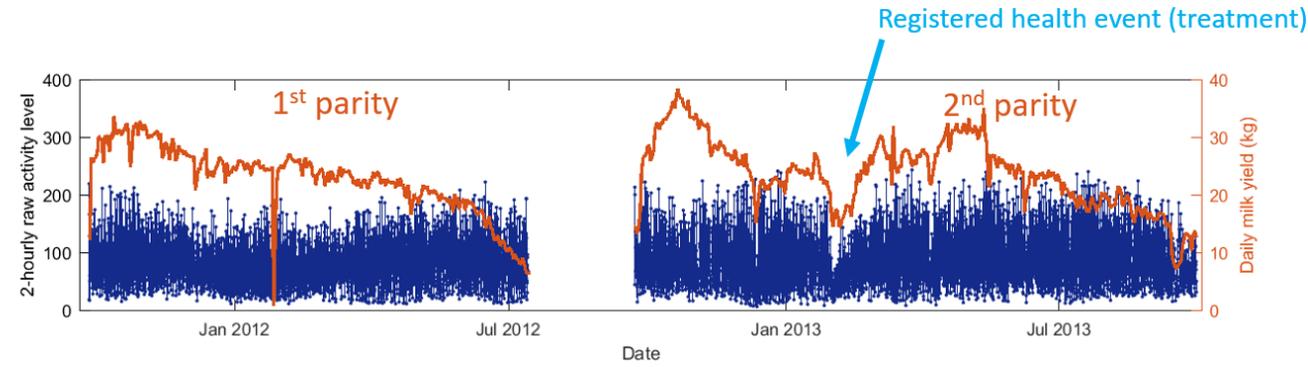
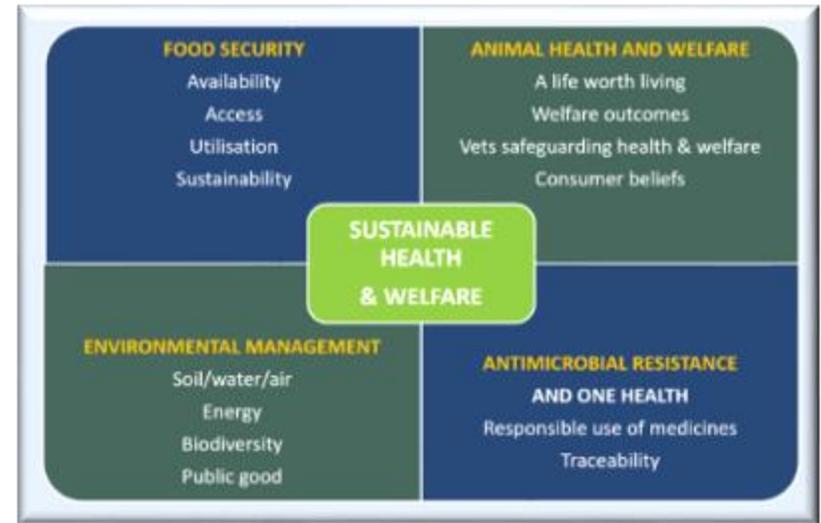
- High-frequency sensor time series >> proxies
 - Data limitations
 - Information vs. complexity



Technology-PLF



DATA
SF + RR
Modeling
Interpret



Precision Livestock Farming in Practice

A working conference
24th and 25th November 2020
National Agri-Food Campus, York YO41 1LZ

The conference is specifically aimed at the most progressive of livestock producers across all species who will be attracted to the conference for its practical and applied nature. It is being organised by the opportunity to get on farm and see precision livestock farming in practice and hear from some of the leading experts in precision livestock farming.

The conference will be held at the National Agri-Food Campus, York, and will be held on the 24th and 25th November 2020. The conference will be held on the 24th and 25th November 2020. The conference will be held on the 24th and 25th November 2020.

GENTORE

RAFT Solutions Ltd, 88 Farm Steadley Road, Ripon, North Yorkshire YO4 2JQ, www.raftsolutions.co.uk • +44 (0)1373 540933 • a@rafft.co.uk

Precision Livestock Farming Conference

Supporting One Health Technology for Animal, Human and Environment

Networking opportunities and a PLF Live session will accompany presentations and discussions from international leaders in the field of precision livestock farming. This engaging and thought-provoking event will be attended by:

- Policy makers
- Industry stakeholders
- Researchers
- Progressive livestock producers

Marguerite Adams University, Stroud, Gloucestershire, GL8 1BN
JULY 18th 2024

£95 + VAT
Any vet who brings along two farmers will receive their ticket FREE OF CHARGE.

BOOK NOW
and receive 10% off your ticket price!

KEYNOTE SPEAKERS

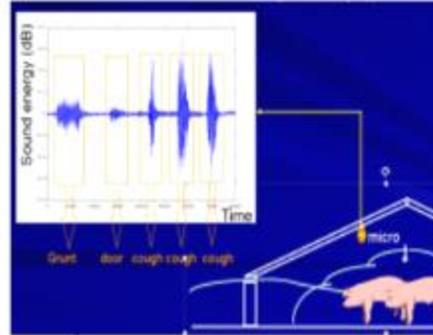
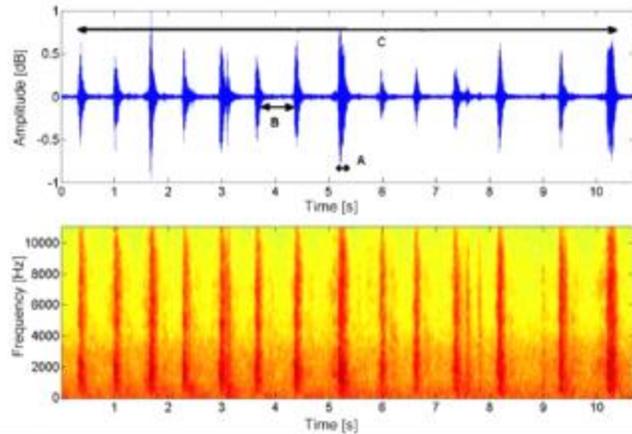
- Professor Stephen Lillford, University of British Columbia
- Professor Ben Matthews, University of Bristol
- Professor Liam Clewley, Royal Veterinary College
- Professor Mark Stubbins, Royal Veterinary College
- Professor Giulio Castellani, University of Padova
- Dr. Isabella Lora, University of Padova
- Dr. Claire Cook, University of Bristol
- Professor Ross Morrison, University of Liverpool
- Dr. Liane Lanyon, University of Liverpool

Precision technologies in pig farming

Cough sound analysis – respiratory problems in pigs

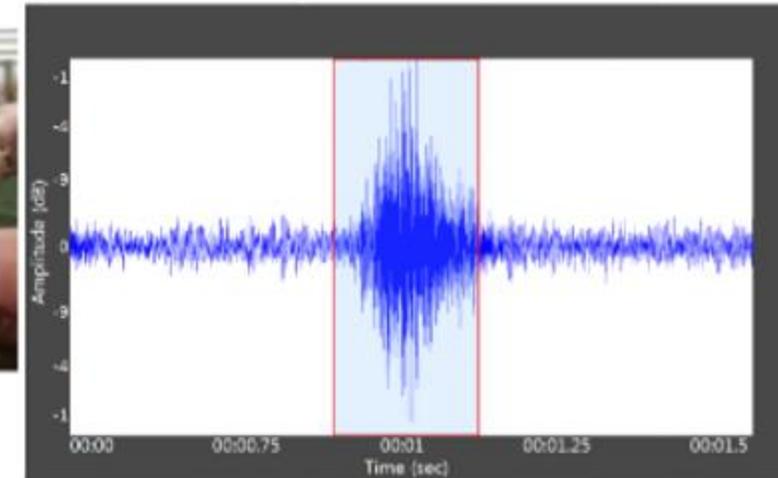


Ferrari, S., Silva, M., Guarino, M., [Aerts, J.](#) and [Berckmans, D.](#), 2008. Cough sound analysis to identify respiratory infection in pigs. *Computers and Electronics in Agriculture*, 64(2), pp.318-325.



Pig wasting disease using sound analysis

Chung, Y., Oh, S., Lee, I., Park, D., Chang, H. and Kim, S., 2013. Automatic Detection and Recognition of Pig Wasting Diseases Using Sound Data in Audio Surveillance Systems. *Sensors*, 13(10), pp.12929-12942.



Measuring welfare repeatedly telemedicine?



Review

The 2020 Five Domains Model: Including Human–Animal Interactions in Assessment Animal Welfare

David J. Mellor^{1,*}, Ngaio J. Beausoleil¹, Katherine E. Littlewood¹, Andrew Paul D. McGreevy^{3,4}, Bidda Jones^{3,4} and Cristina Wilkins⁵

- 1 Animal Welfare Science and Bioethics Centre, School of Veterinary Science, Massey U 4442 Palmerston North, New Zealand; n.j.beausoleil@massey.ac.nz (N.J.B.); k.littlewood@massey.ac.nz (K.E.L.)
 - 2 Equitation Science International, 3 Wonderland Ave, Tuerong, VIC 3915, Australia; andrewmclean@esi-education.com
 - 3 Sydney School of Veterinary Science, Faculty of Science, The University of Sydney, Sydney, NSW 2006, Australia; paul.mcgreevy@sydney.edu.au (P.D.M.); bjones@rspca.org.au (B.J.)
 - 4 RSPCA Australia, P.O. Box 265, Deakin West, ACT 2600, Australia
 - 5 Saddletops Pty Ltd., P.O. Box 557, Gatton, QLD 4343, Australia; cristinaluz@horsesandpeople.com.*
- * Correspondence: d.j.mellor@massey.ac.nz

Received: 28 September 2020; Accepted: 9 October 2020; Published: 14 October 2020

Applied Animal Behaviour Science 261 (2023) 105883

Contents lists available at ScienceDirect

Applied Animal Behaviour Science

journal homepage: www.elsevier.com/locate/applanim



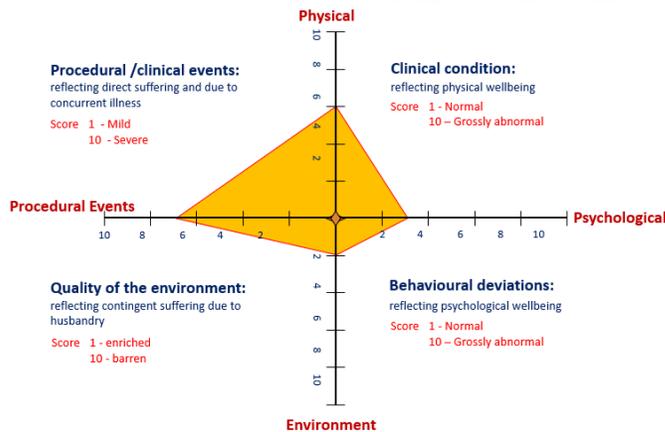
ELSEVIER

Affective trajectories: Are hens influenced by positive and negative changes in their living conditions?

Elizabeth S. Paul^{a,*}, William Browne^b, Michael T. Mendl^a, Gina Caplen^a, Suzanne Held^a, Anna Trevarthen^a, Christine J. Nicol^c

- ^a Bristol Veterinary School, University of Bristol, Langford House, Langford BS40 5DU, UK
^b School of Education, University of Bristol, 35 Berkeley Square, Bristol BS8 1JA, UK
^c Royal Veterinary School, Hawkshead Lane, Brookmans Park, Hatfield AL9 7TA, UK

Quality Network



Downloaded from <https://royalsocietypublishing.org/> on 18 April 2025

Paper

Adaptation of the animal welfare assessment grid (AWAG) for monitoring animal welfare in zoological collections

W. S. M. Justice, M. F. O'Brien, O. Szyzka, S. Wolfensohn



Animal welfare monitoring is an essential part of zoos in many countries. Historically, a variety of welfare managers. Unfortunately, there are a number of issues that make them difficult to implement in practice. The AWAG has previously been proposed as an animal welfare monitoring tool for animals used in research programmes. This computer-based system was successfully adapted for use in a zoo setting with two taxonomic groups: primates and birds. This tool is simple to use and provides continuous monitoring based on cumulative lifetime assessment. It is suggested as an alternative, practical method for welfare monitoring in zoos.

