BWYPEX: Connecting the dots for feed efficiency and methane emissions

ICAR 2023

Caeli Richardson

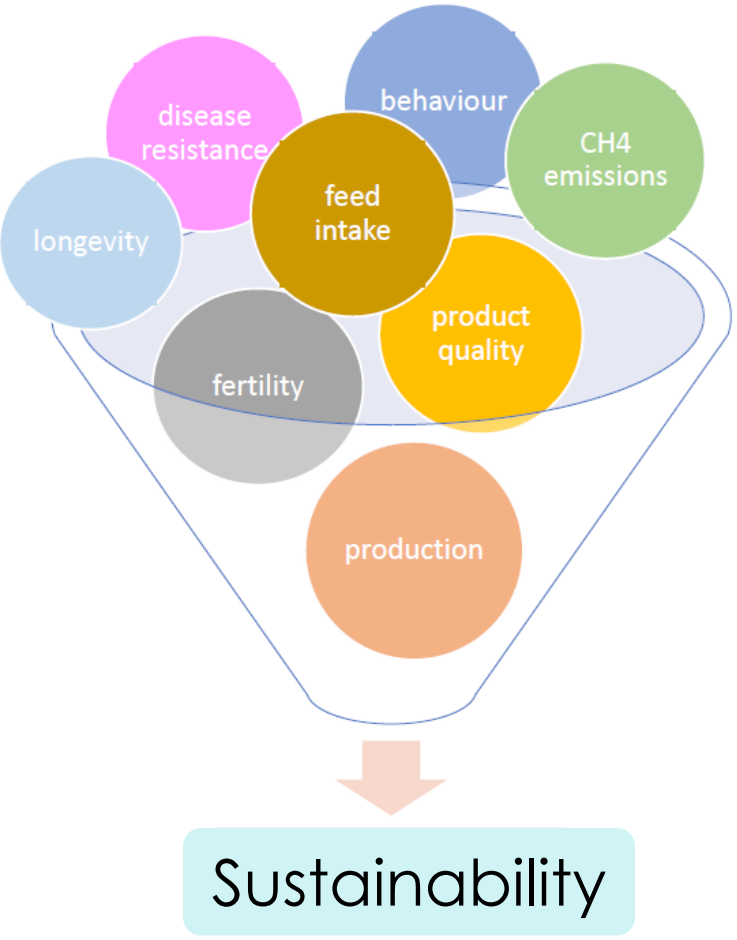
Tackling Climate Change

Project Goal

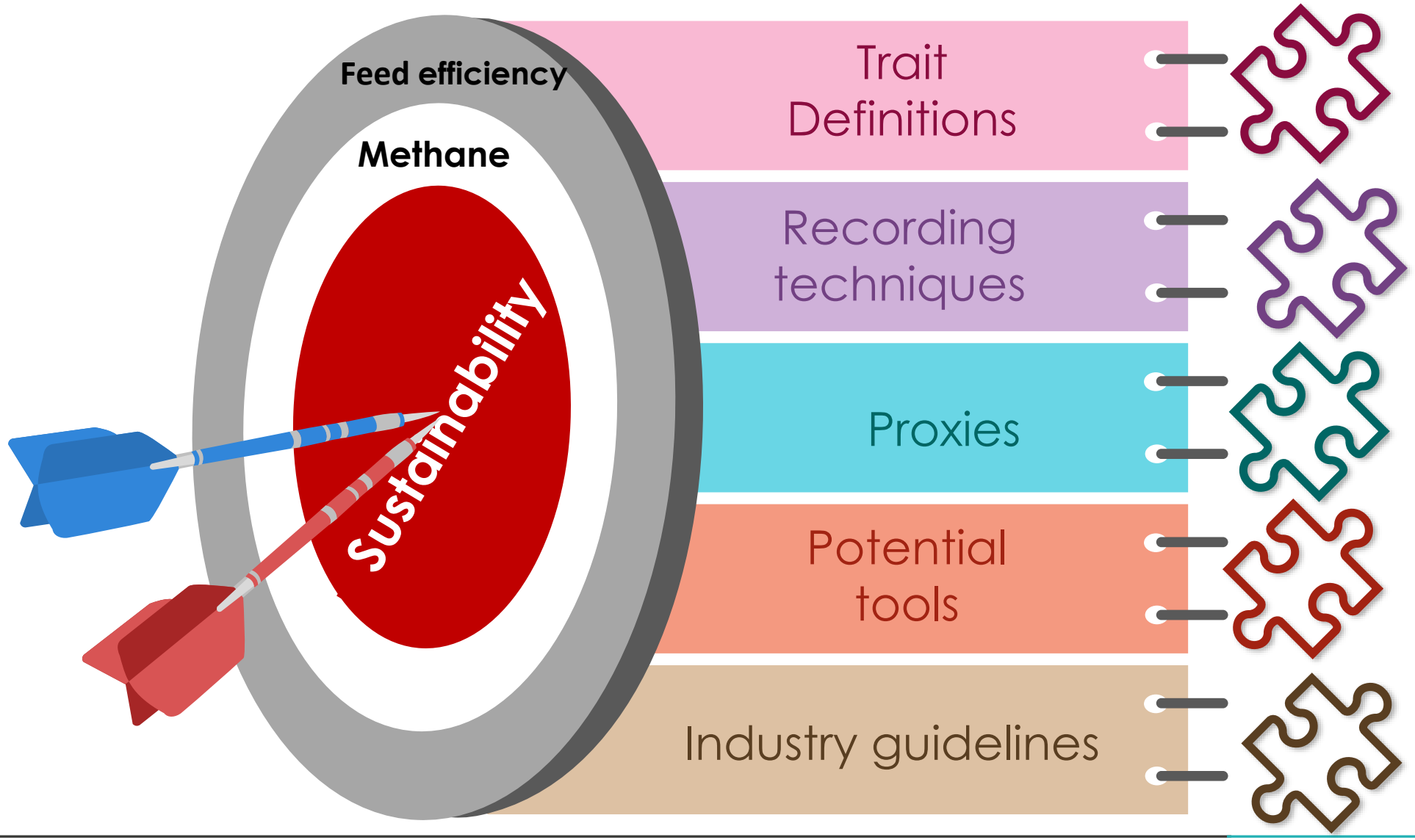
Identify traits to increase sustainability of dairy production

