Zero Discharge:
towards full recovery of nutrient and energy from animal manure

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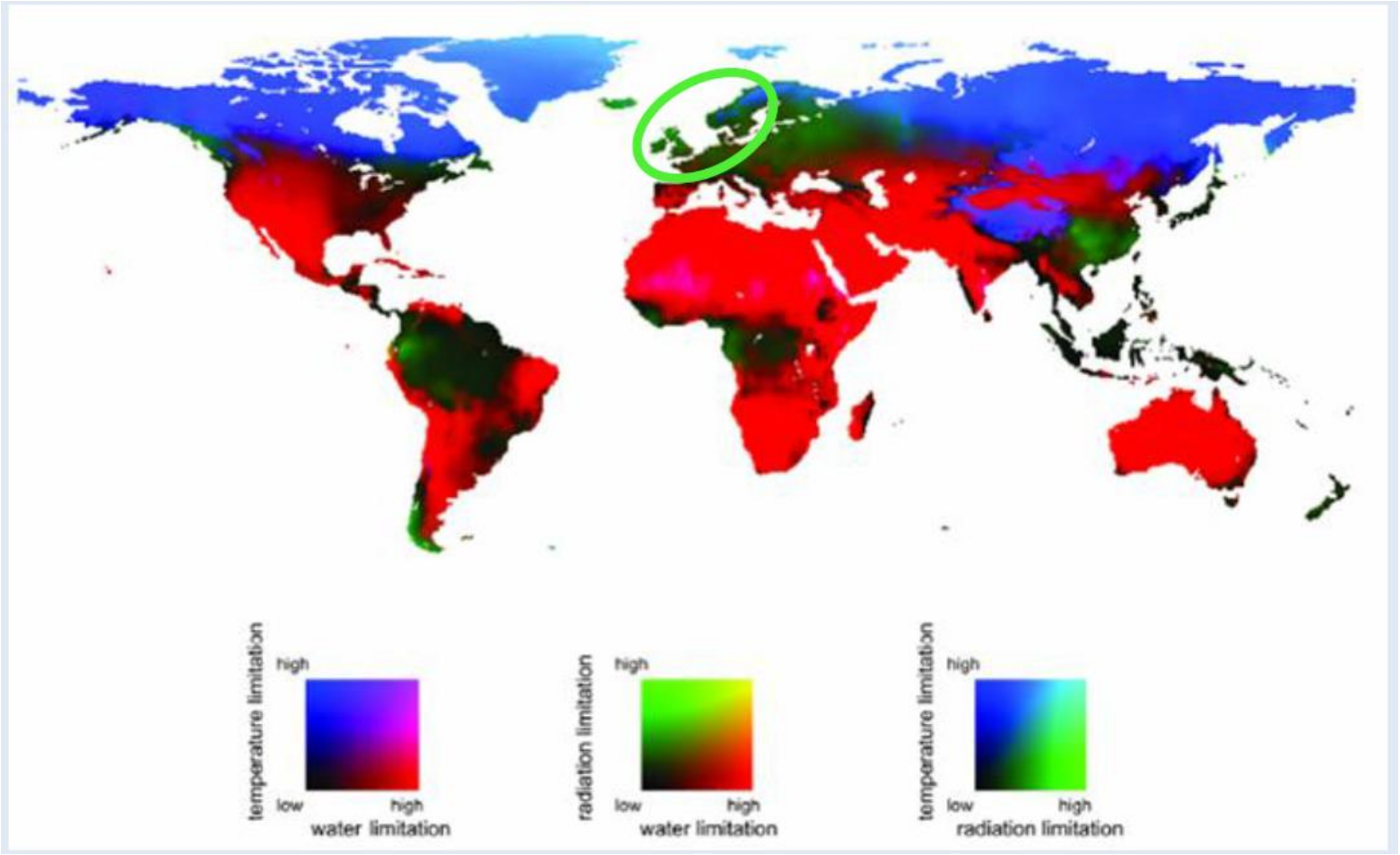
Zero discharge – Why?

- Why
  - Finite resources vs. increased demand
    - Nitrogen, Phosphate, water, land, etc.
  - Energy hungry production systems
  - Environmental Protection
  - Sustainable food, products and service provision

Sustainability

Meeting the needs of the present generation without compromising the ability of future generations to meet their needs."