Research
 Cite this article: Bartlett H, Balford A, Holmes MA, Wood JLN. 2023 Advancing the quantitative characterization of farm animal welfare. *Proc. R. Soc. B* 290, 20230120. <https://doi.org/10.1098/rspb.2023.0120>

Received: 16 January 2023
 Accepted: 22 February 2023

Subject Category:
 Biological applications

Subject Areas:
 biological applications

Keywords:
 animal welfare, life cycle assessment, pigs, livestock, agriculture

Author for correspondence:
 Harriet Bartlett
 e-mail: harrietbartlett@bristol.ac.uk

Electronic supplementary material is available online at <https://doi.org/10.1098/rspb.2023.0120>.

Harriet Bartlett^{1,2}, Andrew Balmford¹, Mark A. Holmes² and James L. N. Wood²
¹Department of Zoology, and ²Department of Veterinary Medicine, University of Cambridge, Cambridge CB2 1TN, UK
 DOI: 10.1098/rspb.2023.0120

Animal welfare is usually excluded from life cycle assessments (LCAs) of farming systems because of limited consensus on how to measure it. Here, we constructed several LCA-compatible animal-welfare metrics and applied them to data we collected from 74 diverse breed-to-finish systems responsible for 5% of UK pig production. Some aspects of metric construction will always be subjective, such as how different aspects of welfare are aggregated, and what determines poor versus good welfare. We tested the sensitivity of individual farm rankings, and rankings of those same farms grouped by label type (memberships of quality-assurance schemes or product labelling), to a broad range of approaches to metric construction. We found farms with the same label types clustered together in rankings regardless of metric choice, and there was broad agreement across metrics on the rankings of individual farms. We found woodland and Organic systems typically perform better than those with no labelling and *Raf tractor* labelling, and that outdoor-bred and outdoor-finished systems perform better than indoor-bred and slatted-finished systems, respectively. We conclude that if our goal is to identify relatively better and worse farming systems for animal welfare, exactly how LCA welfare metrics are constructed may be less important than commonly perceived.

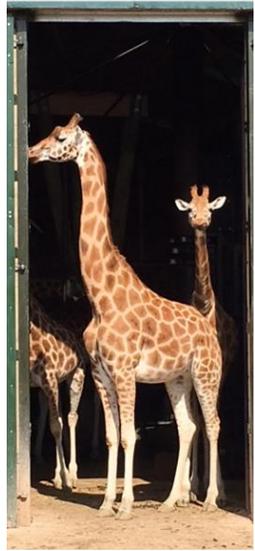
1. Introduction
 Animal welfare describes an animal's health, emotional state and behaviour [1]. In order to improve animal welfare in livestock production, we need to measure it in a way that enables valid comparison of alternative production systems [2]. Efforts to identify systems capable of reducing harmful impacts of food production typically use life cycle assessments (LCAs). LCAs are systematic techniques for quantifying a diverse range of impacts (such as greenhouse gas emissions or land use) across all stages of a product's lifecycle. LCAs are internationally standardized and have been used widely to compare the impacts of products and to identify mitigation strategies. They involve four stages: (i) definition of goal and scope of the analysis, (ii) inventory of inputs and outputs, (iii) grouping of inputs and outputs into impact categories, and (iv) sensitivity and uncertainty analysis. LCAs are mostly used to assess environmental outcomes, but are increasingly being applied to other fields (e.g. nutrition [3]), where the resulting insights help guide key decisions at policy and operational levels [4]. However, less than 1% of animal product LCAs include animal welfare [5–8], in considerable part owing to a lack of compatible metrics. This means LCAs and the decisions based on them at best involve simplistic assumptions about animal welfare, for example based on proxies unrepresentative of overall welfare rather than quantitative, animal-based welfare assessments [9–13], or they rely on subjective measures like stakeholder panels—which can nevertheless be useful in determining the acceptability of a system to a certain group. We

© 2023 The Authors. Published by the Royal Society under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, provided the original author and source are credited.



THE ROYAL SOCIETY PUBLISHING

Welfare measurement & Technology opportunities



- Identification of sensors that can give information over **RESILIENCE** and **EFFICIENCY**



Body weight, BCS



Feeding, rumination

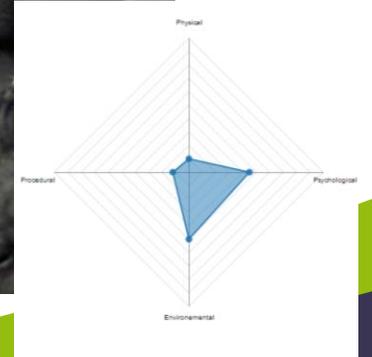
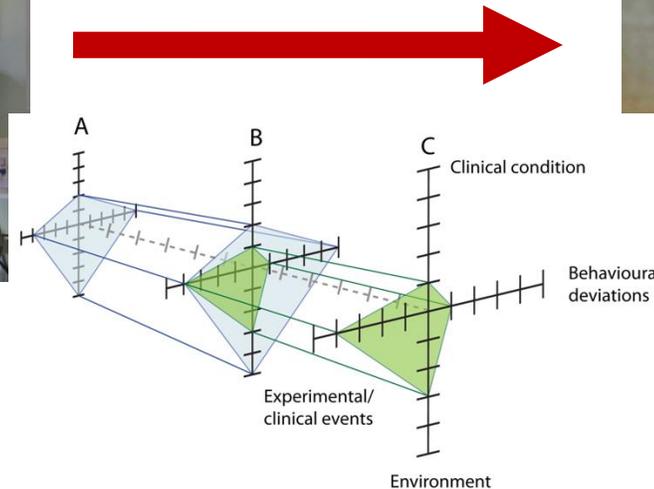


Activity, behaviour



Milk yield, milk parameters, T°

- High-frequency sensor time series >> proxies
 - Data limitations
 - Information vs. complexity



Balancing Sustainability & One Health

GOV.UK

Home > Environment > Wildlife, animals, biodiversity and ecosystems > Animal welfare

Press release

UK to lead the way on animal welfare through flagship new Action Plan

...tion plan to improve the welfare and
...at home and abroad

...t, Food & Rural Affairs and The Rt Hon George

United Nations Climate Change website navigation:

- Home
- COP 26
- Process and meetings
- Topics
- Calendar
- Climate action
- Documents and decisions
- About us

Communication of long-term strategies

Recognising the links between animal health and welfare and the health of our planet, the Government is also working closely with industry to transform future farming policy through the [Animal Health and Welfare Pathway](#) which will forge a new deal between government and farmers to promote healthier and higher welfare animals. The Pathway will pay farmers to improve animal health and welfare, reduce carbon emissions and slow the rise of anti-microbial resistance

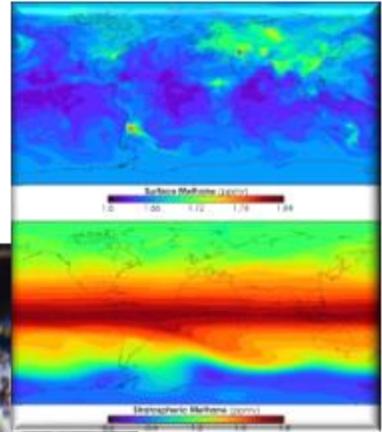
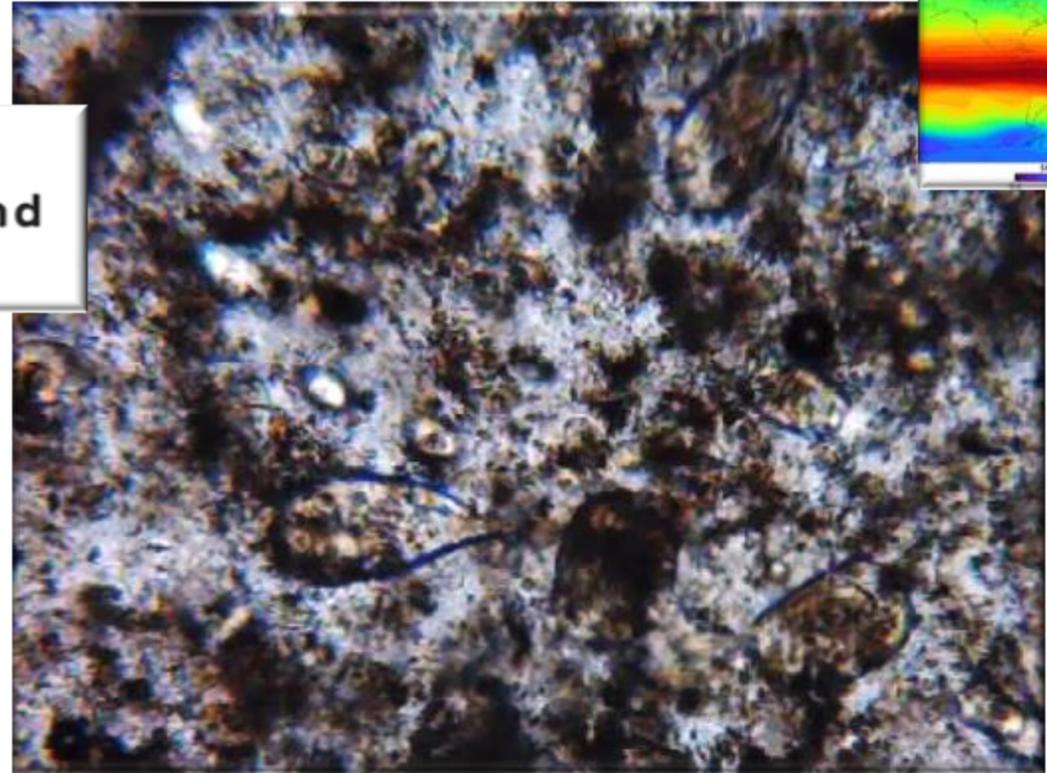
Animal Health and Welfare: Protecting and improving our reputation