With a focus on **feed efficiency and methane emissions**

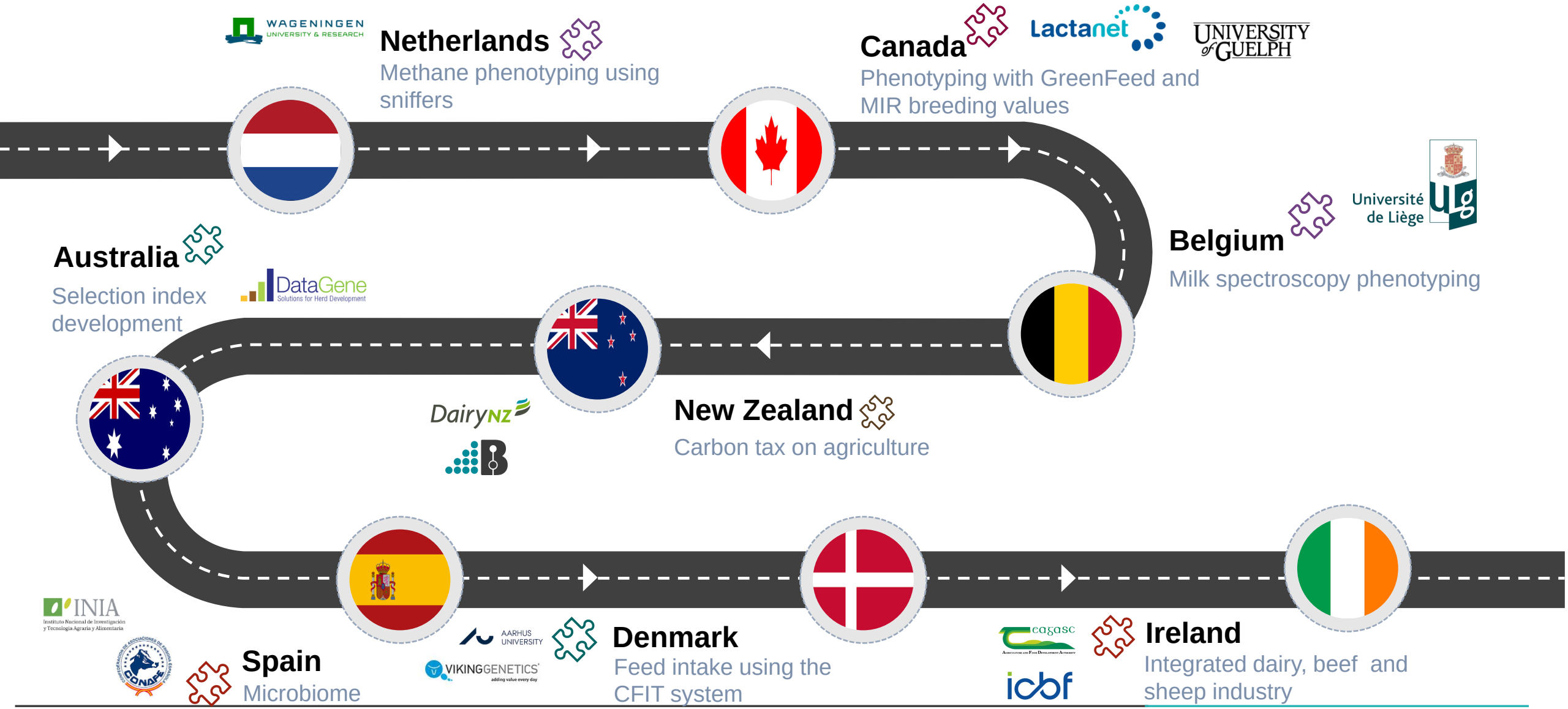
Mentor: Dr. Birgit Gredler-Grandl



Program targets and deliverables



Around the world in 152 days

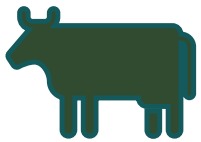


What did I learn?

