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Video Image Analysis for meat yield - opportunities and challenges for value-based marketing of sheep and beef carcasses

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SRUC

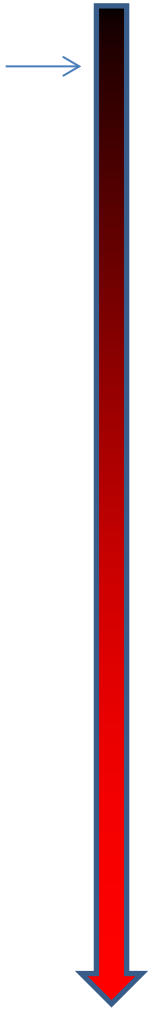
QMS QUALITY MEAT SCOTLAND

Quality Meat Scotland

- Quality Meat Scotland responsible for the development of the Scottish red meat sector.
- Research and Development
- Marketing
- Industry Information
- Communications

- QMS activities, are funded through income derived from statutory levy.
- Quality Assurance Schemes operated by QMS are self-funded from Scheme membership fees.

Talk structure



- Meat value chain
- Carcass evaluation
- Video Image Analysis
  - Beef
  - Sheep
- Value-based marketing
- Opportunities for value-based marketing of sheep and beef carcasses
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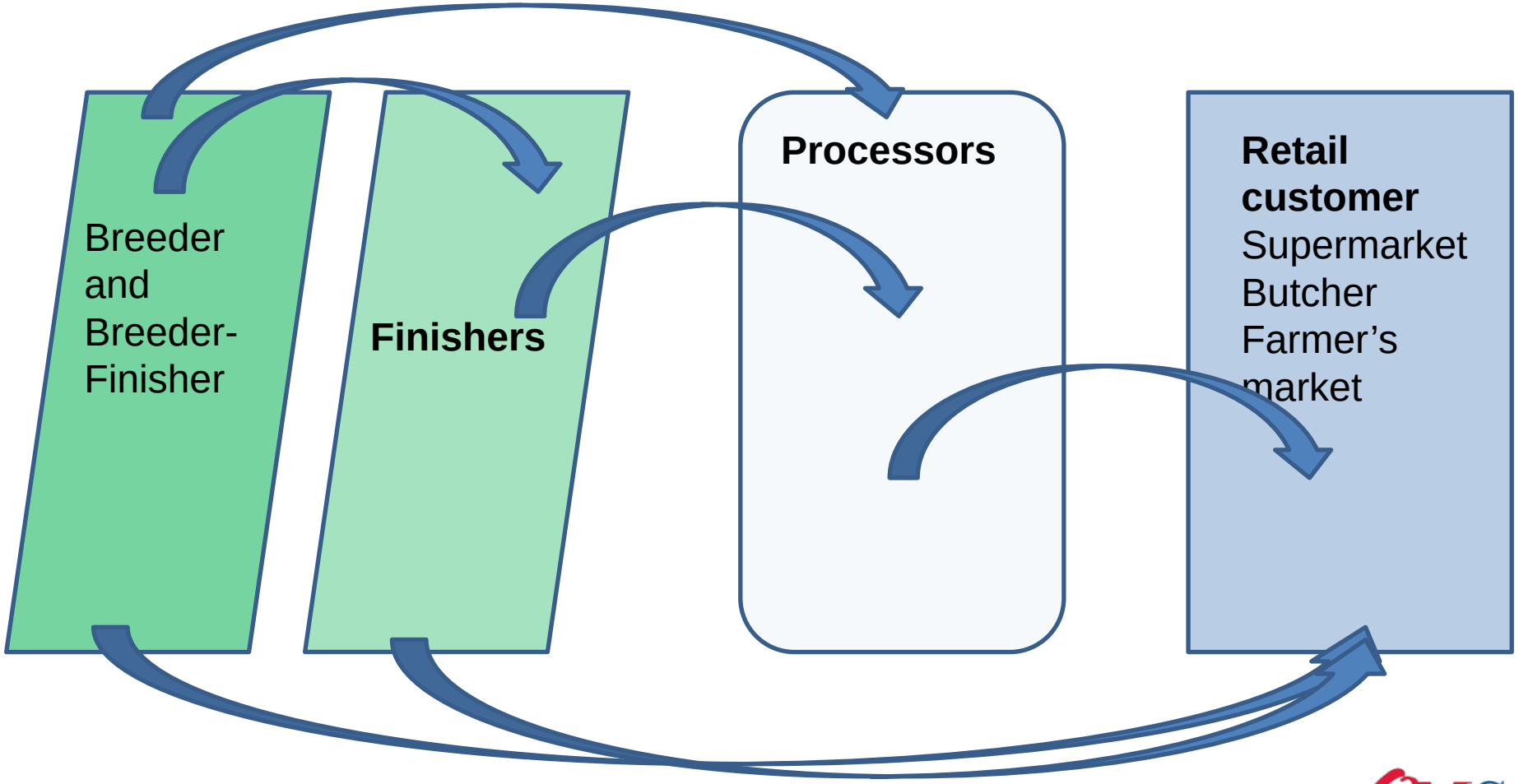
The red meat value chain: Sheep and Beef



