Agri-tech developments in the beef and sheep sectors

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AFCP/HAU Conference
Animal Science – Addressing Current Challenges
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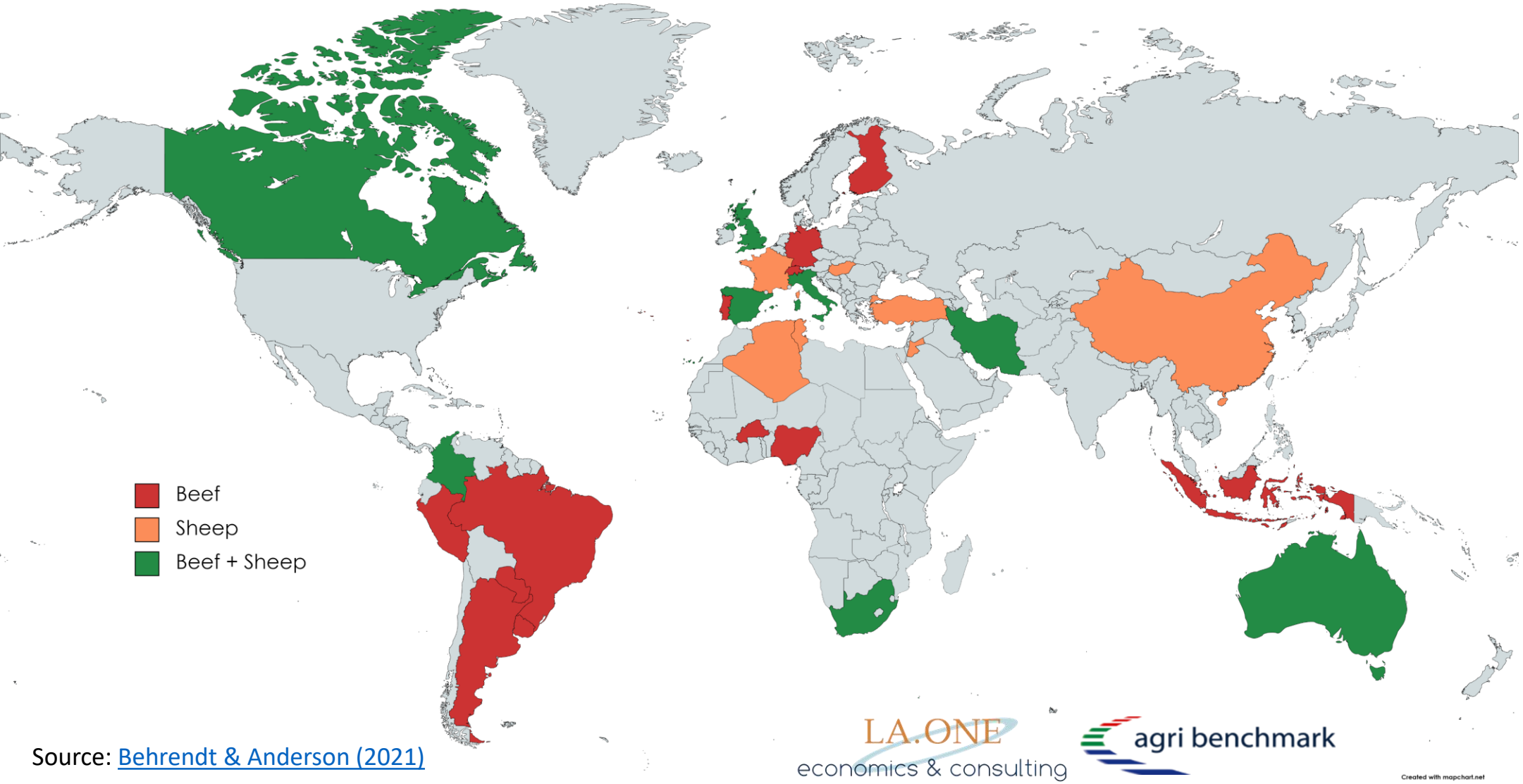
2020 Global PLF technology adoption: Expert Opinion Survey