The Animal Health and Welfare Pathway

Department for Environment Food & Rural Affairs

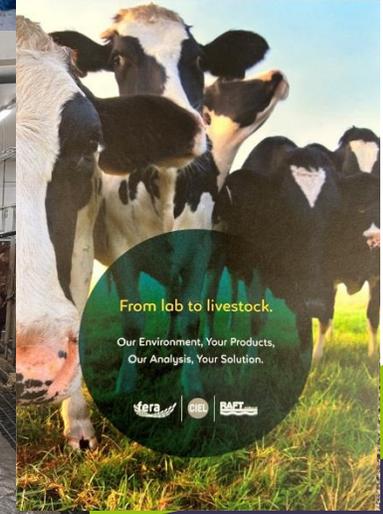


Measuring biodiversity... & rumen health & methane



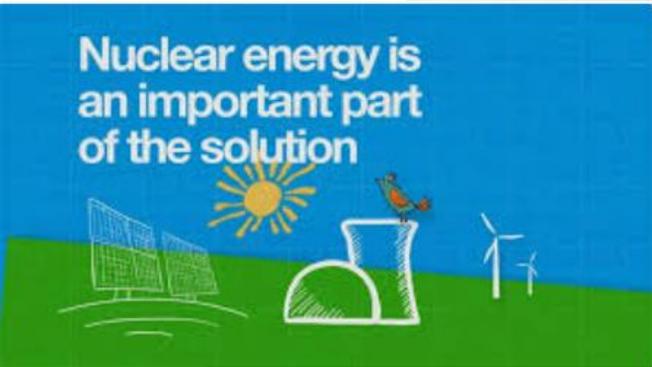
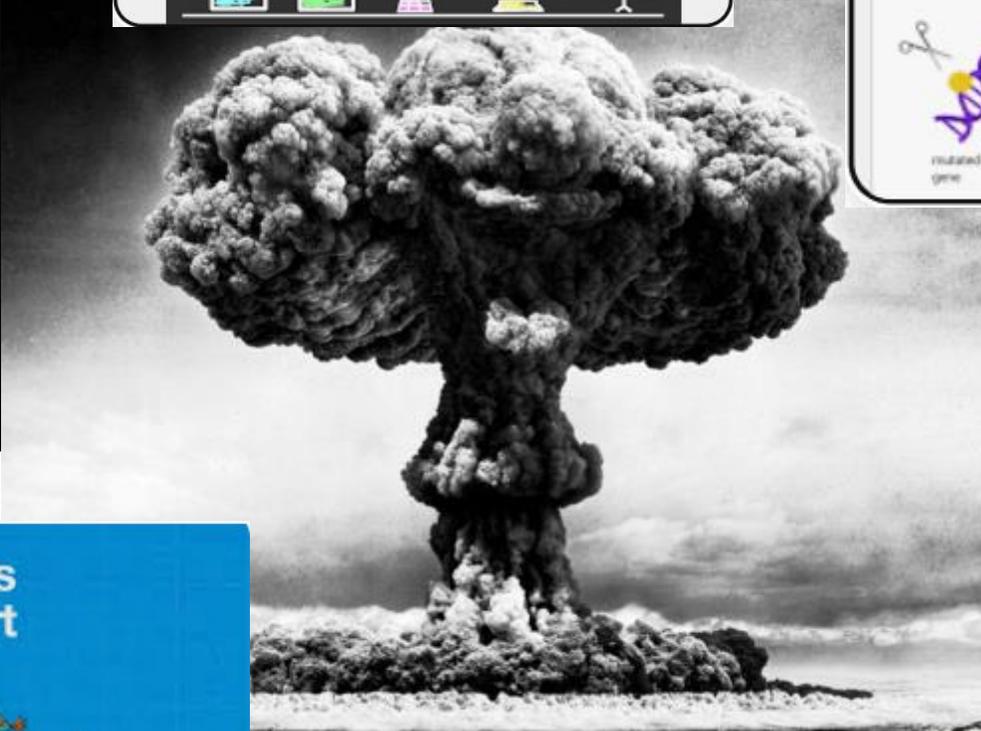
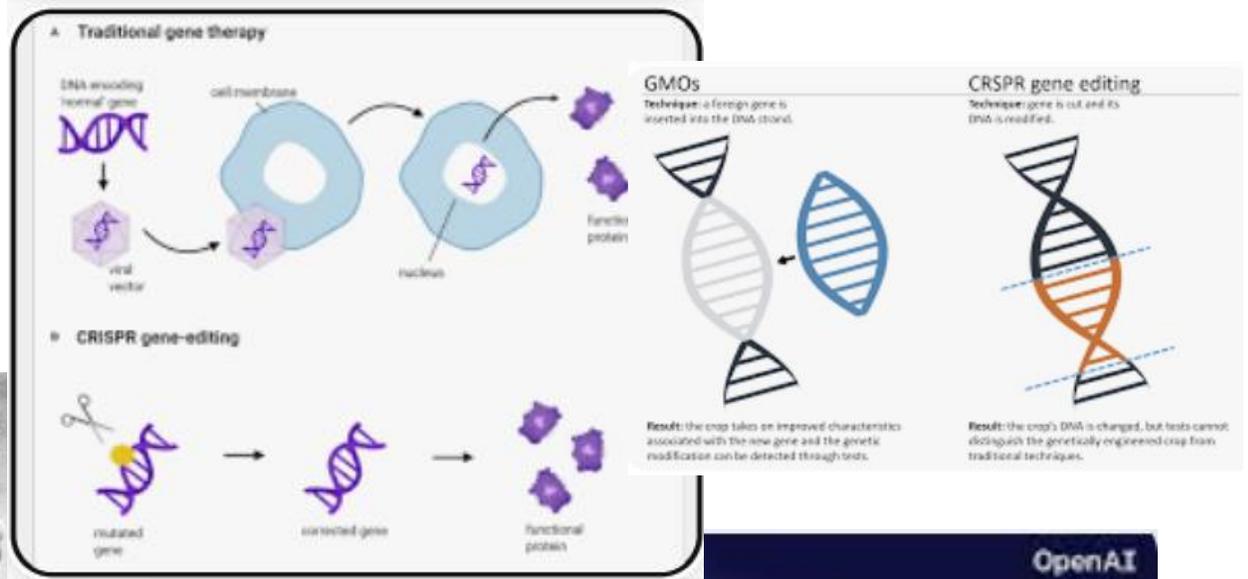
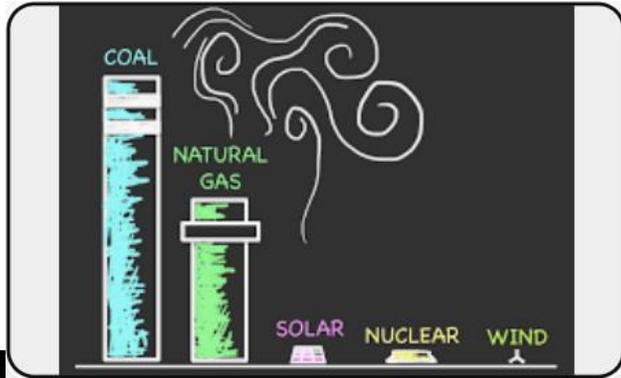
Balancing sustainability:
one health & welfare

Sustainable Balance: Welfare, Health, Food & Environment



But could it all go wrong?





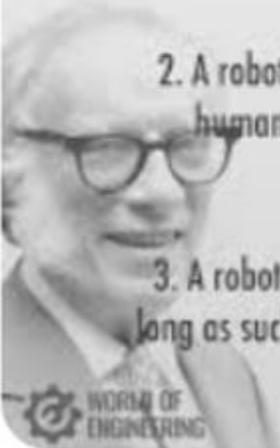
Technology has pros..and cons...

I, Robot-Asimov

- Laws of robotics:

Isaac Asimov's "Three Laws of Robotics"

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.



WORLD OF ENGINEERING

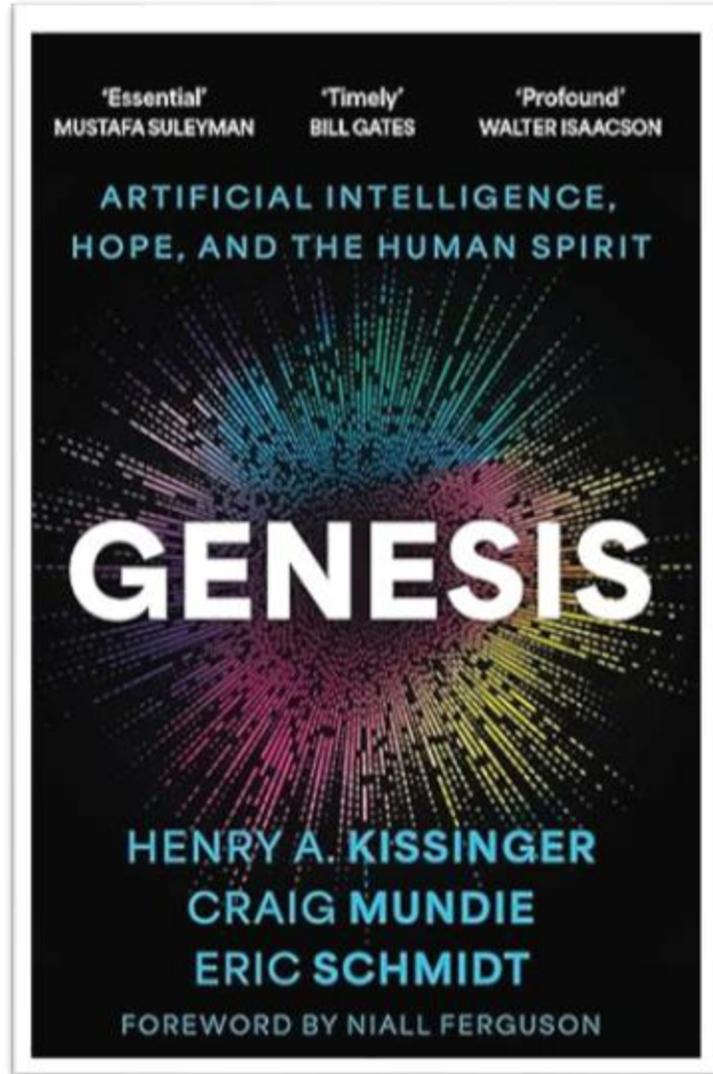


IMDb

I, Robot (2004) - IMDb

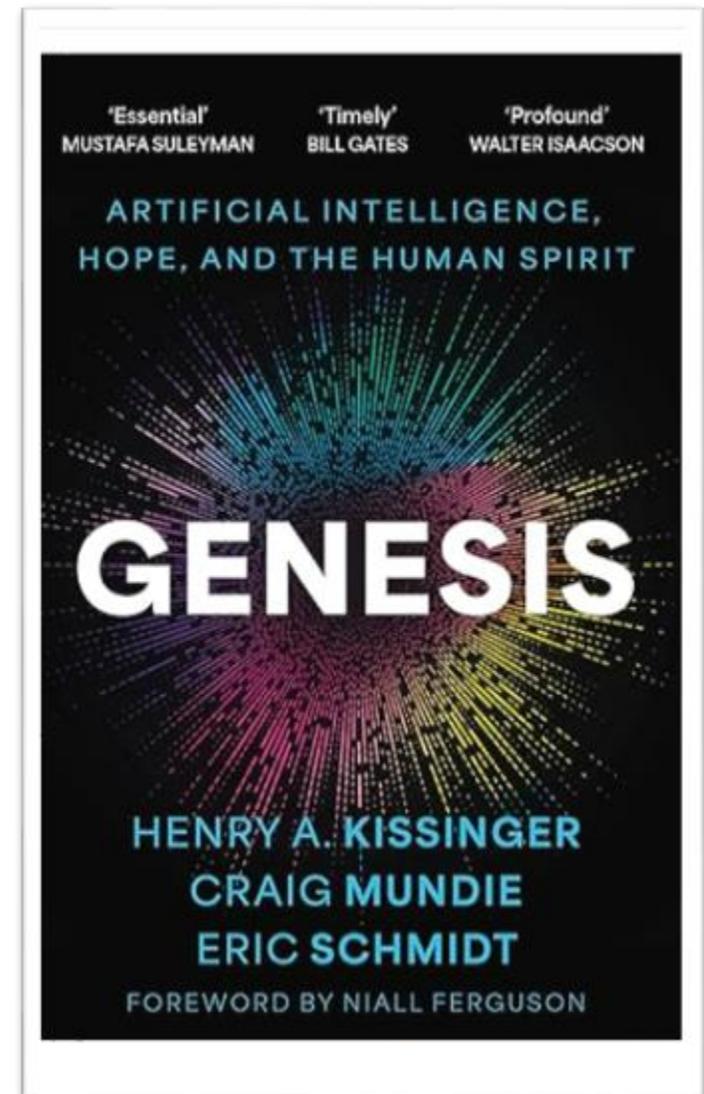


Kissinger and AI



In his final book, the late Henry Kissinger joins forces with two leading technologists to mount a profound exploration of the epochal challenges and opportunities presented by the revolution in Artificial Intelligence.