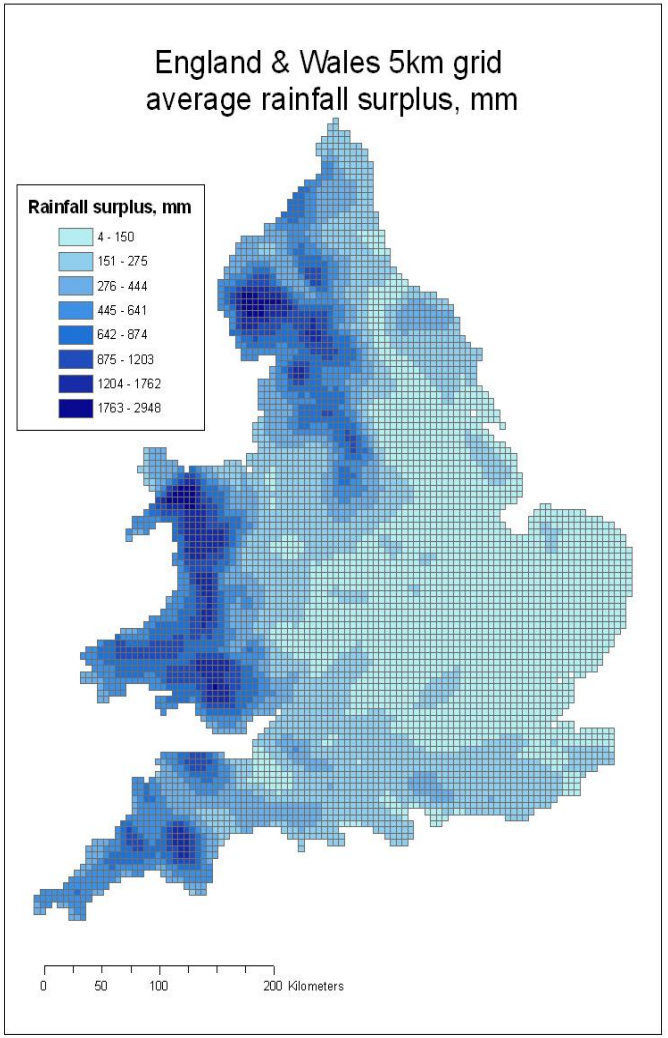
Limiting factors for global plant productivity



Baldocchi et al. 2004 SCOPE 62

Water for life

- Essential for plant growth and livestock
- Changing patterns
- Will dictate what can be grown and produced where



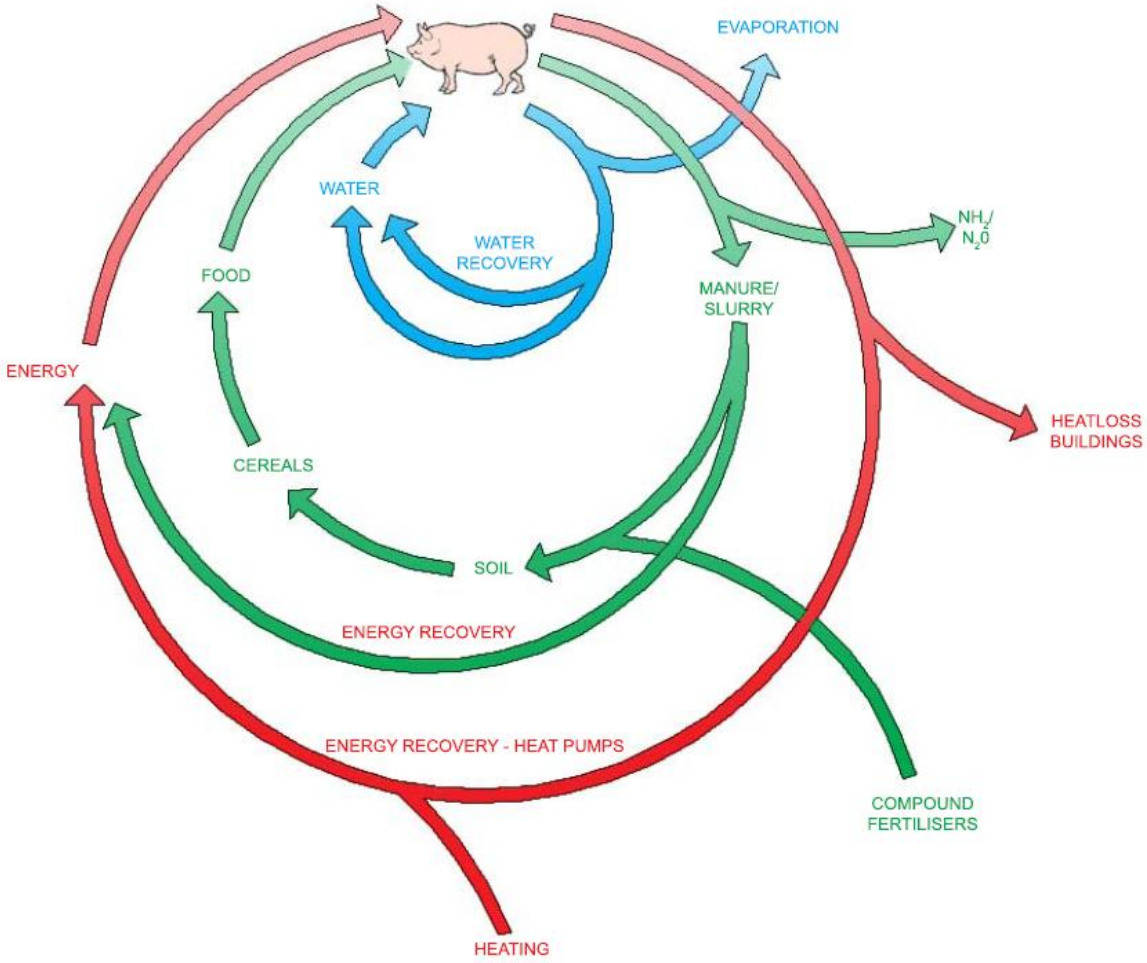
Protect the Natural Environment

- Resources
- Habitats
- Eco systems
- Getting the balance right

Zero discharge – How?