Countries
(n = 27)

Respondents
(n = 57)

Source: Behrendt & Anderson (2021)

LA.ONE economics & consulting

agri benchmark

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Global adoption of 53 technologies…

Data/Decision Making & Marketing technologies	Mean	S.E.
DSTs	16	3.2
Mobile_Apps	12	2.1
Ind_Dbase	23	3.6
Livestock_Trace	37	5.2
Distribu_Ledger	20	4.1
Carcass_feedback	24	4.1
Market_Info	40	4.7
Accounting_sw	30	3.9
Farm_records_sw	25	3.3
Auto_weather	10	2.3
Manual_weather	16	3.2
Online_Climate	43	4.9
Auto_barn	6	1.7
Manual_barn	15	3.5
Video_surv	13	2.7

PLF Technology	Mean	S.E.
Accelerometers	3	0.9
Rumen_bolus	6	1.7
WoW	9	2.2
Preg_scan	31	3.8
A_Insem	25	3.7
Enbryo_trans	6	1.6
Sexed_semen	6	1.9
Oestrus_sync	17	3.2
Genetic_Dbase	20	3.3
FCR	7	1.9
Handlers	40	4.6
Weigh_scales	39	4.2
RFID	40	5.4
Tagging	51	5.1
GPS_loc	3	1.2
BCS	3	1.1
BCS_man	20	2.9
Dose_control	4	1.7

Precision feeding/housing technologies	Mean	S.E.
Mech_Feed	16	2.9
NDVI	5	1.5
DM_man	8	2.0
Soil_moist	7	1.4
Auto_irrg	7	1.4
GPS_fert	10	2.4
VRT_fert	5	1.0
Soiltest_low	15	2.9
Soiltest_high	6	1.9
Precision_DM_graze	4	1.0
Rot_graze_low	20	2.5
Auto_feed	6	1.3
Lick_feed	14	2.6
Virt_fence	5	2.1
Bunk_scan	1	0.3
Auto_straw	1	0.3
Auto_clean	3	1.4
Auto_water	2	0.7
Feed_add	12	2.8
Implants	11	3.2

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Behrendt, K. & Anderton, L. (2021) Global adoption of precision livestock farming technologies. Digitalisation in Livestock Farming – agri benchmark Beef and Sheep Seminar Series. 13 October 2021

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Drivers of PLF technology adoption…

Driver of PLF Technology Adoption *	Mean	S.E.
Upfront cost of investment	4.1	0.11
Profit from adoption	3.8	0.13
Environmental costs and benefits	2.5	0.12
Scale of farming	3.8	0.13
Trialability of technology	3.2	0.11
Awareness of technology	3.5	0.13
Risk of adopting technology	3.2	0.14
Ease and convenience of technology integration	3.6	0.13
Technology's match with personal goals	3.7	0.14
Short term constraints (e.g. family needs, drought, low prices)	3.5	0.15
The social or cultural appropriateness of technology	3.0	0.16
Farmer's level of education, skills, or knowledge	3.9	0.13

1 = Not influential at all; 2 = Slightly influential; 3 = Moderately influential; 4 = Very influential; 5 = Extremely influential

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* Kuehne et al. (2017) Predicting farmer uptake of new agricultural practices: A tool for research, extension and policy. *Agricultural Systems*, 156, pp115-125.