As it absorbs data, gains agency, and intermediates between humans and reality, AI (Artificial Intelligence) will help us to address enormous crises, from climate change to geopolitical conflicts to income inequality. It might well solve some of the greatest mysteries of our universe and elevate the human spirit to unimaginable heights. But it will also pose challenges on a scale and of an intensity that we have never seen - usurping our power of independent judgment and action, testing our relationship with the divine, and perhaps even spurring a new phase in human evolution.



Technology definitions....



Article A Comprehensive Definition of Technology from an Ethological Perspective

La Shan L. Carroll

Graduate School of Education, University at Buffalo, Buffalo, NY 14260, USA
Tel.: +1-401-250-2574

Received: 11 June 2017; Accepted: 12 October 2017; Published: 23 October 2017

the following comprehensive definition: something inherently intelligent enough to either function, be used to function, or be interpreted as having a function that intelligent beings—human or otherwise—can appreciate, something devised, designed (by primary intention), or discovered (by secondary intention) serving particular purposes from a secular standpoint without humankind creating it, or a significant beneficiary of rationally derived knowledge that is “used for” a purpose without itself necessarily being translated into something material that “does” autonomously, or dependently when used.

Keywords: definition of technology; science; philosophy; STS; science and the public; theory of technology

1. Introduction

Although the present article is an attempt to present a more encompassing understanding and definition of technology, there have been other efforts to define technology. According to Skrbina (2015), it is in the work of pre-Socratic Greek philosophers that we first glimpse the principle of (divine) ordering in the word “Logos,” which implicates the principle of creation that was conveyed in the meaning of “Techné.” Nevertheless, it was only over the last century and a half that the use of the word technology and incarnations of its meaning to describe various concepts became widespread. Such usage of the word is responsible for generating much interest in determining the core ideas that its use attempts to capture. Furthermore, it is only upon the determination of these fundamental aspects that any attempt to define technology is possible.

According to Bray (2009), although it is difficult to develop a definition for technology, people do indeed know what it is and can discern between things that are human-made and those that occur naturally. Analysis of the previous statement reveals the apparent relationship between knowledge of technology and one’s ability to differentiate between that which takes place in nature and that which is created. That notwithstanding, this relationship may not be as obvious as one would think, due to the ambiguity of the statement by Bray. The lack of clarity in conveying what is meant by the declaration results from being able to interpret it in either of two ways, with regard to both knowledge and distinction:

doi: 10.3390/ijerph16101920

www.mdpi.com/journal/ijerph



Definition of Technology

Technology is a very hard thing to define because it is such a large area.

Technology - is the use of knowledge to turn resources into goods and services that society needs and wants.

What is Technology? Six Definitions and Two Pathologies

Paul Nightingale (SPRU)

October 9, 2014

Introduction

Despite providing the taken-for-granted infrastructure that supports our daily lives (Blaug, 2004), the amount of academic work on what technology ‘is’, and what gives it its power and influence, is relatively limited (Mitchem and Schatzberg, 2000). However, across a range of disciplines there is an increasing recognition that technology can’t be understood as applied science and the amount of research on technology is increasing in both scale and sophistication. Unfortunately, because it comes from different academic disciplines the research remains rather fragmented, reflecting different positions, perspectives, interests and settings; technology is sometimes understood in

terms of artefacts, sometimes in terms of relations, etc. This has resulted in confusion. To explore how they hence their relative strengths and assumptions. To do this it starts the term technology is new, and its meaning has changed through time have different aims and outcomes, each element.

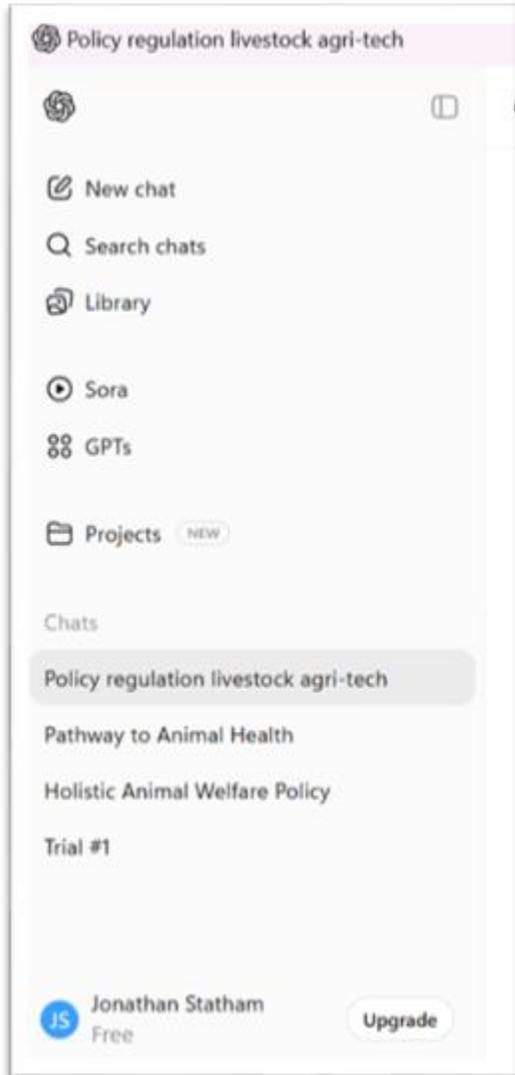
The paper then explores three approach of exploring contradictory and historical examples. These present abstract hierarchical structures, is The results are triangulated using (contrast, process-outcome). For various other different professions (i.e., an etc.). This naming is for illustrating any strong claims about overlap of

¹That goes from the individual, to the

technology

the use of scientific knowledge for practical purposes or applications, whether in industry or in our everyday lives





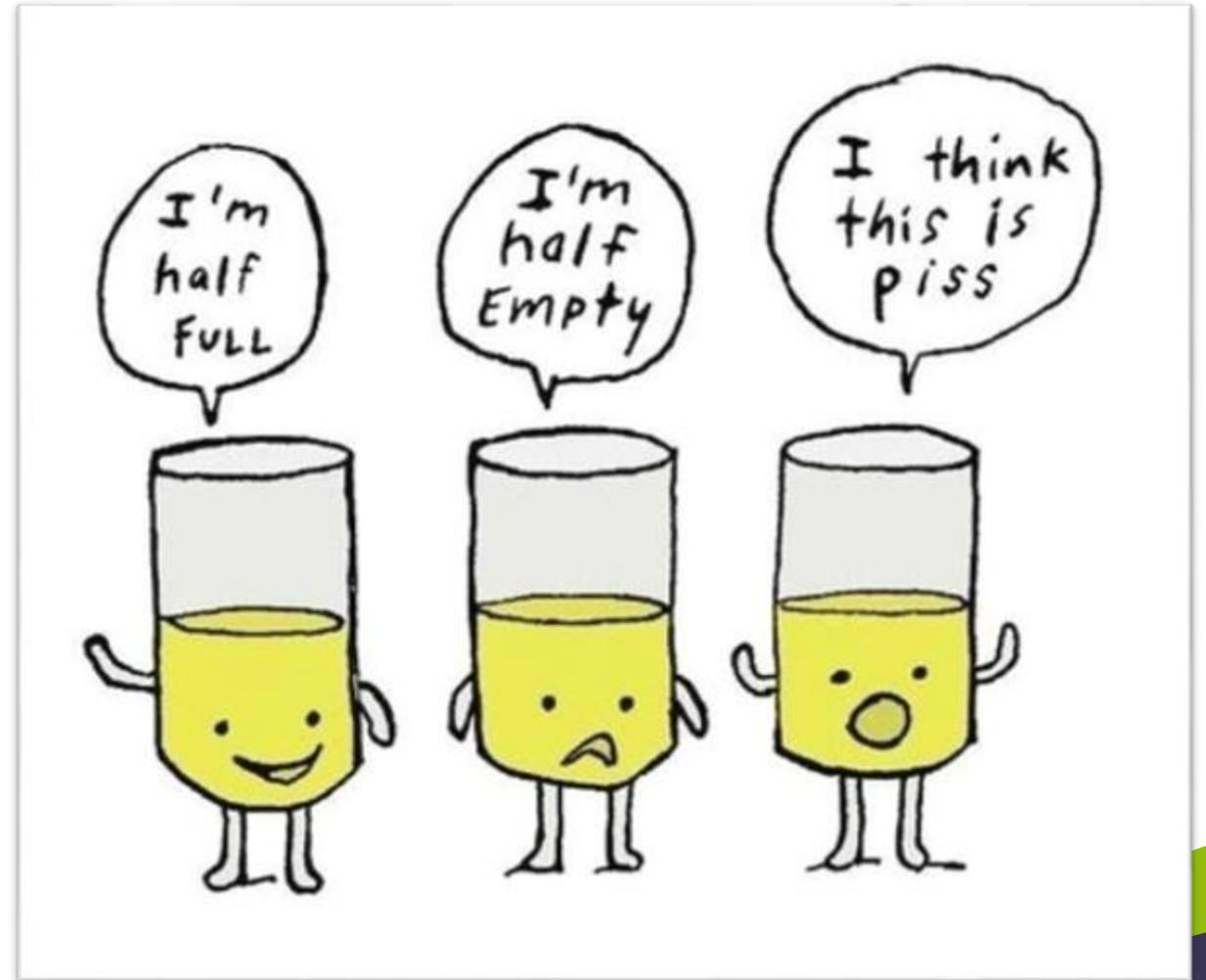
Great — here's a compact, practical briefing you can use right away on **Policy & Regulation for Livestock Agri-Tech**: what matters, where the main regulatory pressures come from, risks and opportunities, and an action checklist for startups, researchers and policymakers.

High-level themes (why regulation matters)

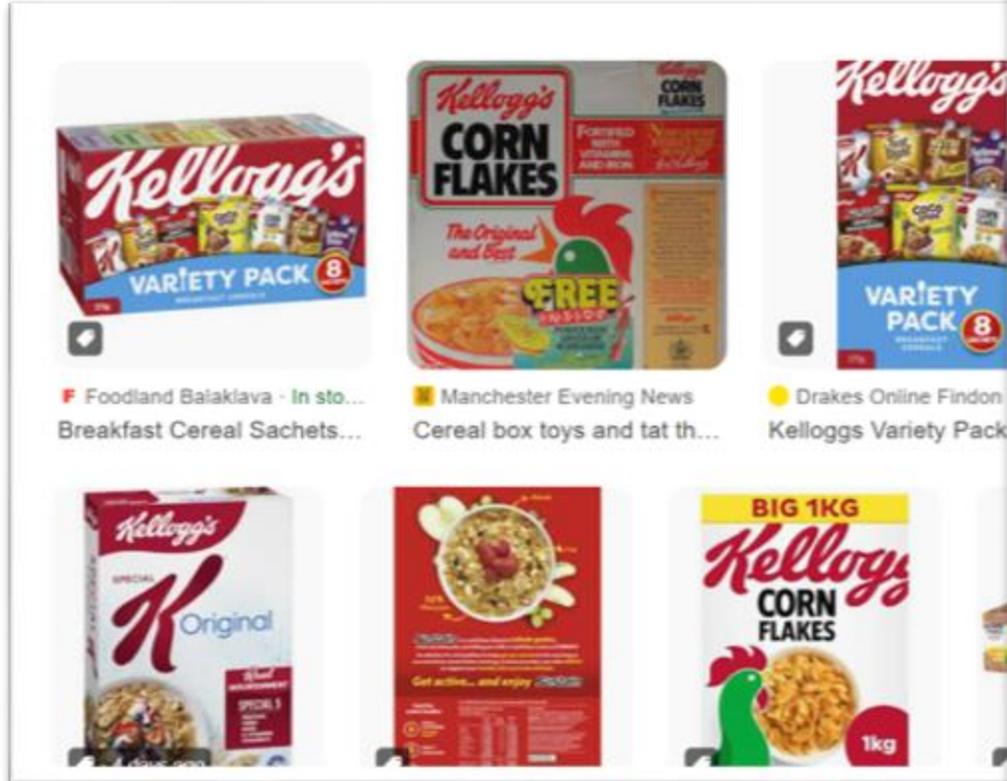
- **Animal welfare & ethics** — tech must meet legal/ethical standards for humane treatment (housing, handling, painful procedures).
- **Biosecurity & disease control** — devices and practices that affect pathogen transmission (e.g., automated feeders, sensors, transport tech) are subject to strict rules and reporting.
- **Food safety & traceability** — provenance systems (RFID, blockchain) must integrate with food safety regimes and official identifiers.
- **Veterinary medicines & inputs** — drugs, vaccines, probiotics, and some feed additives require approvals and prescription controls.
- **Genetics & biotech** — gene editing, cloning, and transgenic animals hit the most regulatory scrutiny and often special permitting.
- **Environmental compliance** — nutrient management, emissions (GHG, ammonia), waste and water use are regulated and may drive technology adoption.
- **Data governance & privacy** — who owns sensor/animal data, consent, allowed uses, and cross-border transfer rules.
- **AI/automation liability & safety** — automated decision systems (feeding, culling, breeding decisions) raise questions about accountability and standards.
- **Cybersecurity & critical infra** — connected systems controlling gates, pumps, medications need resilience and compliance with industry standards.