- Consider the full system – integrated approach.
- Don’t push losses along the line
- End to Start or Start to End?
  - The product, i.e. the reason
  - Consequences of actions e.g. nutritional strategy
- Applied to;
  - Existing systems
  - New systems
- Windfall Opportunities
  - Counteract inevitable losses

Integrated Systems



Feed, Housing, Manures

>£

<NH_3

<CH_4

HEAT

>£

<N_2O

Inputs

Kg £

Sun

<P

<NO_3

Water

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Integrated Systems to minimise losses

- Location
- Animal Health
- Feed inputs
- Housing
- Manure storage
- Manure processing
- Manure utilisation
- Product utilisation

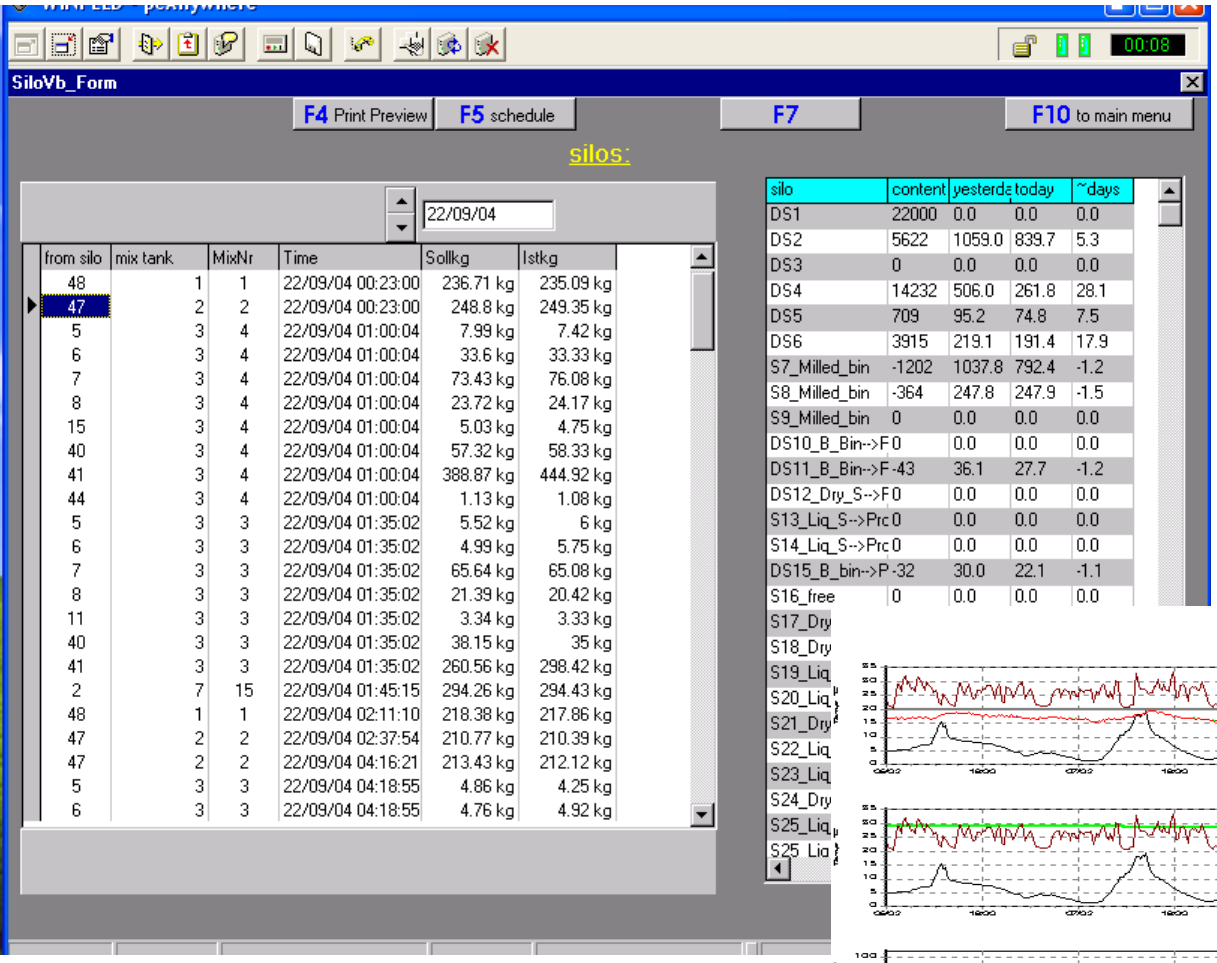
Minimising losses - Location

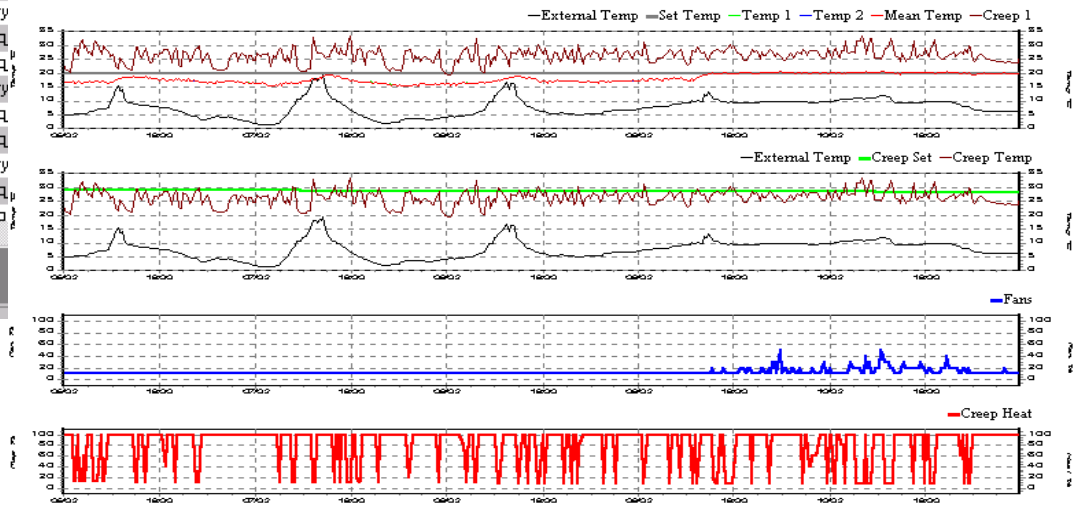
- Marketable yield
- Recovery
  - Heat
  - Water
  - Manures
  - Generated energy

Minimising Losses – animal health

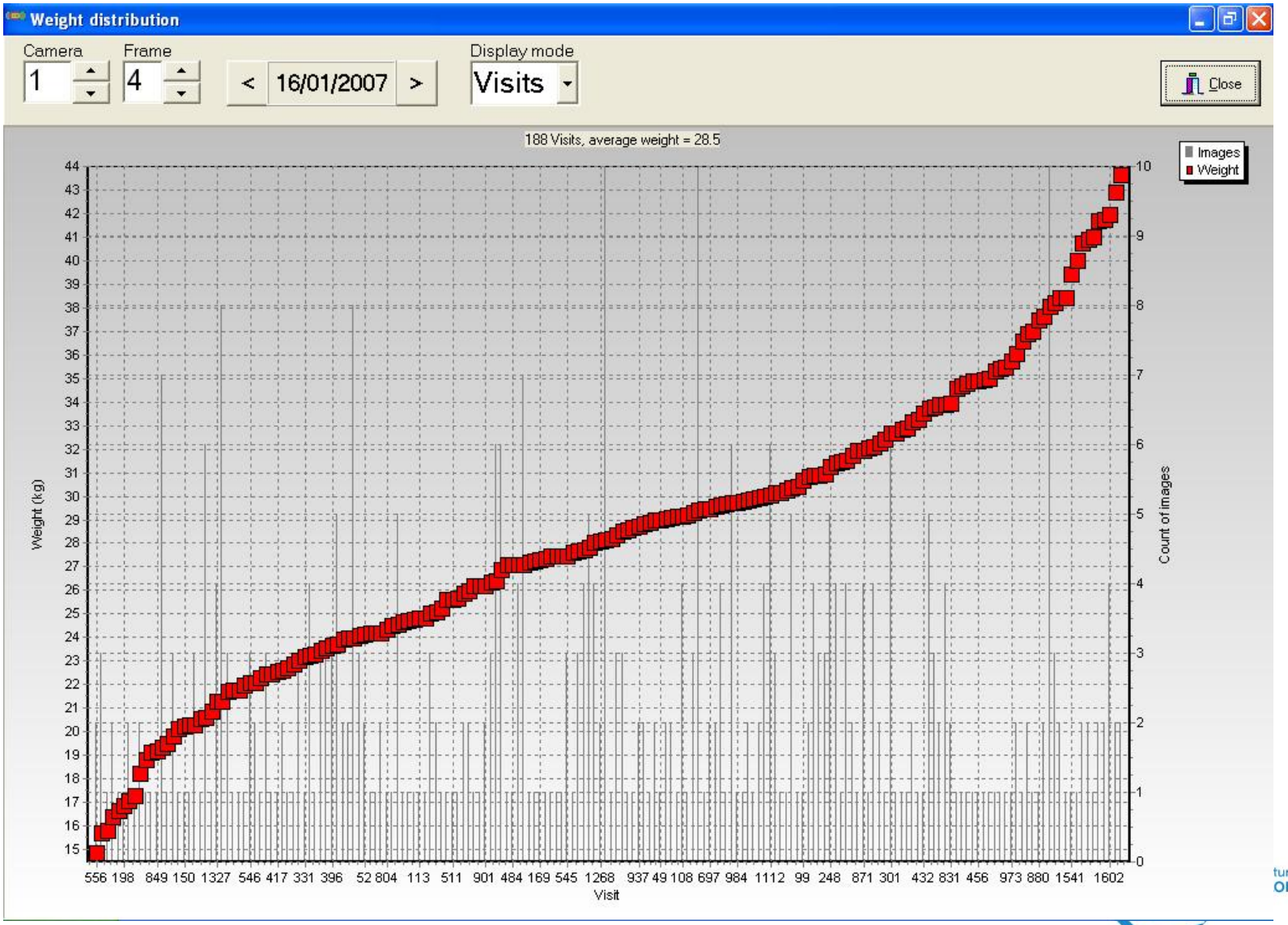
- Growth rate
- Resource use
- Product quality & rejections
- Death = waste