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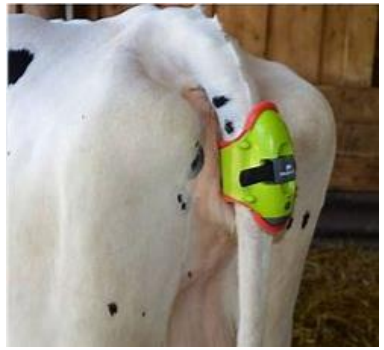
Technologies transforming beef and sheep sector

- Identification (biometrics & recognition – image processing) & traceability (RFID/EiD)
- Welfare and production monitoring (telemetrics, biometrics, physiological state/biosensing, image analysis)
- Genomics – gene editing (disease resistance, NFE etc)
- Phenotypics – G x E x M interactions
- Robotics/sensors – milking, herding, spatial monitoring
- Metabolic modifiers – anabolics, growth hormones, feed additives (e.g. methane inhibitors – 3-NOP, Bromoform)
- ICT (LoRa Technology & IOT)

Transforming livestock systems with precision technologies…



CERES TAG

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Transforming livestock systems with precision technologies…

C-Lock SmartScale

C-Lock GreenFeed System

D4AgEcol
DIGITALISATION FOR AGROECOLOGY

Funded by the European Union

UKRI Innovate UK

BREED FOR CH4NGE
BREEDING LOW METHANE SHEEP

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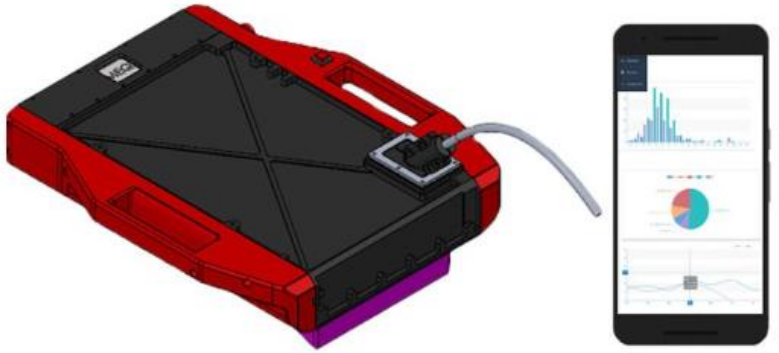
Transforming traditional supply chains…

MEQ Probe has been developed to objectively measure eating quality

Nanoscale Biophotonics >> spectral signatures >> Intramuscular Fat, Shear Force, and pH of the meat.