Far too much to include in this presentation

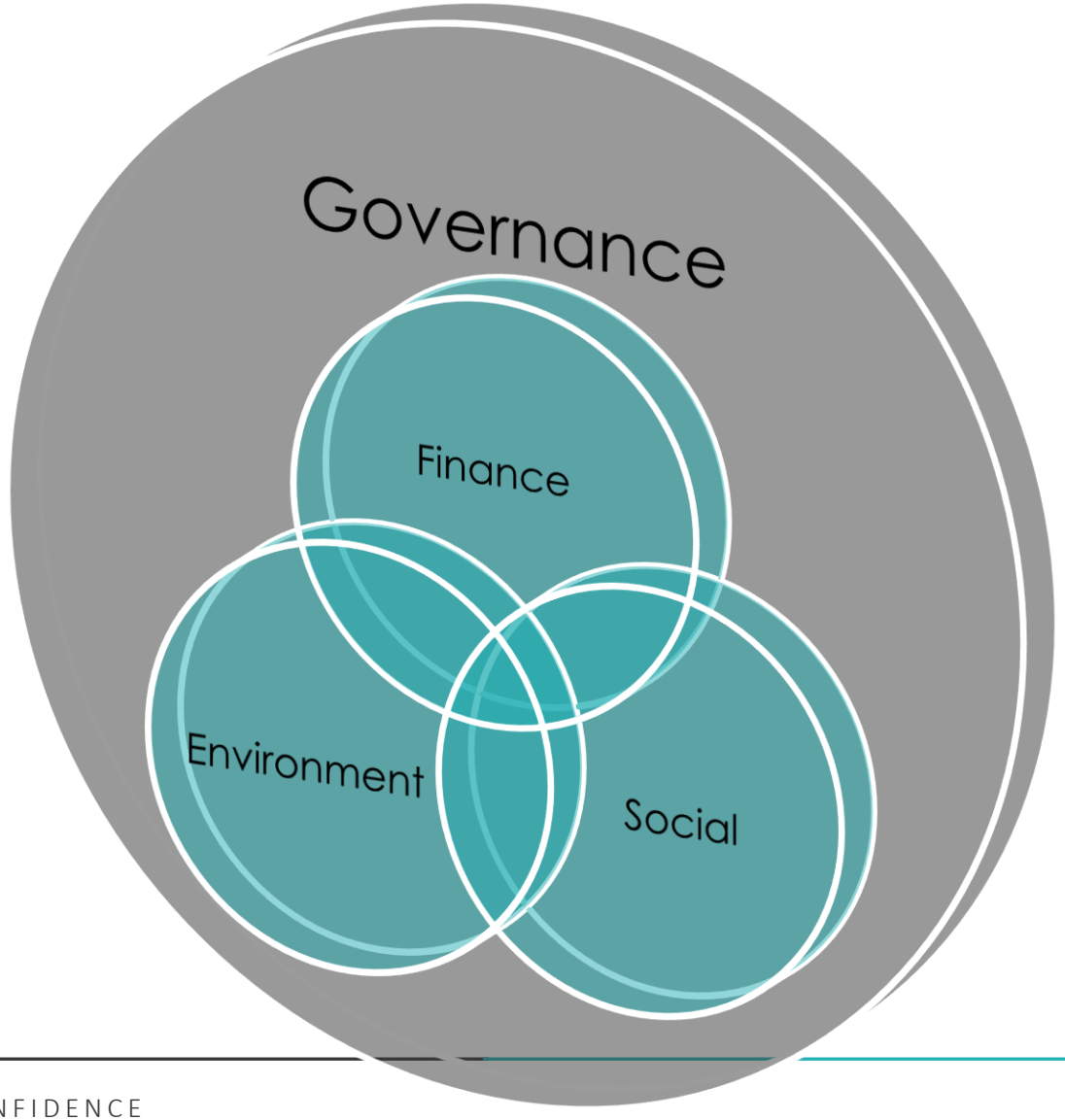
Non-technical learnings

We have a lot of data

	 Phenotypes	 Commercial Farms	 Research Farms
Methane	> 21,500	69%	31%
Feed Intake	> 25,000	4%	96%

Need to use non-traditional selection criteria

- Government policy
  - Carbon tax
  - Nitrogen leaching restrictions
  - Emissions inventory goals
  - Supply management
- Data availability
  - What phenotypes can you measure and on how many animals?
- Impact
  - Farmer
  - Society



Every technology has pros and cons…

Caeli's Criteria	GreenFeed	Sniffer	SF6
Accuracy	1st	3rd	2nd
Volume	2nd	1st	3rd
Labour	2nd	1st	3rd
Cost	3rd	1st	2nd
Average score	**2**	**1.5**	**2.5**

What is a sniffer?