Who decides what is the truth?

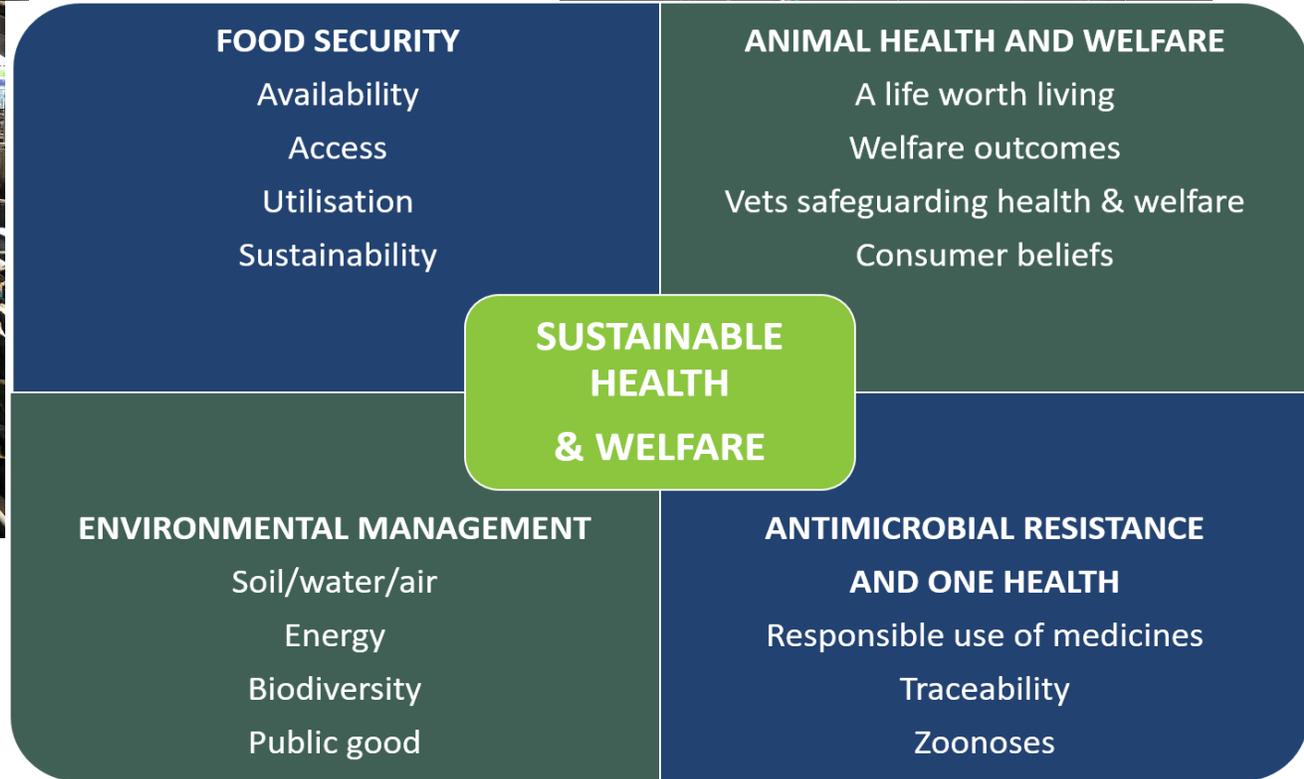
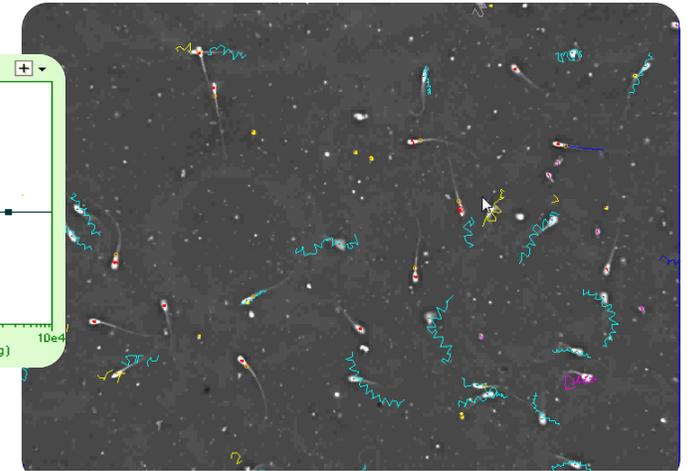
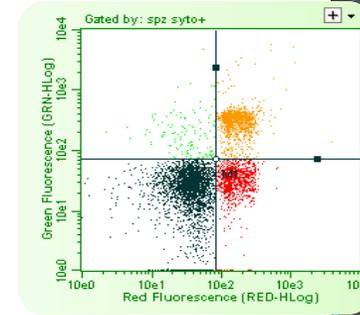
- Validation?
- Authentication?
- Selecting the training dataset is pivotal for machine learning
- Who decides what is right?



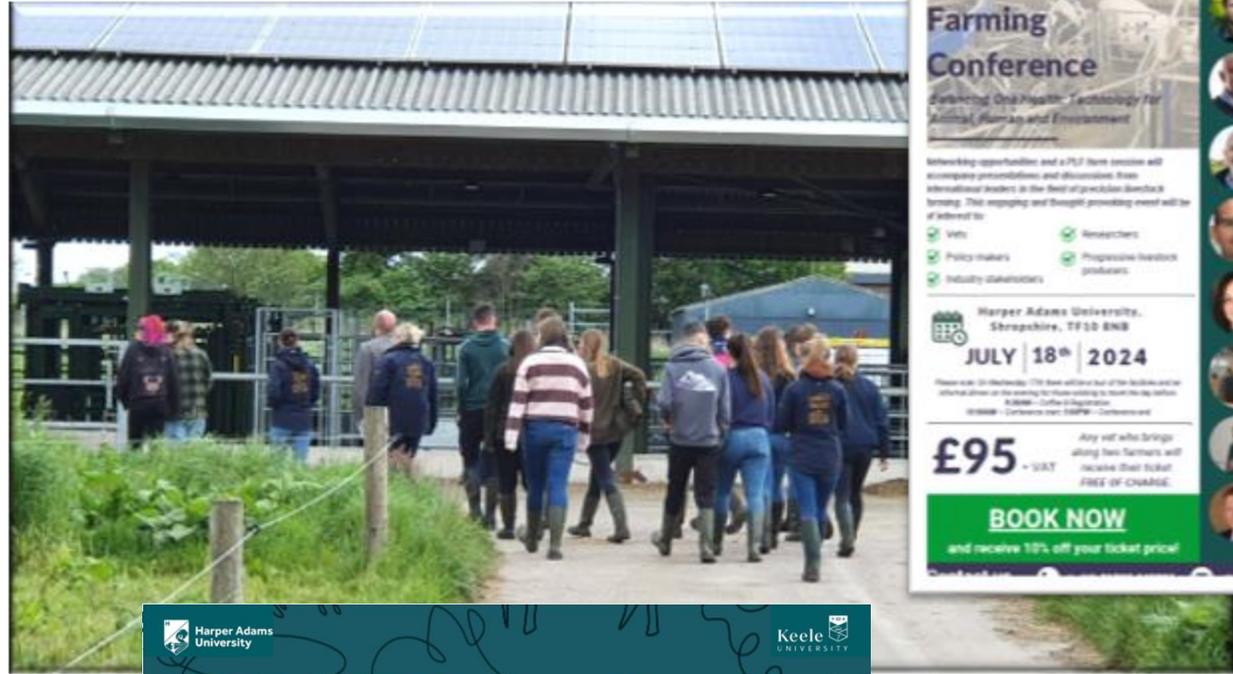
Authentication



Education



Educating Vets, students and animal keepers...and beyond -preparation for the future



RAFT **InSHAW** **BASE**

Precision Livestock Farming Conference

Advancing One Health: Technology For Animal, Human and Environment

Networking opportunities and a PLF farm tour will encourage practitioners and researchers from international leaders in the field of precision livestock farming. This engaging and thought-provoking event will be of interest to:

- Vets
- Policy makers
- Industry stakeholders
- Researchers
- Progressive livestock producers

Harper Adams University, Shropshire, TF10 8NB

JULY 18th 2024

Places are limited! The fee will cover the cost of the tickets and the refreshments on the evening for those staying in the on-site B&BB - Coffee & Reception 8.00am - Coffee & Reception 10.00am - Conference 10.30am - Conference and

£95 + VAT
Any vet who brings along two farmers will receive their ticket **FREE OF CHARGE**

BOOK NOW
and receive 10% off your ticket price!

KEYNOTE SPEAKERS

- Professor Stephen Leffler, Orlans, France
- Professor Ross Atkinson, UK
- Professor Liam Glendon, Harper Adams University, UK
- Professor Mark Butler, Harper Adams University, UK
- Professor Olivier Couvet, University of Poitiers, France
- Dr. Susanna Lena, University of Poitiers, France
- All Clark, Harper Adams University, UK
- Professor Max Kyriazakis, School of Biological Sciences, Harper Adams University, UK
- Julian Lindberg, Harper Adams University, UK

Harper Adams University

Keele University

I. Precision Livestock farming PLF in Practice

Harper & Keele VETERINARY SCHOOL

Harper & Keele **InSHAW** Institute for Sustainable Health and Welfare

RAFT Solutions Ltd

research | advanced breeding | food futures | training

FarmSkills

GROWING FARM BUSINESS SUCCESS

RAFT Solutions Ltd

research | advanced breeding | food futures | training

Online

T Training

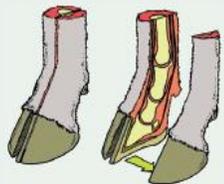


Training and coaching farmers and vets has been at the heart of everything we do for over 20 years, as we work with vets and farmers to develop key skills to improve animal health and welfare and grow farm business success.

From the early days of ATB training delivery for farmers to running highly specialised embryo transfer courses for vets, our team delivers over 50 small group workshops every year.

Our team includes five LANTRA Awards approved veterinary trainers and two who have followed the two day Instructional Techniques workshop.

As part of XLVets, we also helped develop and manage the award winning FarmSkills programme of training, which still forms a key part of our delivery today.