MEQ Live provides estimates of yield and meat eating quality on live animals



Source: ABC, permission MEQ Probe (31/10/2018)
https://www.meqprobe.com/

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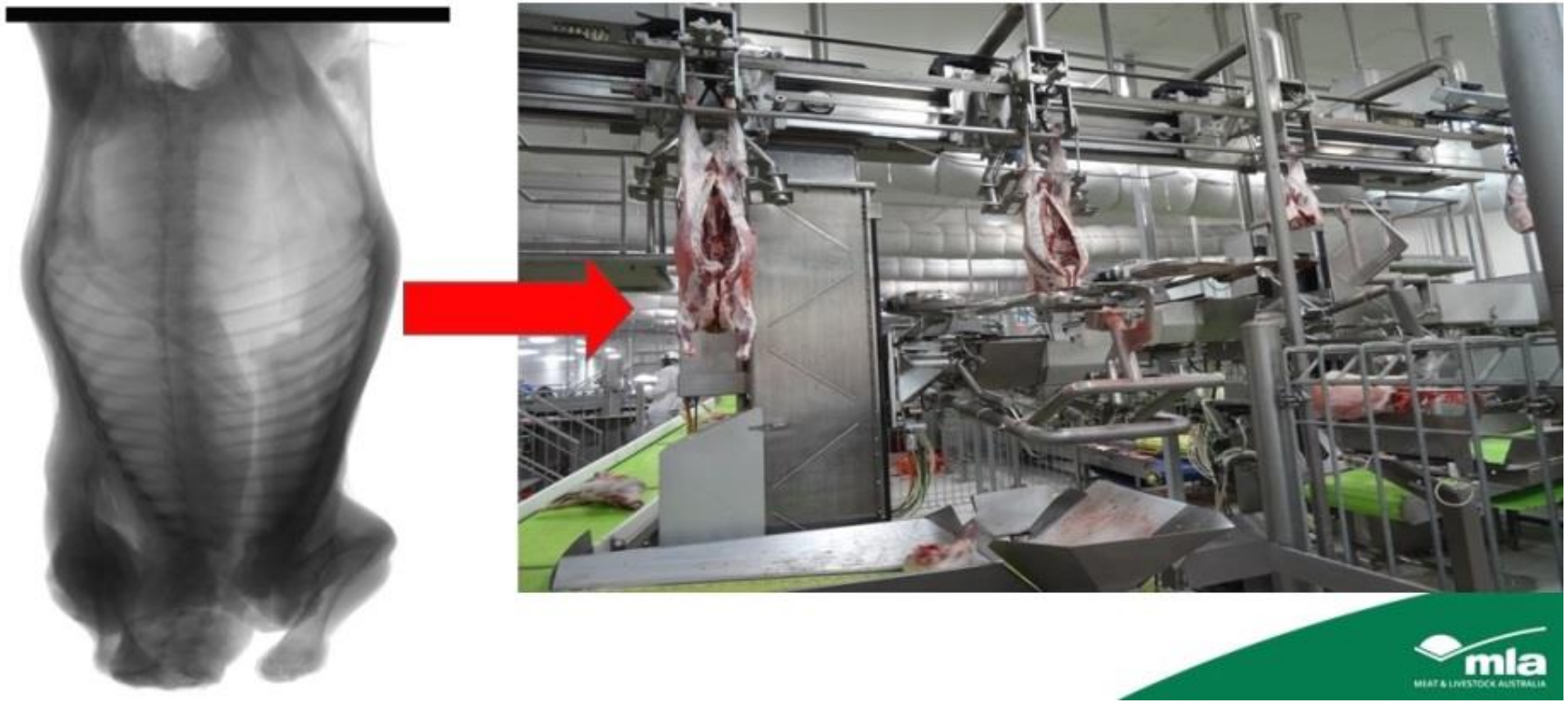
Transforming traditional supply chains…