- Sniffer
  - Gas sensors adapted to dairy methane
  - Raw data in ppm
    - Equation to convert ppm to g/day
    - CO2 and liveweight
- GreenFeed
  - Advantage of measuring the volume of air (flux)
  - Converts raw data to g/day
    - Aligned with inventory

GreenFeed and Sniffer SOP discussion

Example content to include in research tender

Environment

- Description of the conditions the equipment will be used in
- Methane measurements in robot on dairy farm
- Durable enough to withstand the condition of the farm

Data Ownership

- Raw data ownership

Maintenance

- Description of user maintenance required for daily use
  - Preventative maintenance
  - Corrective maintenance
- User manuals and on-farm training (and documentation)
- Calibration requirements

Technical Support

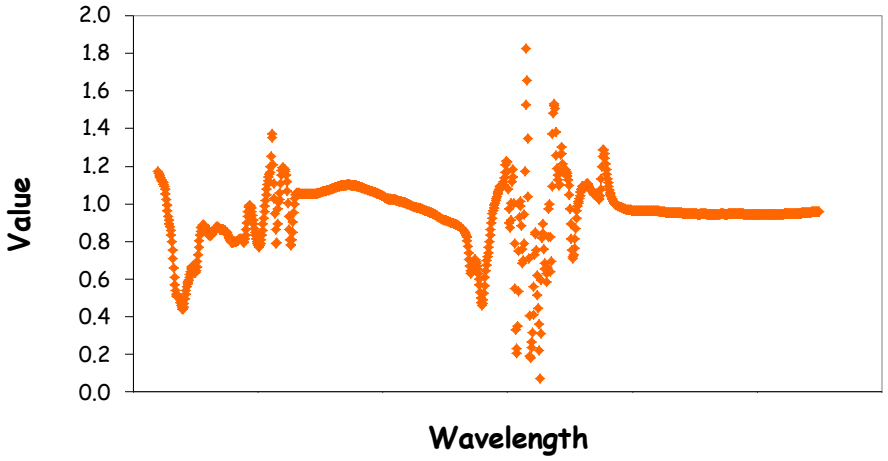
- Site acceptance test
- Return policy for faulty equipment

Equipment Specification

- Spare parts servicing availability
- Maximal and minimal detection limits and measuring ranges of the target gasses (with accuracies)
- Fast response time) for each gas
- Temperature ranges the sniffer operate in for ambient temperature
- Moisture, dust, and barn environment proof
- Required repeatability in barn environment
- Flow rate of internal sampling pump
- Automated warning if airflow drop or errors in sampling
- Air filter prior to entering analyser
- Limited interference due to water by exclusion or standardization
- Connection for data network

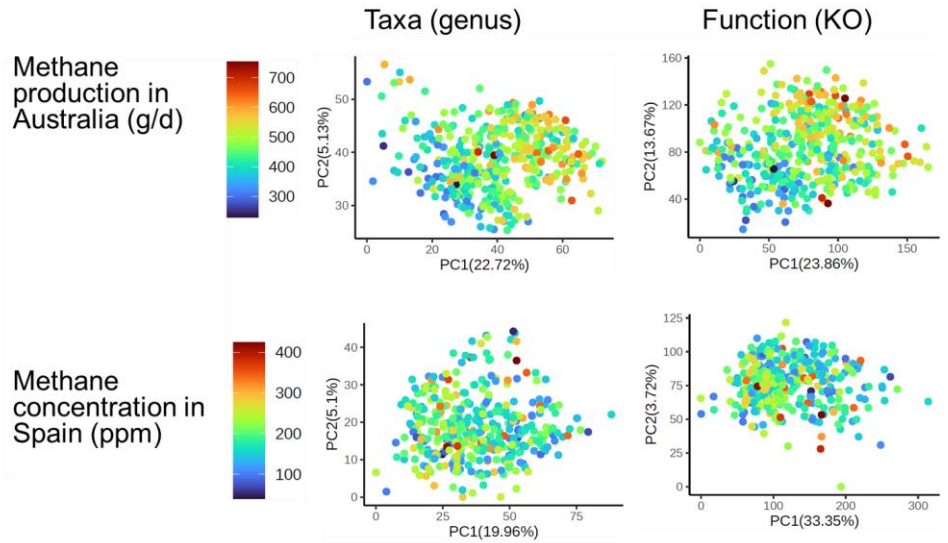
…and so does each proxy

Mid-Infrared Spectrum



Practically free data, but need a representative reference population with lots of variation

Microbiome Profile



Less expensive, but still labour intensive and invasive

Potential challenges …

Need more data (preferably on commercial farms)