RAFT Solutions Ltd, Mill Farm, Studley Road, Ripon HG4 2QR
T 01765 645893 E office@raftsolutions.co.uk W www.raftsolutions.co.uk



- SemenRate
- RAFT Solutions - About Us
- Working with Partners - Project examples
- GenTORE

VideoThumbnail.jpg



Please click here to talk to booth representatives



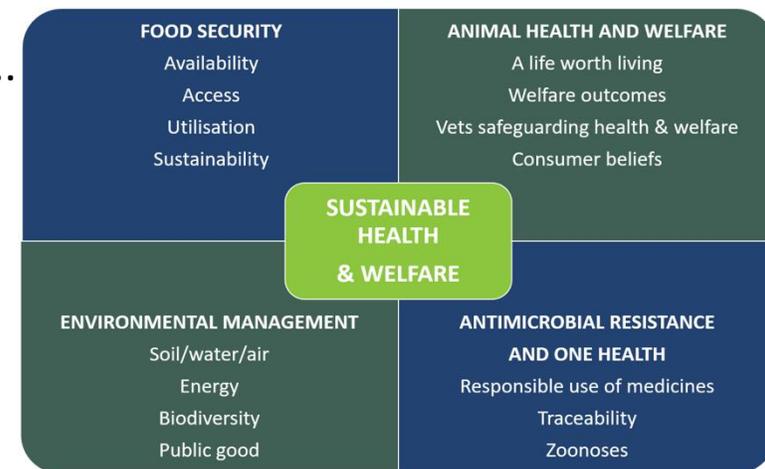
Precision Livestock Farming Conference 2024





Responsibilities & Opportunities

- Digital technology does not have to be binary.....
- Humans and Tech *can* be collaborative
- This is not either/or....
- Human input is *essential*....
- ***Balance*** is the key



Policy & Regulation for Livestock Agri-Tech

1. Introduction
2. Overcoming regulatory challenges for emerging technologies
 - Need for government
 - Smarter regulation
3. **Policy frameworks for sustainable innovation**
 - **Crossing the ‘valley of death’**
 - Investing in Innovation



The screenshot shows the AI(Live) website agenda. At the top is the AI(Live) logo, which features a stylized cow head made of a network of nodes and lines. Below the logo is a navigation bar with five items: HOME, WHAT IS AI(Live)?, AGENDA, SPEAKERS, and REGISTRATION. The AGENDA item is highlighted in a yellow-to-orange gradient. Below the navigation bar, the time slot 14:50 – 15:30: is displayed in bold. The main topic is **Policy and Regulation for Livestock AgriTech**. Below this, there are three bullet points: 'Overcoming regulatory challenges for emerging technologies.', 'Policy frameworks for sustainable innovation.', and 'Speaker: Jonathan Statham – Chair Animal Health and Welfare Board for England'. At the bottom left of the screenshot, there is a small logo for 'The Farm/Innovate'.

Policy frameworks for sustainable innovation

Investing in Innovation

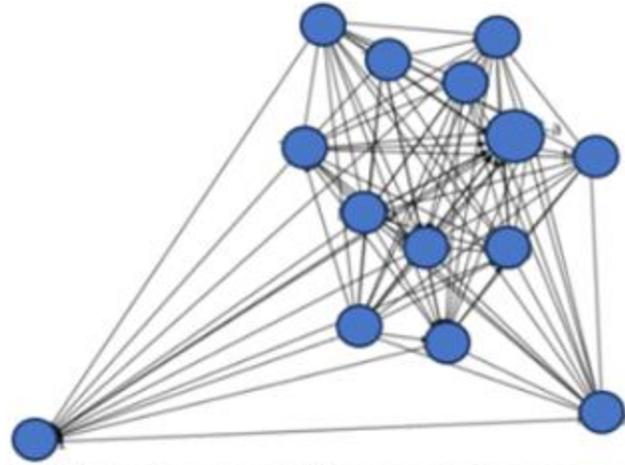
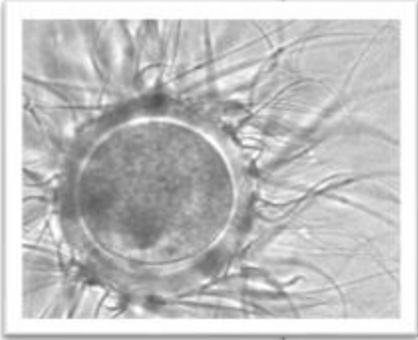


Figure 17: Bayesian network of target cytokine interactions

Bayesian network of target cytokine interactions

- **Engineering biology**
 - Agri-Tech & Bio-tech
 - Life sciences
- **Data/Digital**
 - Artificial intelligence

■ ■ UK Regulatory Roadmap for Livestock Agri-Tech

Core Regulatory Bodies

- Defra – Animal health, welfare, environment
- APHA – Disease control, biosecurity
- VMD – Veterinary medicines, feed additives
- FSA – Food safety, traceability
- Environment Agency – Emissions, waste, permits
- ICO – Data protection (UK GDPR)

Key Regulatory Areas

- Animal Welfare Act 2006 & farmed animals regulations
- APHA notifiable disease reporting requirements
- VMD approval for medicines & diagnostic devices
- Food traceability via livestock ID systems
- Environmental permitting (emissions, waste, water)
- Data protection under UK GDPR & DPA 2018

Risks & Opportunities

- Risk: Misclassification of product (VMD delays)
- Risk: Unverified claims → Trading Standards action
- Opportunity: Defra & UKRI innovation grants
- Opportunity: Demand for Net Zero & welfare tech

Action Checklist

- Classify product early (equipment, software, veterinary)
- Embed welfare safeguards & APHA reporting compliance
- Draft farmer data agreements (UK GDPR aligned)
- Check environmental permits for emissions/waste
- Run validated trials with UK vets & farms
- Engage Red Tractor / RSPCA Assured for credibility

Quick Win Strategy

- Pilot in sandbox with Defra/APHA engagement
- Demonstrate welfare, disease & sustainability alignment
- Apply for Innovate UK / Defra scaling grants
- Position as enabler for Net Zero & traceability goals





GOV.UK

<https://assets.publishing.service.gov.uk> › media PDF

Industrial Strategy: Digital and Technologies Sector Plan

9 Jun 2025 — We will take a whole-of-government approach to delivering this vision, reforming the business environment for digital and technology businesses ...

74 pages

1. Developing and deploying critical technologies

Technology has the potential to significantly influence the UK's future prosperity, security, and global leadership. By making best use of our strengths, we can improve lives for citizens, create opportunities for growth and maximise the strategic advantage we create.

The government is committed to making strategic choices and supporting the technologies which are most critical to the UK, including:

- advanced connectivity technologies (formerly called future telecoms)
- artificial intelligence
- engineering biology
- quantum technologies and
- semiconductors

2. Signalling UK strengths and ambitions

The UK must clearly communicate its global leadership in science and technology.



UK Government

THE UK'S MODERN
INDUSTRIAL
STRATEGY

DIGITAL AND
TECHNOLOGIES

Sector Plan



research | advanced bree



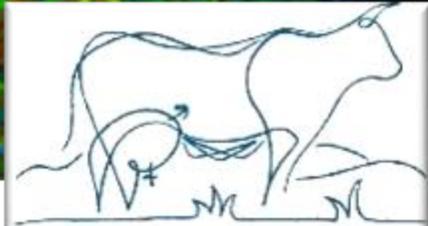
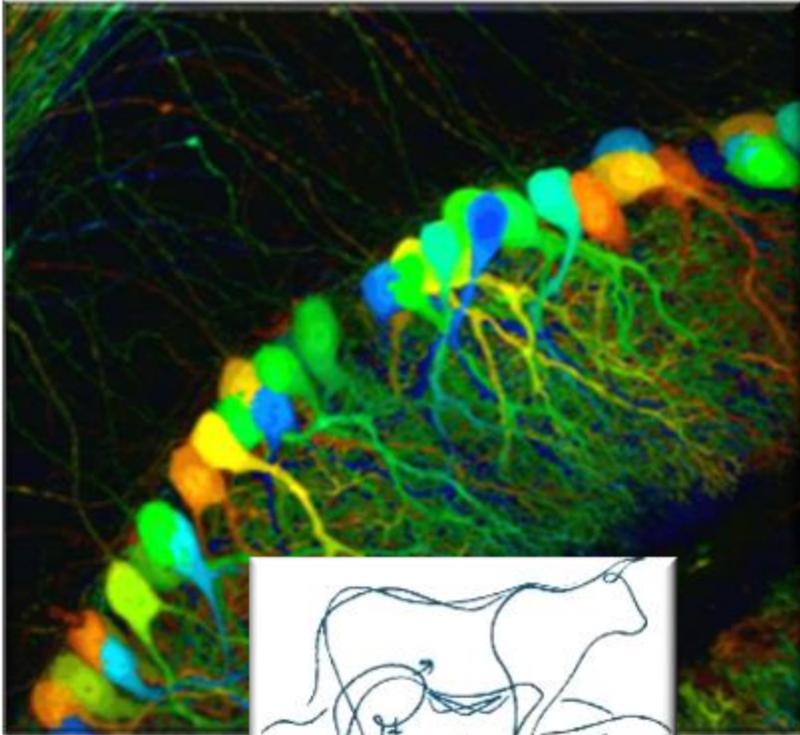
1. **A new Engineering Biology Steering Group** will bring together both the current and the next generation of academic, start-up and industry leaders in engineering biology working in the UK.
2. **World-leading R&D:** We will target public investment towards world-class R&D on the critical challenges and foundational research that will enable innovation breakthroughs and the creation of new products. We will invest £2 billion over the next 10 years in engineering biology.
3. **Infrastructure:** We will invest in UK infrastructure to reduce the costs of both the early stages of engineering biology innovation, and its scale-up. We will develop a plan for UK facilities supporting start-ups and scale-ups.
4. **Talent and skills:** We will grow and retain a diverse talent pool within the UK to match demand from academia and industry, covering scientific, technical and entrepreneurial skills. We will invest in fellowships and doctoral training including the new Discovery Fellowships.
5. **Regulation and standards:** We will work across government and with all relevant regulatory bodies to ensure that the UK's regulatory landscape will help engineering biology-derived products to reach the market. Using the new Engineering Biology Regulators' Network, government will implement a set of regulatory sandboxes to create pathways for this to happen.
6. **Adoption in the wider economy:** We will foster a cohort of investors and customers who are well-informed about engineering biology's potential, and a pipeline of firms who understand potential customers' priorities. We will hold a showcase of the most exciting engineering biology firms. Government sector teams will raise awareness of engineering biology across their sectors to ensure the pull through of products and services.
7. **Responsible and trustworthy innovation:** We will make the UK a world leader in responsible innovation by 2030. Government will lead an open dialogue on the benefits, challenges and risks of the technology, encouraging a renewed commitment to responsible research and innovation. We will work with allies and partners to shape international norms and standards, including through multilateral forums.

- **Regulation and standards:** We will work across government and with all relevant regulatory bodies to ensure that the UK's regulatory landscape will help engineering biology-derived products to reach the market.
- Using the new Engineering Biology Regulators' Network, government will implement a set of regulatory sandboxes to create pathways for this to happen.