DEXA whole of carcase scanning systems

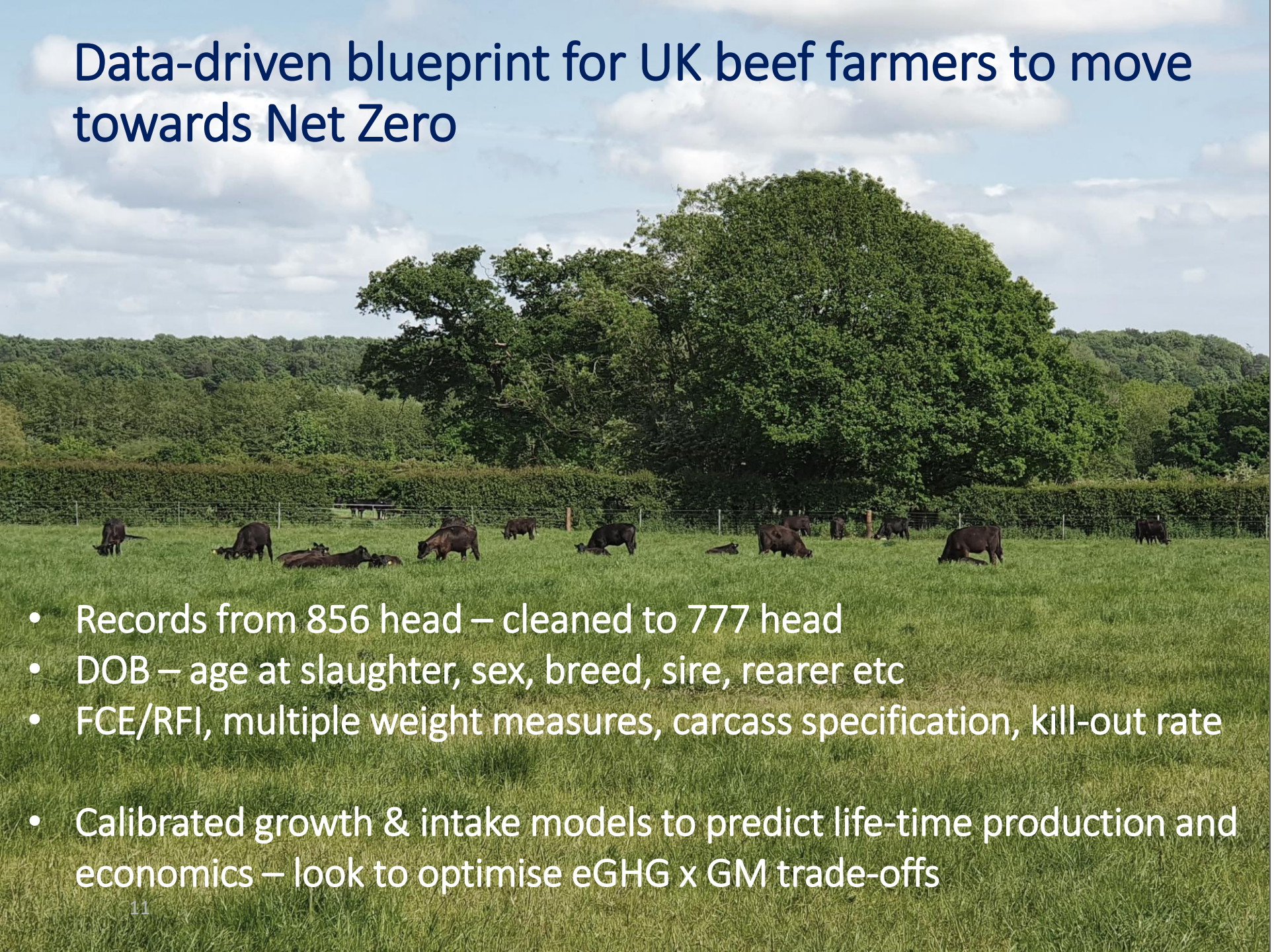
JBS Bordertown and Scott Automation & Robotics



Challenges to technology adoption…

- Decision makers informing design & development
- Inter operability & system integration - Sensors and data acquisition
- Business models for data management & ‘trust in sharing’
- Information sources for big data analysis
- ICT challenges & connectivity
- Support/servicing networks for new technologies
- Social perspectives on high-tech agriculture
- ECONOMICS of adopting a technology

Data-driven blueprint for UK beef farmers to move towards Net Zero



- Records from 856 head – cleaned to 777 head
- DOB – age at slaughter, sex, breed, sire, rearer etc
- FCE/RFI, multiple weight measures, carcass specification, kill-out rate

- Calibrated growth & intake models to predict life-time production and economics – look to optimise eGHG x GM trade-offs

Capper, J., Ford, L., Behrendt, K., Harris, E. (2023) Helping farmers navigate the green economy: A data-driven blueprint for net zero beef. Animal – science proceedings, 14(2): 388-389. https://doi.org/10.1016/j.anscip.2023.01.515