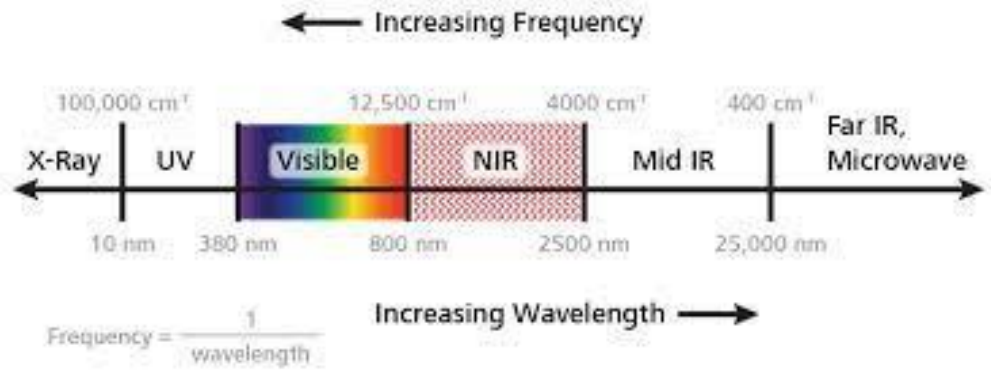
Difficulty measuring in pastoral systems

- Challenges
  - Inventory equations based on total mixed ration diet
  - Measurement techniques are labour intensive
  - Impractical for commercial farms

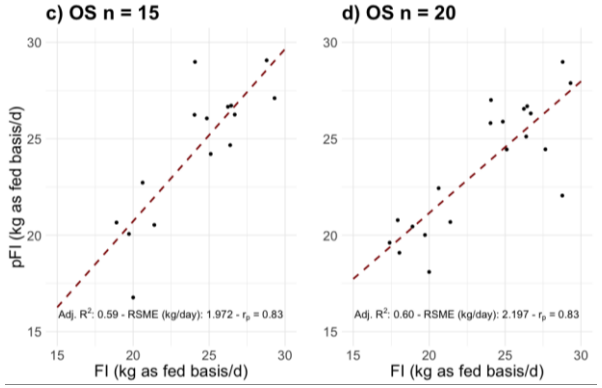
Adapting new technologies

3D cameras in commercial farms

NIR (near–infrared spectroscopy)



Saliva microbiome for feed intake

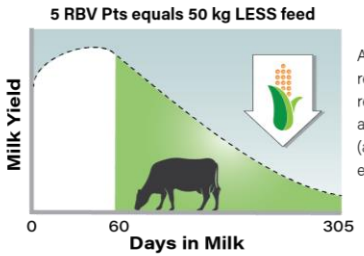


MIR and feed additives

3-NOP

Available now

Breeding Values



A 5pt higher RBV results in a cow that requires 53 kg less feed after peak lactation (after 60 DIM) each and every lactation.