Relationship to consumers

Animals → Meat products → Meat products

RED MEAT

Breeder | Finisher | Processor

VALUE CHAIN

Retailer
(Customer)

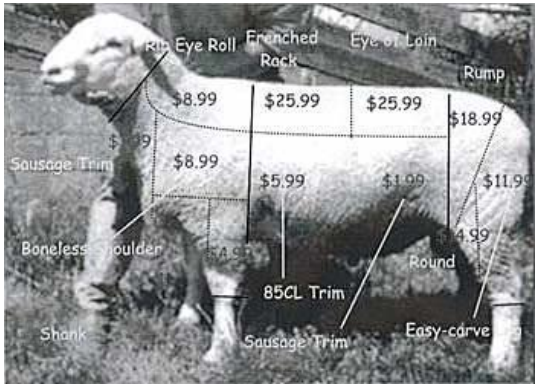
Consumers

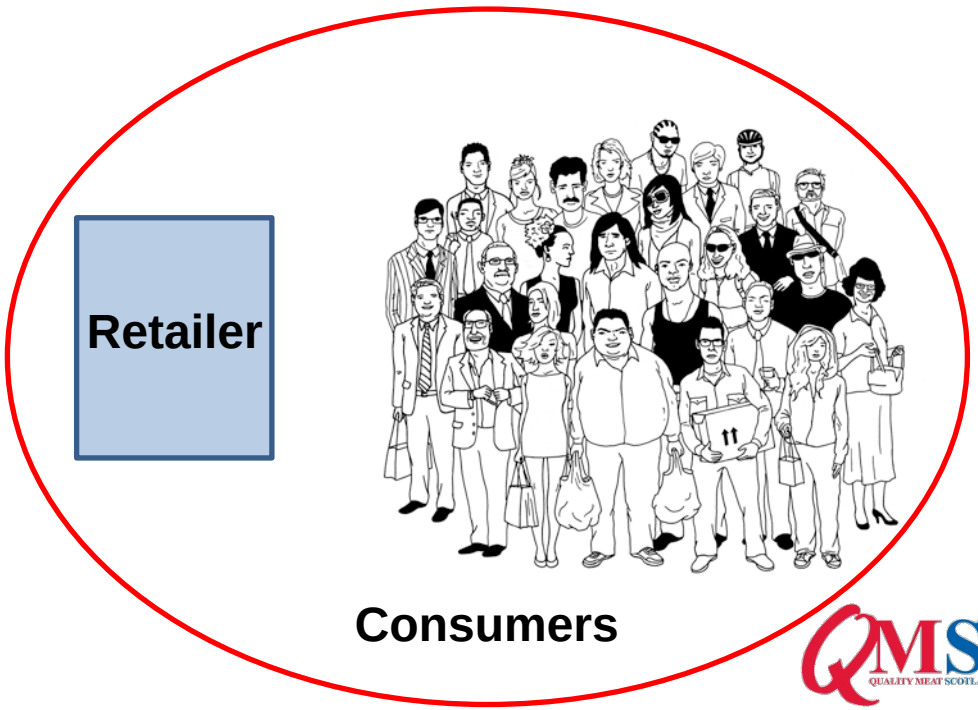
Even Less Money ← Less Money ← €/kg Money

Image source: YouGov

Meat Quality and Consumers

- Some cuts of meat are more valuable largely on account of their superior eating quality (e.g. beef fillet, sirloin, rump and lamb chops etc).
- But quality is variable, and poor quality adversely affects repeat purchase events (Grunert 2005).