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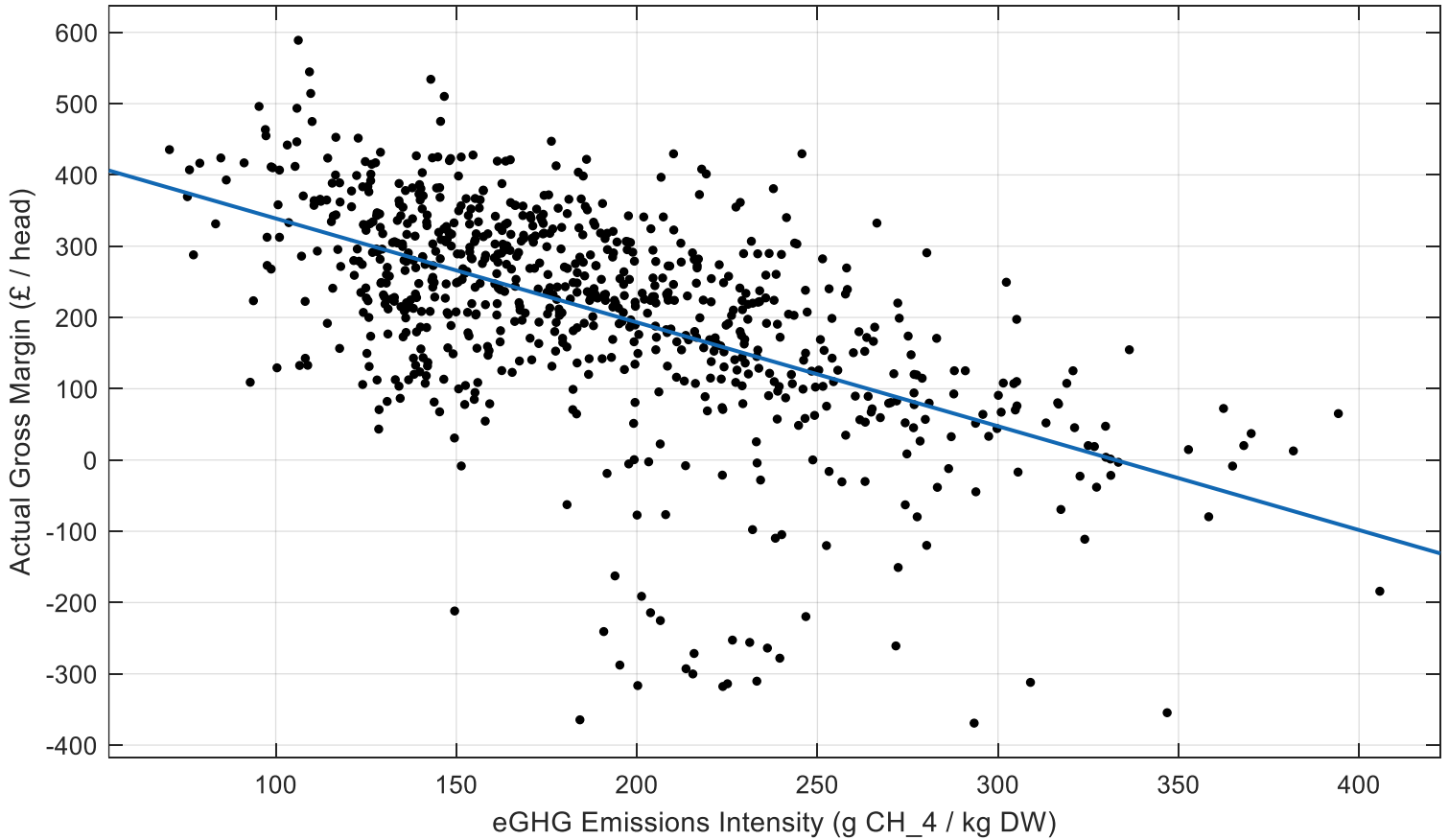
eGHG Emission Intensity & Economic