Precision Feeding & Real Time Monitoring





Growth Monitoring - pigs

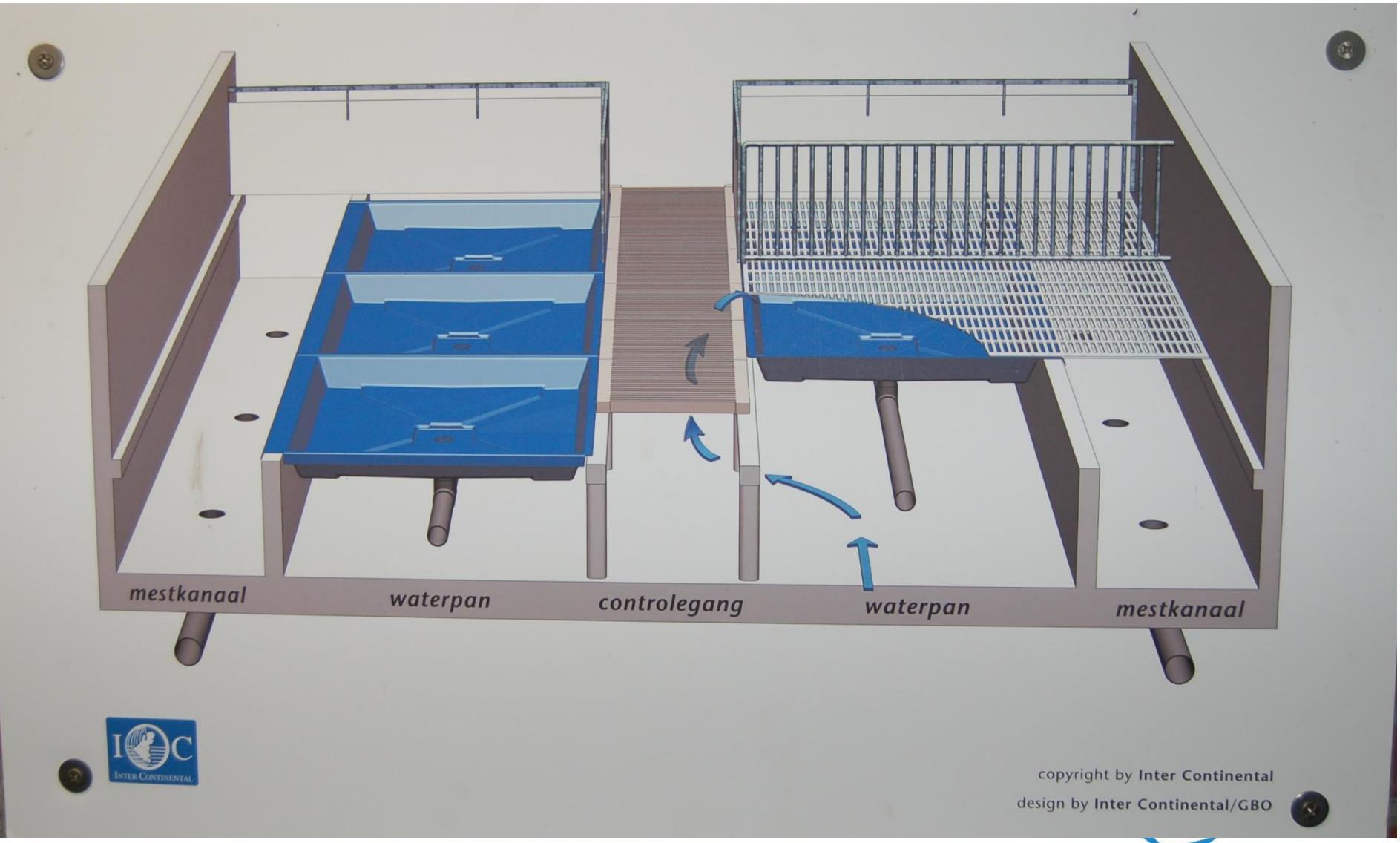


Minimising losses - Housing

- Low emission housing
- Combine with low protein diets
  - Faeces/urine
  - Frequent manure removal
    - Slats/part solid
    - solid/solid with gutter
    - Scrape
    - Flush
    - Acidification
  - Manure cooling
  - Straw to absorb
- Welfare – loose vs. restrained