20% Methane Reduction By 2050 WITH SEMEX

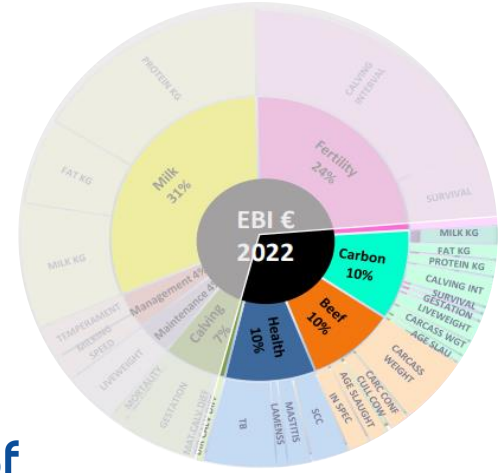
Lactanet

Genetic Indexes

DataGene Solutions for Herd Development

Sustainability Index

A breeding tool for a greener future



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Other Management

KRINGLOOP WIJZER

EMR

AGANAV

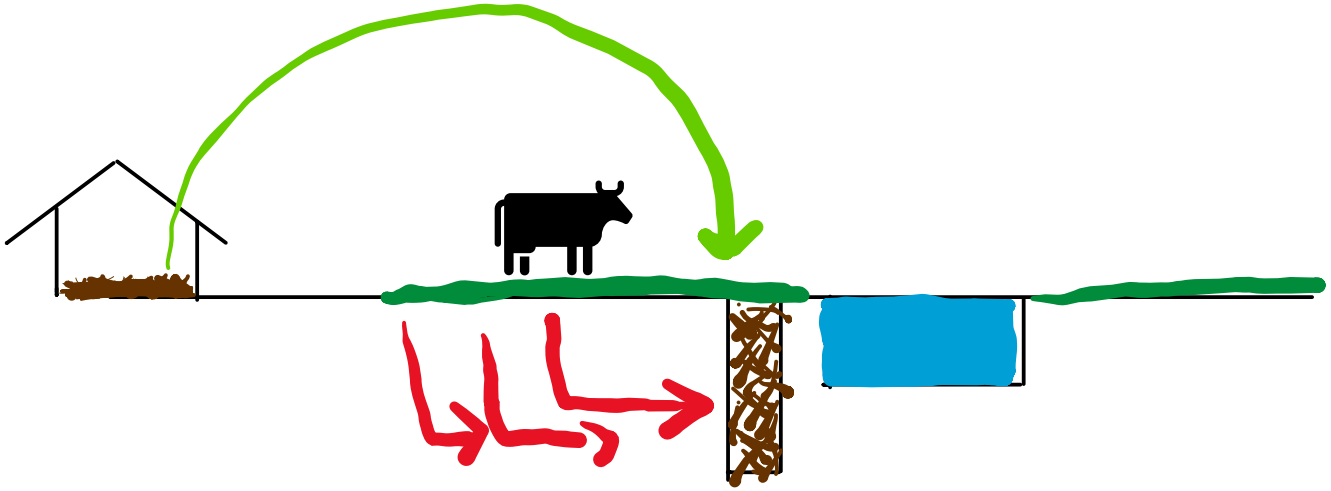
eagasc

Bord Bia Irish Food Board

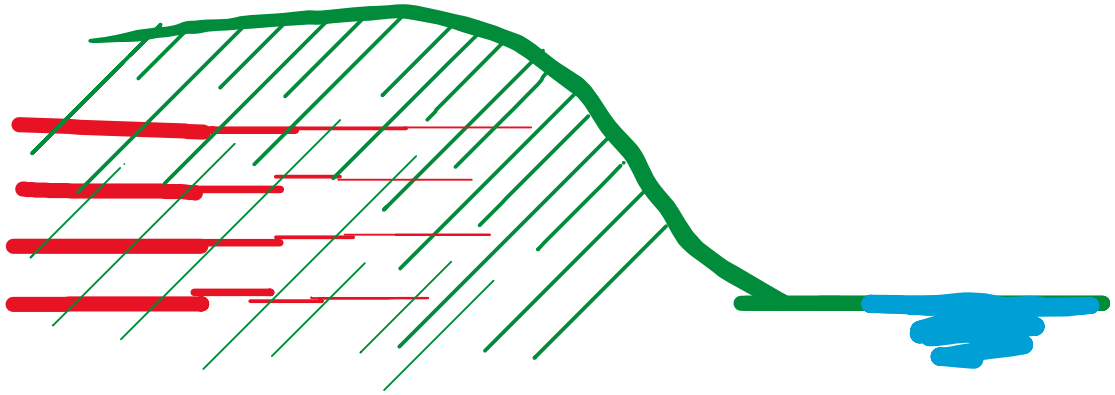
The Dairy Carbon Navigator
Improving Carbon Efficiency on Irish Dairy Farms

Case study: New Zealand

Water barrier with calf bedding

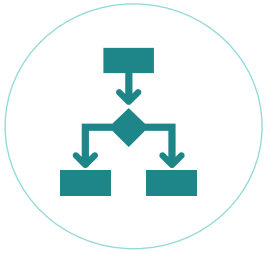


Water protection with tillage patterns



He Waka Eke Noa

Our Future in our hands | Primary Sector Climate Action Partnership



CHOICE AND CONTROL

Gives farmers choice and control over how they manage their emissions

SPLIT-GAS APPROACH

Recognises the different warming impact of methane

CARBON SEQUESTRATION

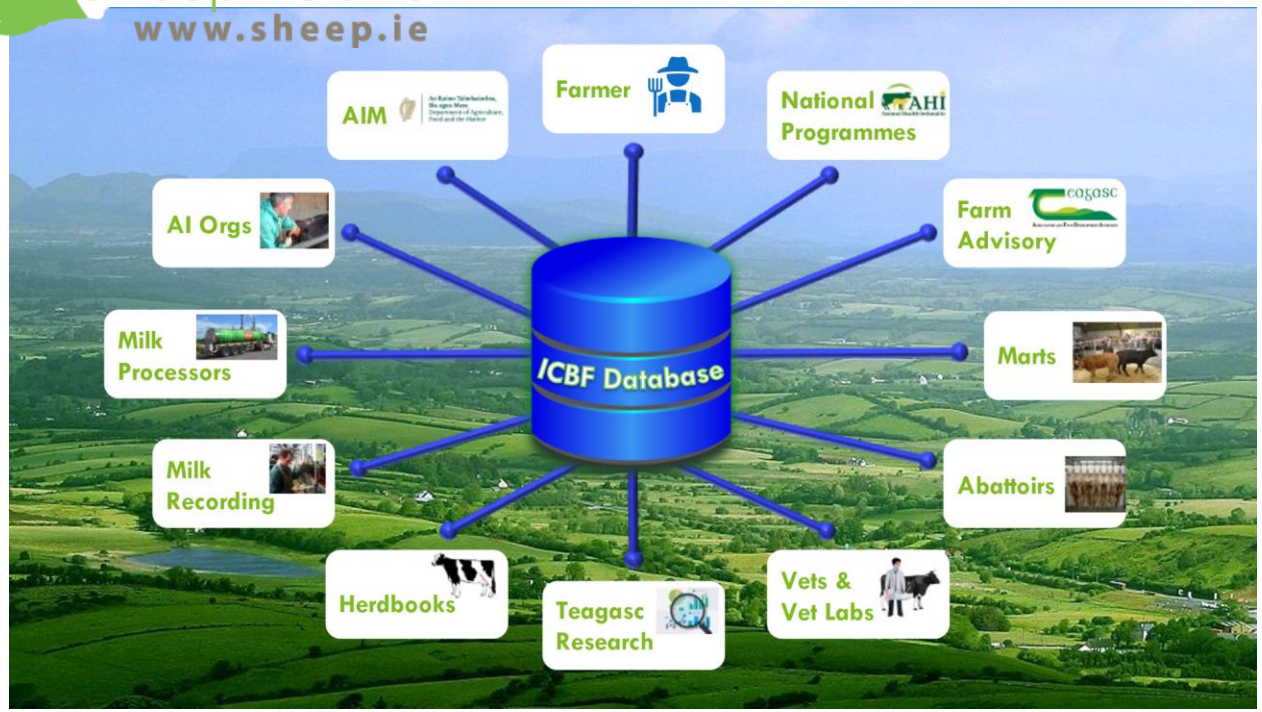
Recognises carbon sequestration not able to be entered in the Emissions Trading Scheme