~~Trade-offs~~ win:win



GM = -1.457 x eGHG EI + 484.6 R-square: 0.3193

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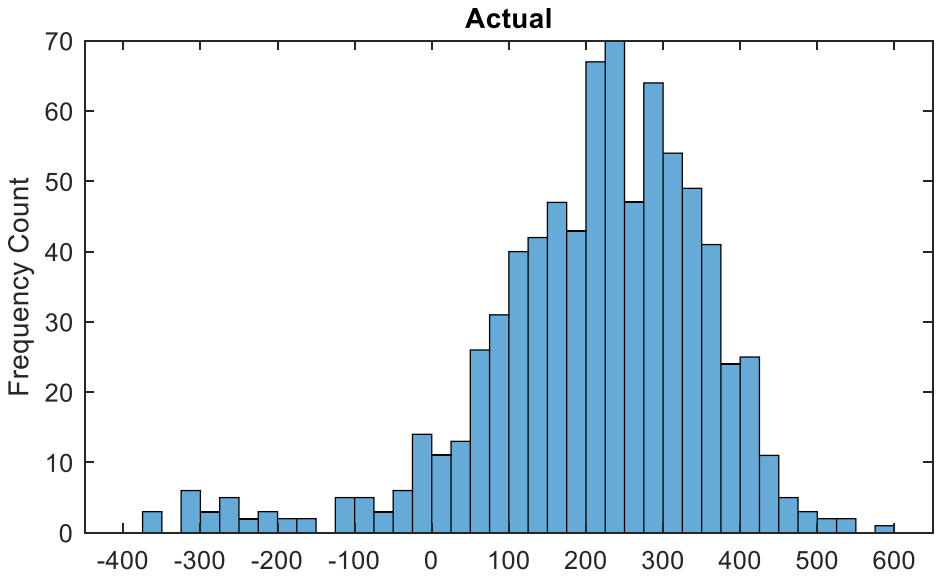
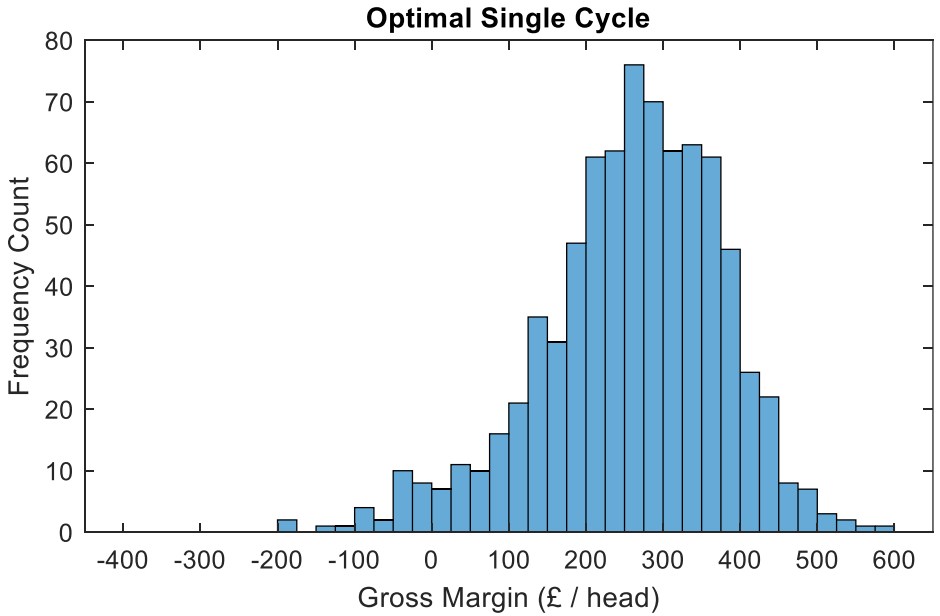
Economics



Average = £210 per head



Average = £259 per head

23% increase

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Multi-cycle optimality…

Cycle	Maximum Gross Margin (£/hd – finishing in perpe…ty)		Weight at slaughter (kg Lwt/hd)		Age at slaughter (Days)	
	Mean	StDev	Mean	StDev	Mean	StDev
'Actual'	5094	3662	612	44	500	34
'Single'	7033	3442	531	53	438	44
'Multiple'	7372	3620	511	32	422	50