Minimising losses – housing 2

- Ventilation rate
- Air movement paths
- Heat exchangers
  - 110kg pig = 150W
- Exhaust air cleaning (ammonia & dust)
- Opportunities to offset
  - Solar heat and power
  - Ground source heat
  - Water harvesting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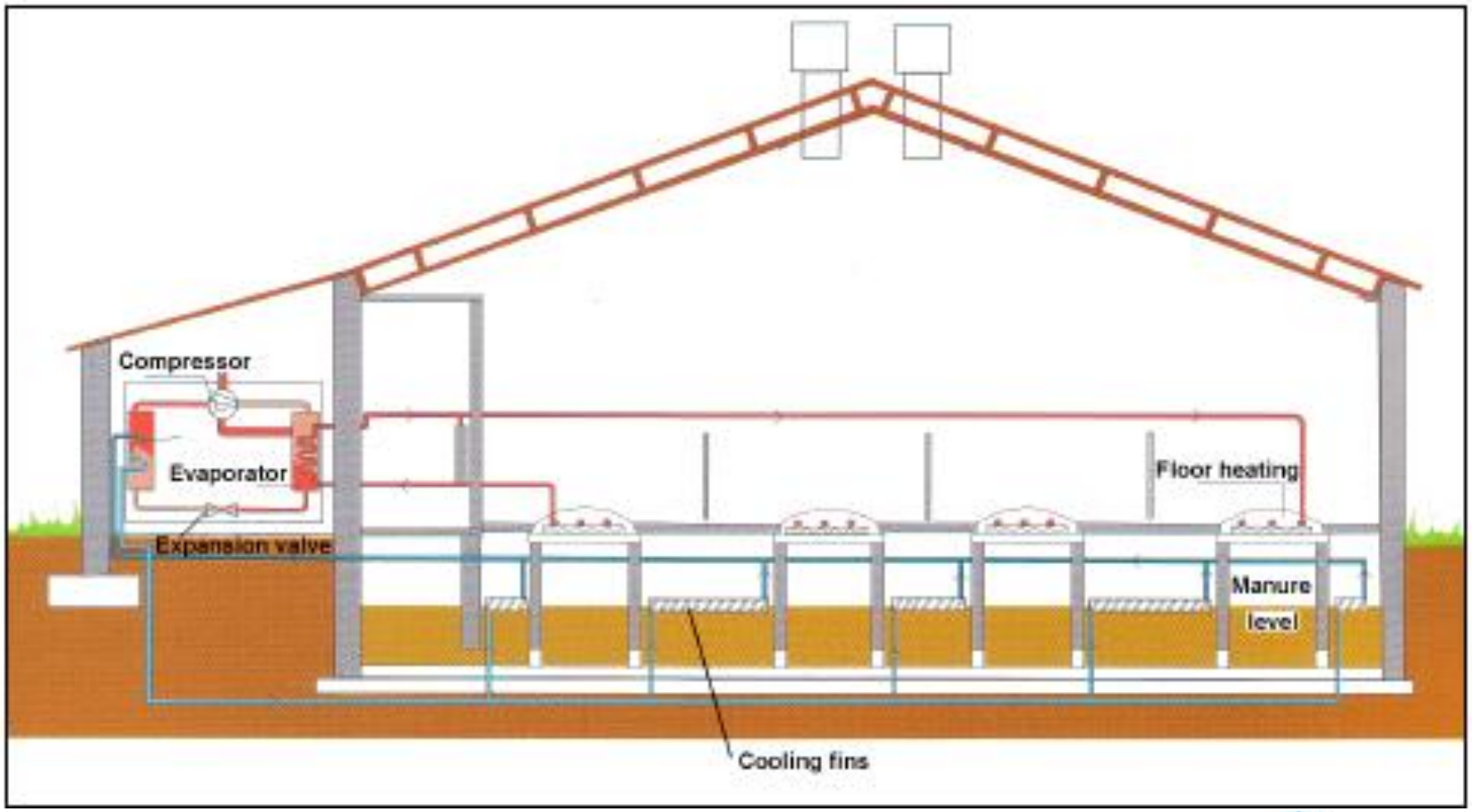
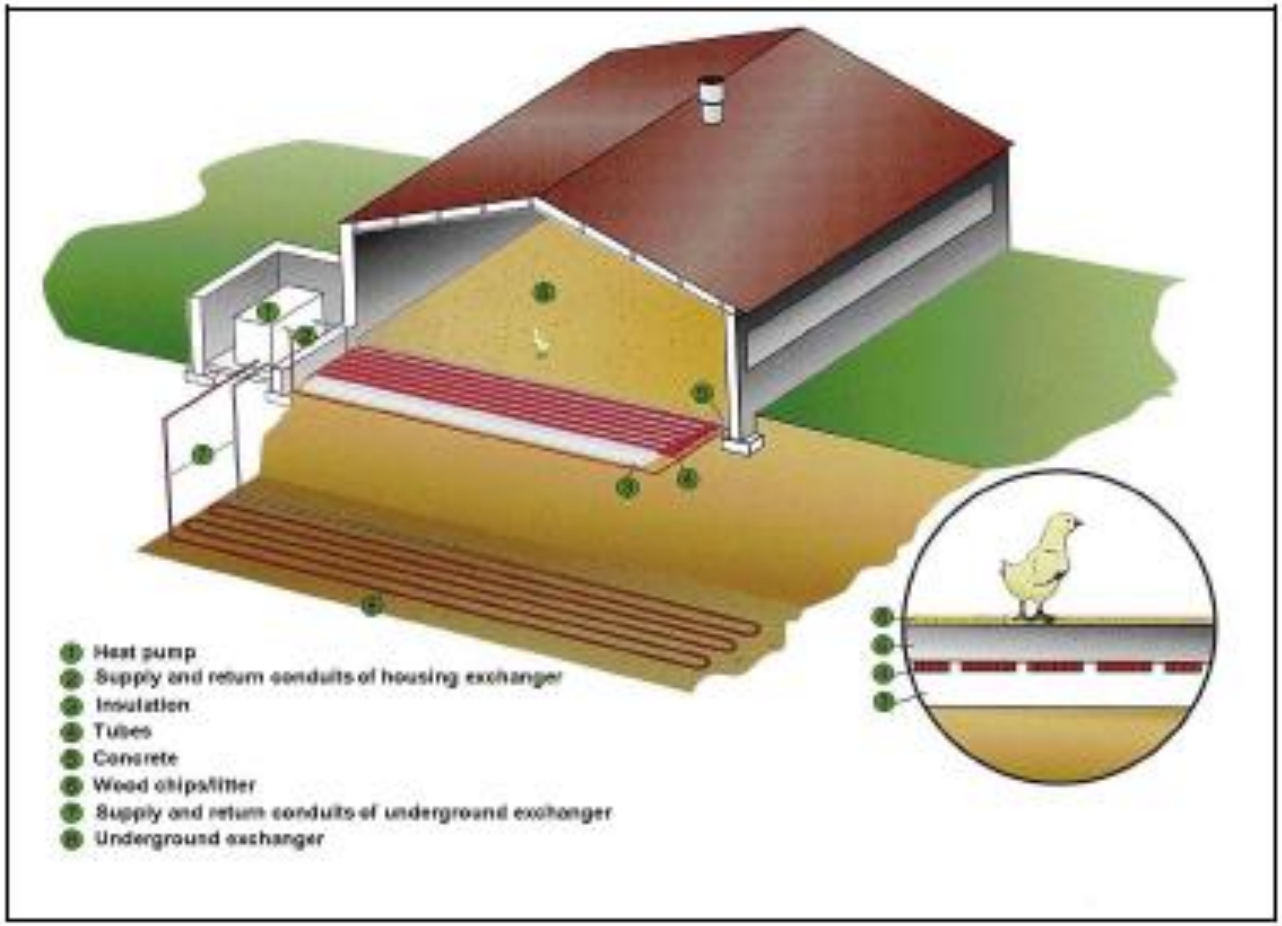
BAT Part slated floor with manure cooling fins



BREF. Figure 4.23: manure surface cooling fins. Wageningen

Heat Recovery in a Broiler House



BREF Figure 4.3

Minimising losses – Manure Storage

- Appropriate storage
- Separation
- Covering
- Diffuse aeration/conditioning
- Use of additives
- Holding capacity matched to application timing

Minimise Losses – manure processing

- Anaerobic digestion
  - Heat, power
  - Improved N availability, reduced seed and pathogen burdens
- Ammonium extraction
- Phosphate rebalancing and stripping
- Heat from manure stores
- Gasification

Minimising Losses – manure application

- Analysis
  - Laboratory
    - Chemical
    - Near Infrared Spectrometry
  - On farm test kits
- Planning as part of fertilisation regime
  - Professional advisers
  - Decision support tools (MANNER NPK)
- Homogenous or fractions
- Application techniques