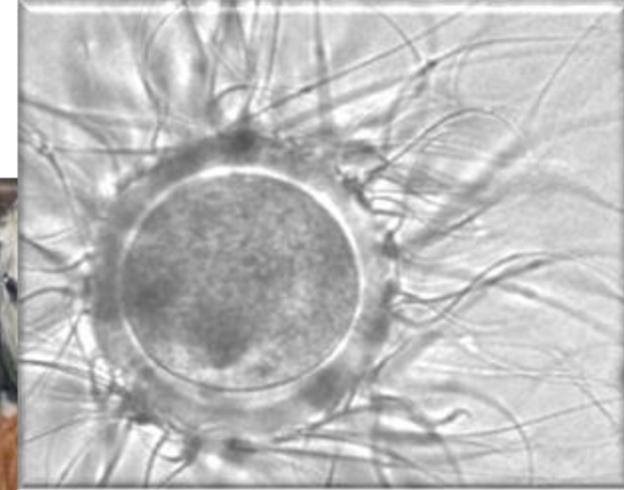


Genetics -Resilience & Efficiency

Advanced Breeding & Genomics



GENTORE

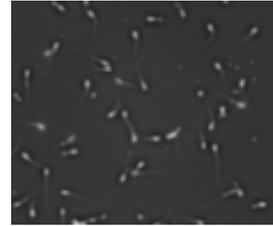


PLF & Sustainable Breeding: MultiModal Semen Analysis



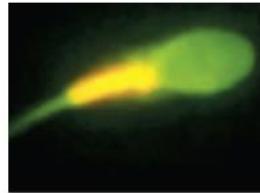
Microscope/CASA
observation

External and kinetic parameters
(motility, concentration)

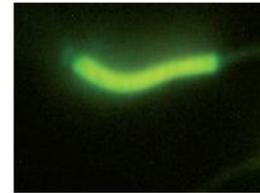


Flow cytometry
analysis

Internal physiological parameters



High potential



Low potential



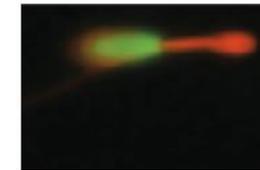
Live



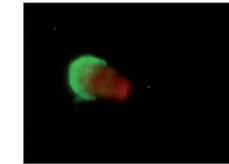
Dead



Normal organization



Membrane phospholipid
disorder



Disrupted acrosome

Helps to take an
objective
decision on
Semen quality



A Machine Learning Model for Frozen-thawed Bull Semen Quality Assessment

Isaiah Akinyemi¹, Theocharis Kyriacou¹, Katie Burton² and Jonathan Statham^{2,3}

¹Keele University

²RAFT Solutions

³Harper and Keele Veterinary School

Keele
UNIVERSITY



ML Algorithm Model Testing and Evaluation

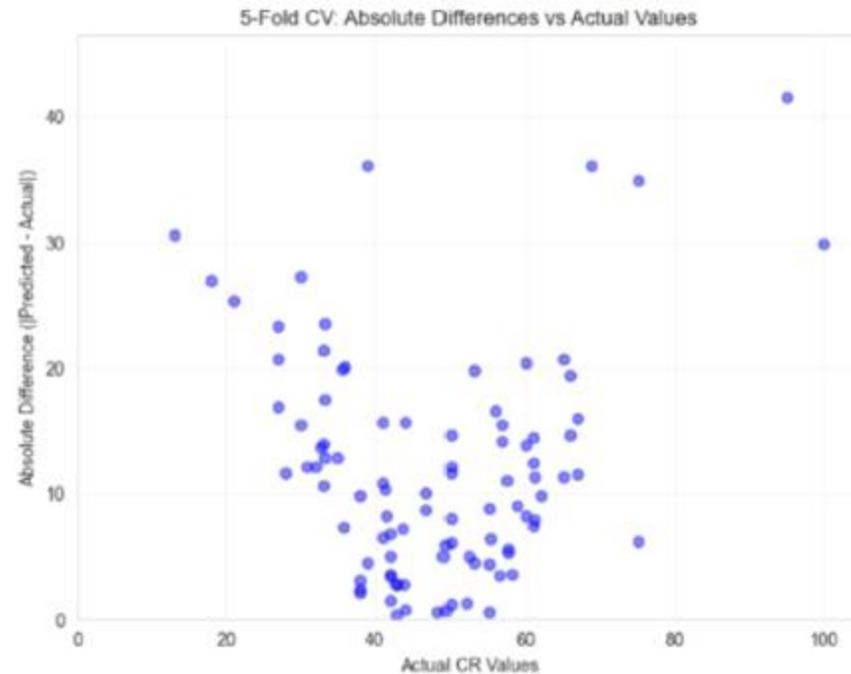


Figure 5: Batch Actual vs Absolute Difference

It can be observed in figure 5 that the model produces less error between 0-20% when actual CR is between 28% and 67%.

When CR is less than 40% and greater than 60%, the errors in prediction of CR increases.

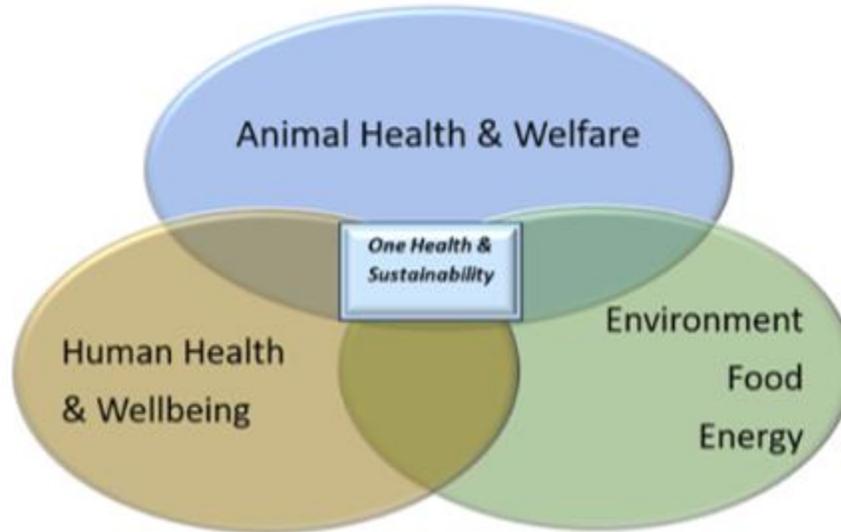
We used machine learning to interrogate the importance of semen parameters in our model. Figure 6 shows this importance by ranking the input parameters used in the calculation of the output (CR).

Animal Health and Welfare Board England (AHWBE)

AHWBE Vision & Strategy September 2025

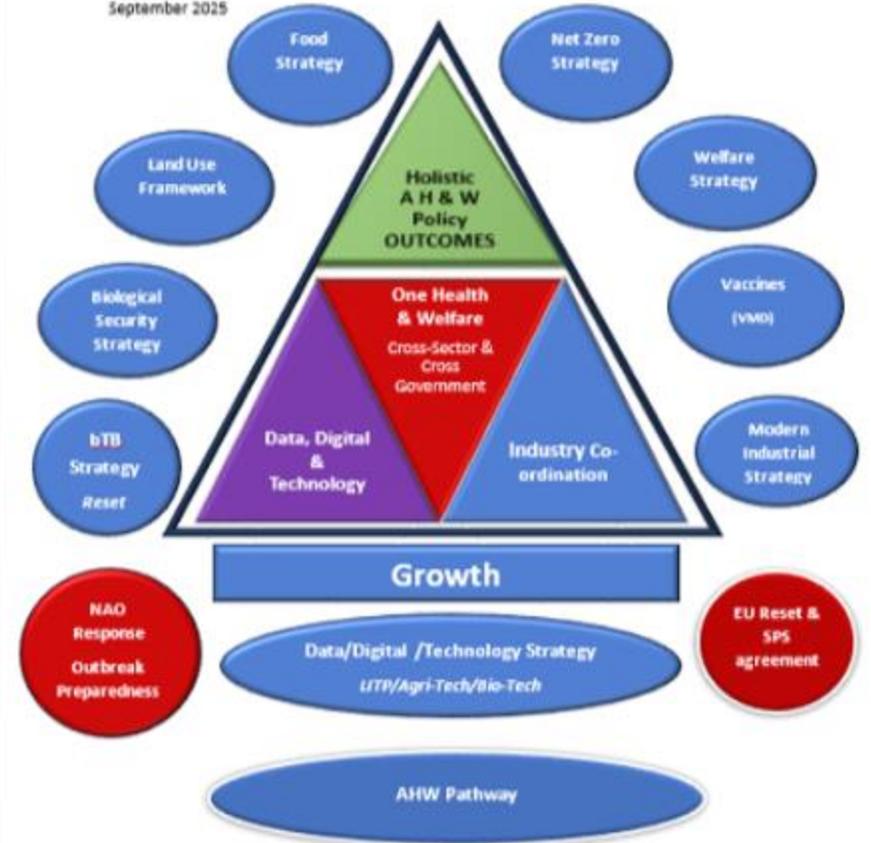
VISION

1. Leading thinking on a new, inclusive cross-cutting 'One Health & Welfare' balance that champions evidenced high standards of animal health, welfare and **sustainable productivity** across government and wider society



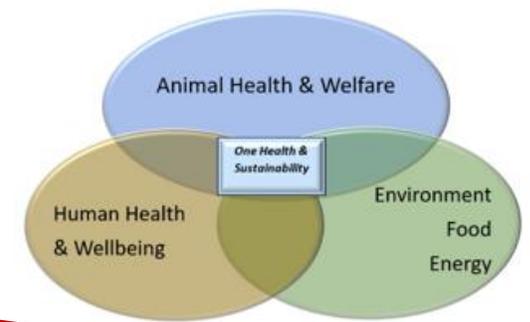
Animal Health and Welfare Board England (AHWBE)

September 2025



Animal Health and Welfare Board England (AHWBE)

Autumn Strategy: 6 points



1. Support government development and signposting of a ***sound evidence base*** to measure and manage balanced animal health, welfare and ***sustainable productivity*** within a wider 'One Health & Welfare' approach for society over the next three to five years.
2. Support government to deliver a new cross-cutting agenda **by *building connections*** to achieve a resilient balance between animal health & welfare, the environment, technology, human health & food security.
3. **Control or eradicate key endemic, exotic and zoonotic disease** of kept animals
4. Improve **education/KE/Skills** of all animal keepers/stakeholders
5. Promote the **traceability & authentication** of biosecure food and all kept animals in *international trade deploying a sound data/digital strategy*
6. Manage conflicts and threats to the vision of achieving the One Health & sustainability balance through Animal Health & Welfare through providing a ***forum for leading consensus.***

*Animal Health and Welfare: Protecting and improving
our reputation*

The Animal Health and Welfare Pathway



Department
for Environment
Food & Rural Affairs

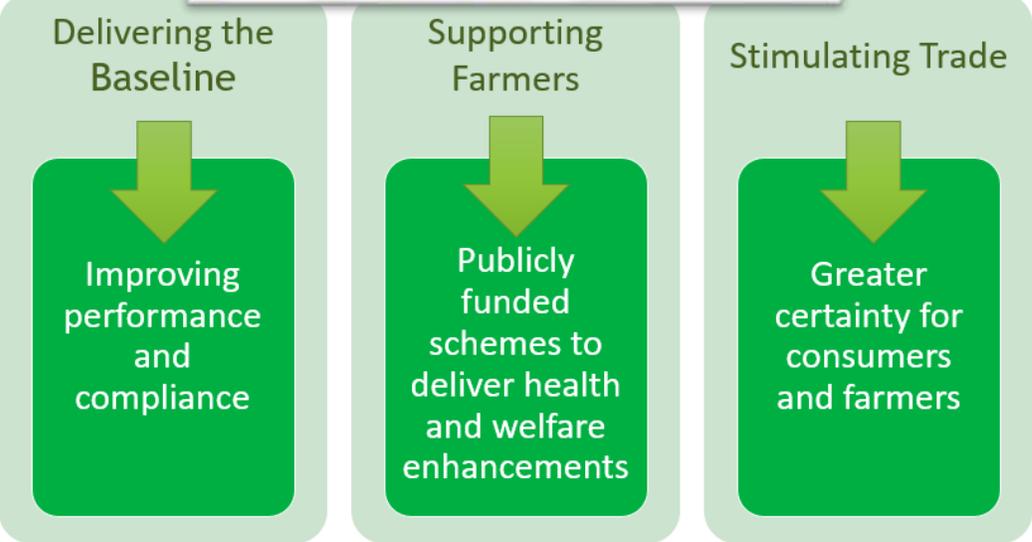


2. Animal Health & Welfare Pathway- Grants



Animal Health and Welfare: Protecting and improving our reputation

The Animal Health and Welfare Pathway



US investment in UK Tech?