AGRICULTURAL INVESTMENT

Reinvests revenue raised from the sector back into the agriculture sector

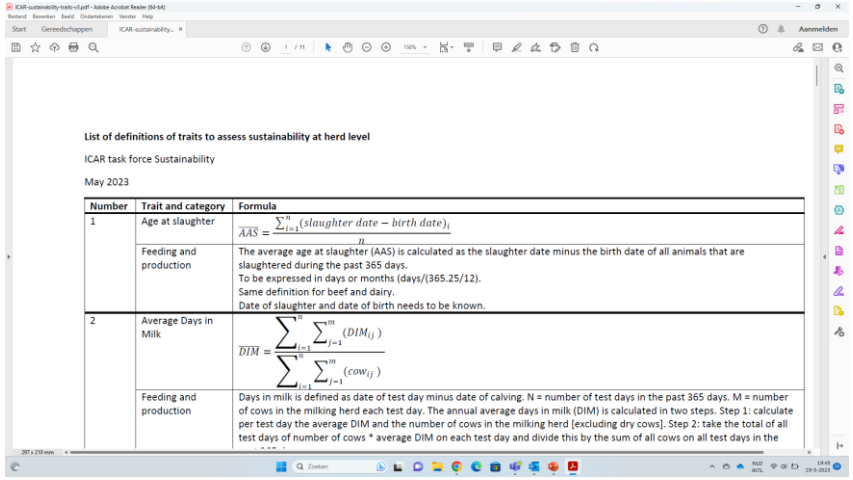
Working together with farmers and growers on practical solutions

The power of integration



impact

List of sustainability traits are on ICAR website



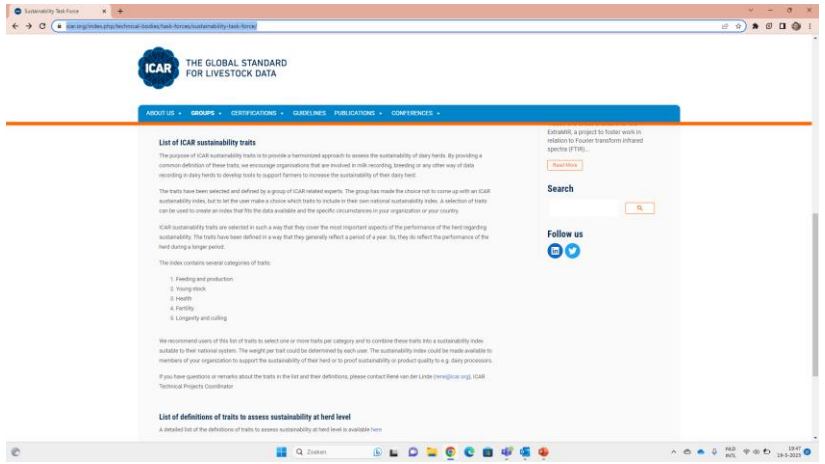
List of definitions of traits to assess sustainability at herd level