Minimising losses – manure application

- Application techniques
  - Timing
  - Uniformity
  - Low emissions
  - Low soil losses
  - Minimise crop damage/quality impacts

Crop nutrients

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Samson

Recovering Livestock N

- Treatment
  - Separate
  - De-nitrification
  - Recover
- Transport

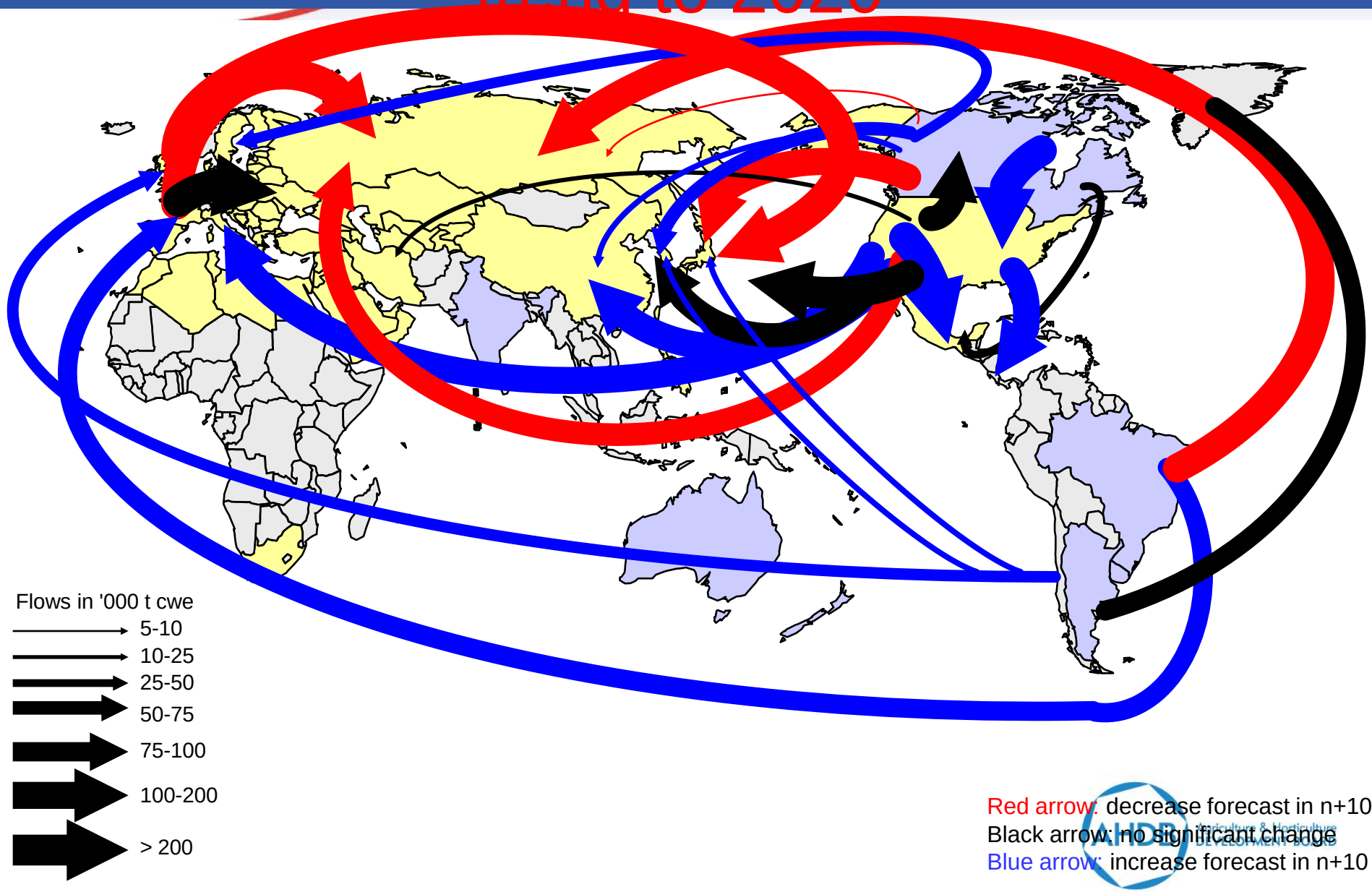
Phosphate Recovery

Anaerobic Digestion

Minimising losses – product utilisation

- Extract full value
  - Meat cuts
  - Offals
  - Oils & fats
  - Hides, skins, feathers etc
  - Processed animal protein (PAP)

Pigmeat Trade Flows (incl. live), 2010 with trend to 2020



Successful sector

Drivers to Change

- Legislation?
- Financial
  - Lean manufacturing
  - Process analysis
  - Adopting technology and improving skills
  - Returns to stimulate investment

Those who rise to the challenge will not only survive but prosper

Thank You

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