UK leads to secure 30% of the top 10 RegTech deals as funding halved in Q3 QoQ

Company	Funding (\$Bn)
Veritas	\$220.0m
ADICorWab	\$63.0m
Devo	\$40.0m
Sedric	\$40.0m
Aveni	\$33.0m
Comcast	\$3.0m
Authia	\$3.0m
Smiply	\$3.0m

FinTech Global
RegTech deals as funding halved i...

TECH COMPANIES TO INVEST IN BRITAIN
to unleash growth

GOV.UK
Raft of tech companies investing in ...

US-UK SIGN 'RECORD-BREAKING' DEAL

2 days ago

YouTube
Biggest Investment Package In British ...

THE UK'S MODERN INDUSTRIAL STRATEGY

a day ago

Chosunbiz
UK attracts \$280 trillion investment ...

Investment in the UK grow by 44% in 2019 compared to last year.

Legal IT Insider
JK tech sector outpaces China and US to ...

US-UK Tech Prosperity Deal

3 days ago

Devdiscourse
US-UK Tech Prosperity Deal:...

Beyond the 'Silicon Kingdom' slogan ...

a day ago

LBC
Beyond the 'Silicon Kingdom' slogan ...

Year	UK Unicorns	UK Startups
2019	0	15
2020	24	85
2021	31	126

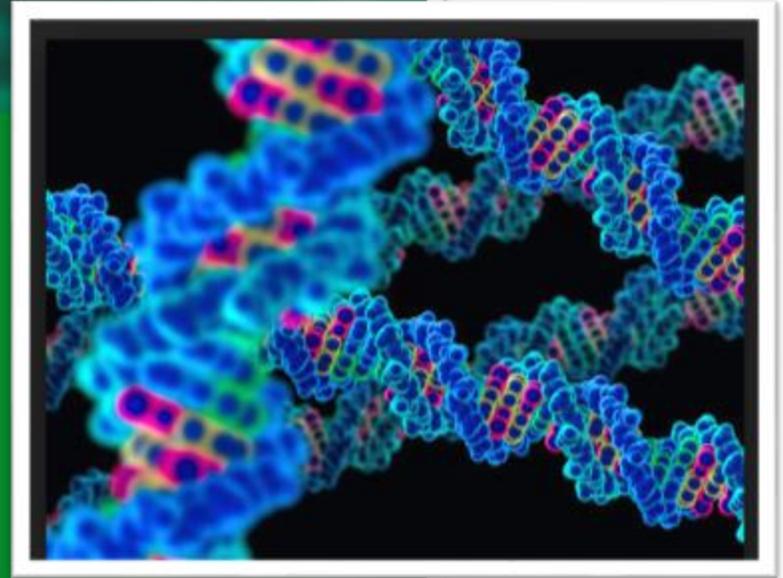
Startups Magazine
UK tech industry grew unicorns ...

Selling less of the family silver:

Better UK innovation and industrial policies
for economic growth

David Connell and Bobby Reddy

July 2024



Faculty of Law

- > Research Centres
- > Institute of Criminology
- > Computer Office
- > Squire Law Library
- > Moodle
- > Log in

[Home](#)[About](#)[People](#)[Courses](#)[Research](#)[International links](#)[Access & outreach](#)[Alumni & development](#)

News Articles

[Current](#)[2025 Archive](#)[2024 Archive](#)[2023 Archive](#)[2022 Archive](#)

Selling less of the family silver: boosting UK growth

Monday, 15 July 2024

Changes to UK innovation and industrial policy could reduce the early sale of promising companies to overseas firms and increase economic growth, says new report from [Cambridge Judge Business School \(JBS\)](#) co-authored by Faculty Professor of Corporate Law and Governance [Bobby Reddy](#).

The early sale of venture capital-backed science and technology-based start-ups is the most important problem facing UK innovation and industrial policy, says a report issued last week (11 July) by the [Centre for Business Research \(CBR\)](#) at Cambridge Judge Business School.

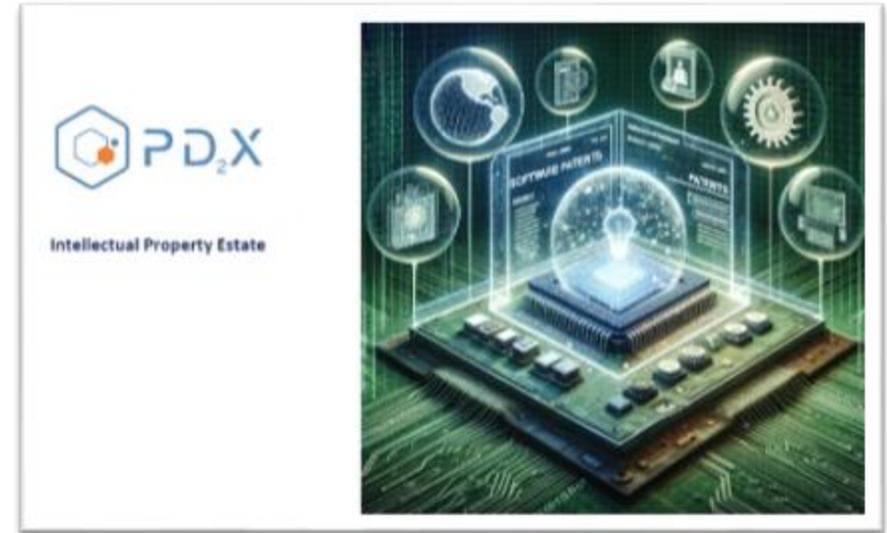
Although the sale of large, mature firms such as ARM and Micro Focus often create headlines, acquisitions of earlier-stage innovative British companies – such as Deepmind, Solexa, Skyscanner, Shazam and Neptune Energy – by overseas buyers are arguably more damaging to the British economy.



"It is essential that ambitious entrepreneurs with the desire and ability to grow a major UK corporation are given as much help as possible to do so, whether this be as a public or private company," says the 66-page report, entitled *Selling less of the family silver*.

Practical regulatory checklist for startups & implementers

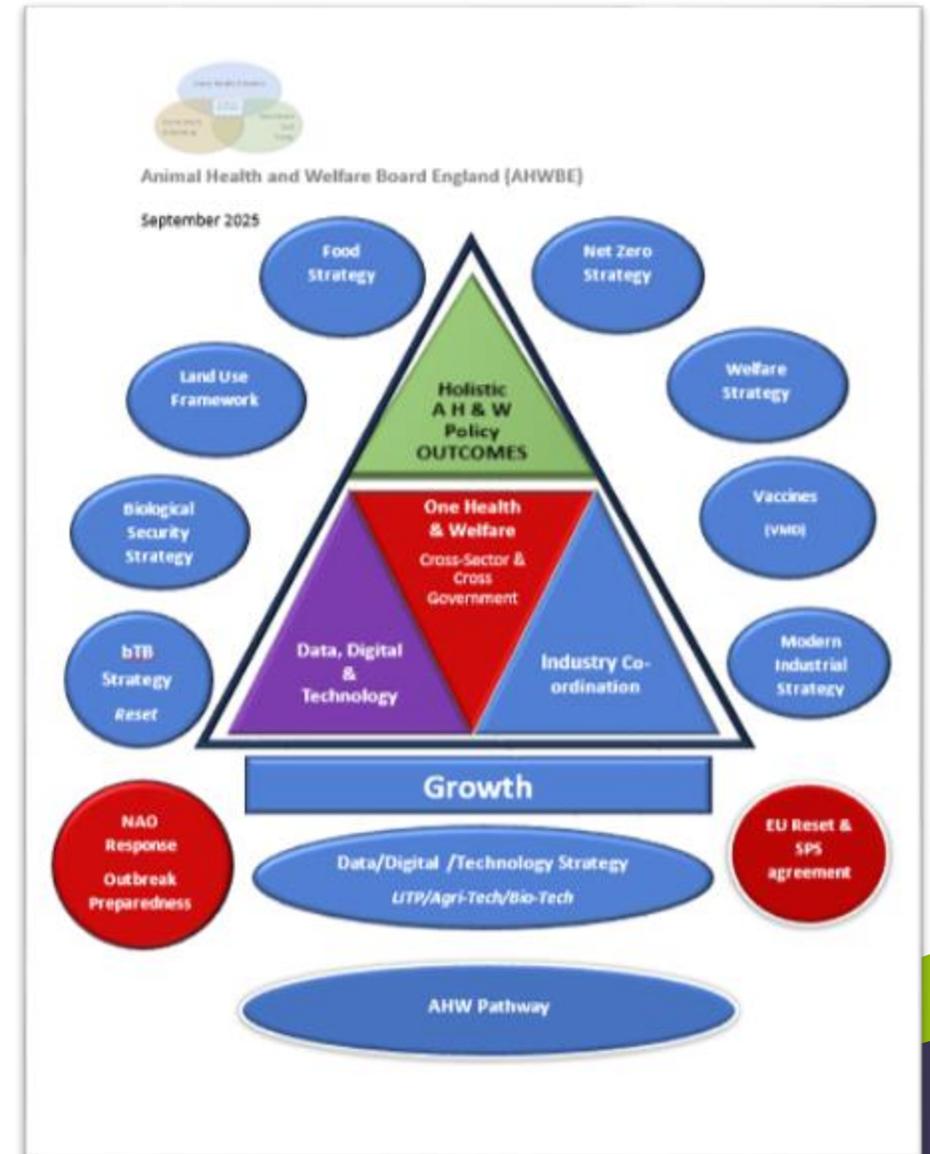
- Determine product classification early: device, veterinary product, software-as-medical/veterinary, or ag equipment.
- Map applicable authorities & standards in target markets (national + regional).
- Build **data governance**: clear ownership, consent forms for farmers, retention policy, breach plan.
- Avoid unverified therapeutic claims in marketing; base claims on validated trials and compliant language.
- Engage veterinary professionals early for trials and ethical approval.
- Plan for **traceability** integration: use accepted identifiers (ear tags, national IDs) and interoperability standards.
- Include animal welfare KPIs and monitoring in deployments; keep logs for audits.



- Design cybersecurity controls and document them (access, updates, incident response).
- Factor regulatory timelines and documentation into budgeting—testing, validation, and approvals take time.
- Consider insurance / product liability coverage aligned with automated decisions.

Policy levers that accelerate responsible adoption

- **Regulatory sandboxes** — allow limited trials under supervision (great for data-driven products).
- **Standards & certification schemes** — interoperability, data formats, and animal welfare certifications build trust.
- **Subsidies & procurement** — government programs that fund adoption if tech meets regulatory requirements.
- **Open data platforms** — with privacy protections to enable disease surveillance and research.
- **Public-private partnerships** — for disease reporting, vaccination campaigns, digital ID programs.



Policy & Regulation for Livestock Agri-Tech: Summary

1. Overcoming regulatory challenges for emerging technologies
 - Need for government
 - Smarter regulation
2. Policy frameworks for sustainable innovation
 - Crossing the 'valley of death'
 - Investing in Innovation



The screenshot shows the AI(Live) event website. At the top is the AI(Live) logo, which features a stylized cow head made of a network of nodes and lines. Below the logo is a navigation bar with five items: HOME, WHAT IS AI(Live)?, AGENDA, SPEAKERS, and REGISTRATION. The AGENDA item is highlighted. Below the navigation bar, the time slot 14:50 – 15:30: is displayed, followed by the title **Policy and Regulation for Livestock AgriTech**. Underneath the title are three bullet points: 'Overcoming regulatory challenges for emerging technologies.', 'Policy frameworks for sustainable innovation.', and 'Speaker: Jonathan Statham – Chair Animal Health and Welfare Board for England'. At the bottom left of the screenshot, there is a small logo for 'Blue Farm/InnovateUK'.

Thank you
Any questions?



Innovation in
sustainable
livestock food
production

www.raftsolutions.co.uk