38% profit gain

45% profit gain

5% profit gain

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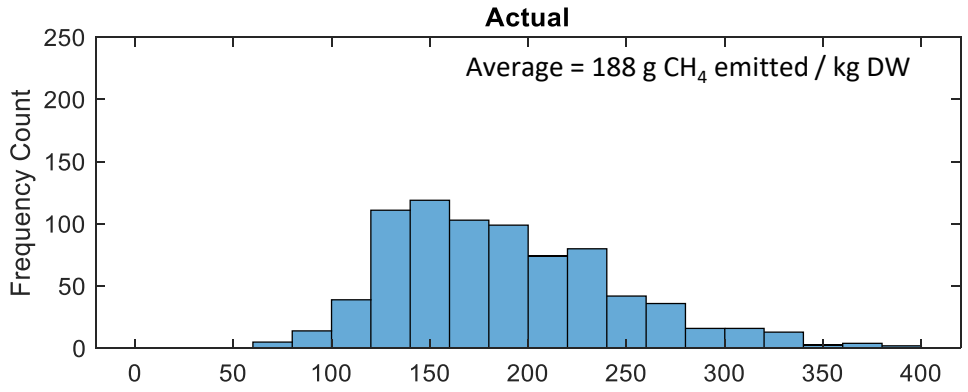
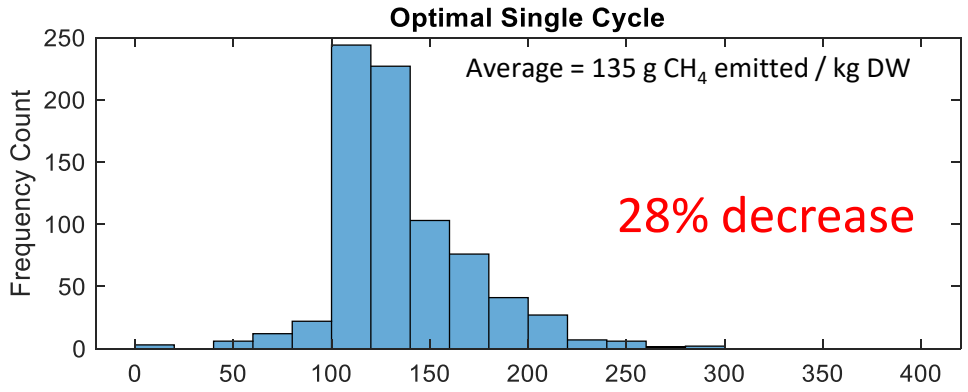
Emissions & Economics

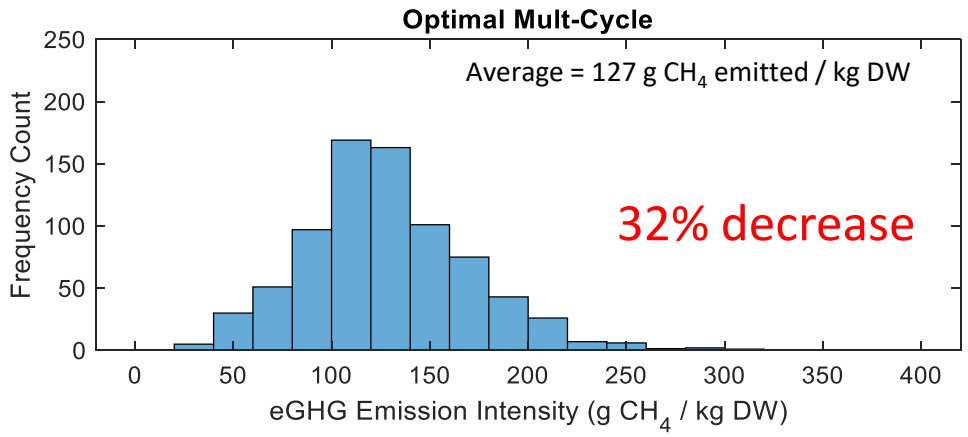
Emission Intensity



Average = 57 kg CH_4 emitted / hd
(**44.44 tonnes CH_4 emitted**)



Average = 37 kg CH_4 emitted / hd
(**28.51 tonnes CH_4 emitted**)



Average = 33 kg CH_4 emitted / hd
(**25.94 tonnes CH_4 emitted**)

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Thank you and further information:

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