ICAR task force Sustainability

May 2023

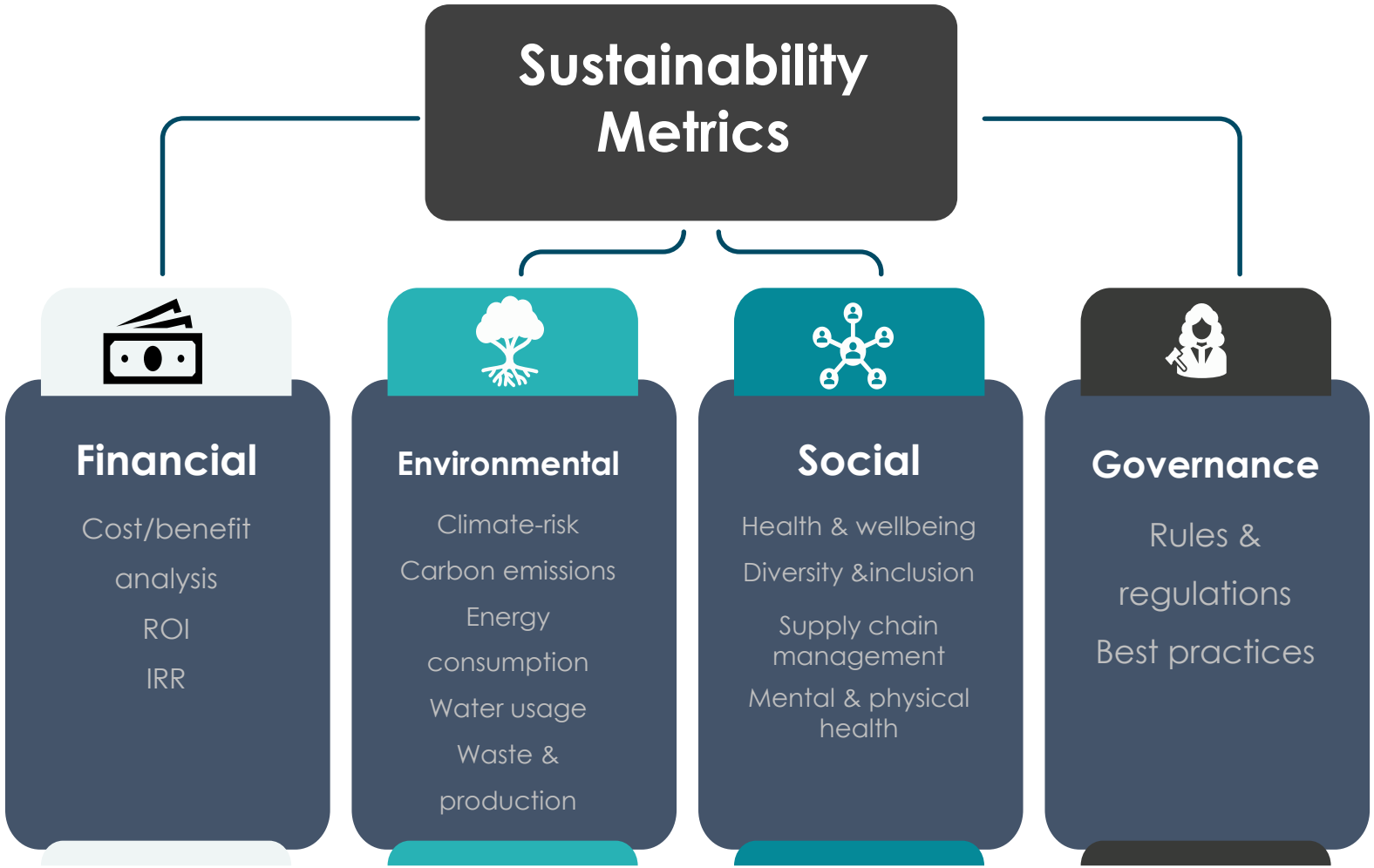
Number	Trait and category	Formula
1	Age at slaughter	$\overline{AAS} = \frac{\sum_{i=1}^{n}(slaughter\ date - birth\ date)_i}{n}$
	Feeding and production	The average age at slaughter (AAS) is calculated as the slaughter date minus the birth date of all animals that are slaughtered during the past 365 days. To be expressed in days or months (days/(365.25/12). Same definition for beef and dairy. Date of slaughter and date of birth needs to be known.
2	Average Days in Milk	$\overline{DIM} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{m}(DIM_{ij})}{\sum_{i=1}^{n}\sum_{j=1}^{m}(cow_{ij})}$
	Feeding and production	Days in milk is defined as date of test day minus date of calving. N = number of test days in the past 365 days. M = number of cows in the milking herd each test day. The annual average days in milk (DIM) is calculated in two steps. Step 1: calculate per test day the average DIM and the number of cows in the milking herd [excluding dry cows]. Step 2: take the total of all test days of number of cows * average DIM on each test day and divide this by the sum of all cows on all test days in the

- ICAR > Homepage > Groups > ICAR Task Forces > Sustainability Task Force
- https://www.icar.org/index.php/technical-bodies/task-forces/sustainability-task-force/



- Feedback on the list can be send to René van der Linde: rene@icar.org

Environmental Social Governance Plan



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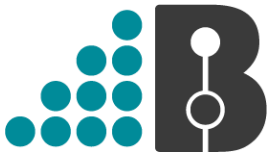
ICAR would like to acknowledge the 11 Members who help fund the inaugural Brian Wickham Young Persons Exchange Program



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New Zealand Animal Evaluation Limited **(NZAEL)**;
a wholly owned subsidiary of DairyNZ

Brian's Perspective

*With regard to **sustainability**, all I can say is that **the application of good science** has served the industry well over the last fifty years and I see it as the **best tool** set for dealing with the sustainability challenges **of the future**.*