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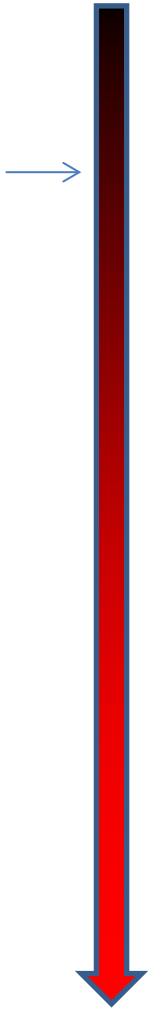

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Carcass evaluation

- A carcass is a composite of lean meat, fat co-products and waste.
- Determine the value per unit weight:
- which is largely due to:
  - The yield of saleable meat (% of carcass weight).
  - The eating quality of the meat.

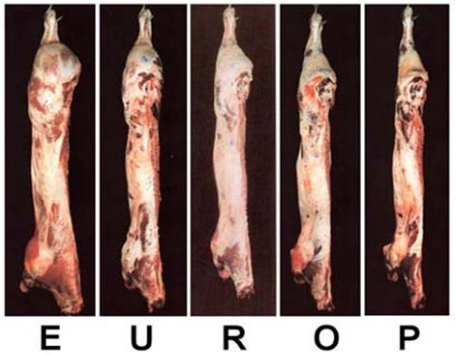
- Overlap between evaluation and classification.
  - But two distinct processes with different objectives.
  - Classification aims to describe a carcass.

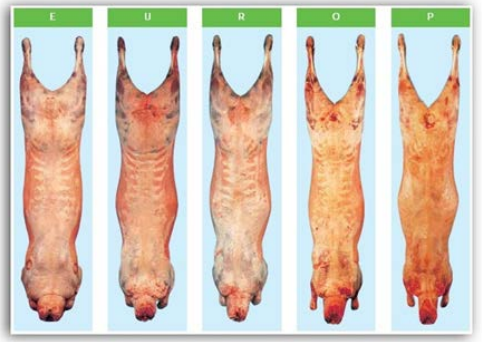
Summary of Classification

- Conformation and fat class.
- In some countries still <u>subjective.</u>

(Despite the use of photographic references).

  - Staff costs.
- Potentially varies by region (within and between EU countries).
  - Prediction of saleable meat yield via classification can be inconsistent between genders.
- Need to minimize the amount of variation arising from assessment method.
- No eating quality provision.





Saleable meat yield

- **lean meat + some fat and bone**
  - Saleable meat yield = saleable meat weight / Carcase weight x 100.

What about Kgs?

- The weight of saleable meat is important!

- Heavier carcases have more kgs of meat, but they may yield less if:
  - The percentage of fat is higher or
  - The muscle to bone ratio is lower.

Car analogy:

The size of the fuel tank vs. litres per 100 km;

which is a more informative measure of performance or efficiency?

Beef saleable meat yield example

	Carcase 1 (70% yield)	Carcase 2 (60% Yield)
Weight (kg)	350	350
Purchase Price (£/kg)	3.77	3.77
Purchase price (£)	1319.50	1319.50
Yield	70	60
Weight of saleable meat (kg)	245	210
Return @ £6.00/kg	£1470	£1260
Margin	**£150.50**	**£-59.50**

Yield and composition

- Changes in composition throughout growth are largely determined by changes in fatness.
- Producers have the most control over fatness.
- Ratio of muscle to bone is relatively stable over most of the animal's life.
- Excessive fat
  - More trimming.
  - Reduced yield of saleable meat.

Supply : penalty dilemma

- EUROP conformation and fatness are used to determine value per kg carcass weight.

In theory:

- Price per kg ↑ with *higher* degree of conformation
- Price per kg ↓ with *higher* degree of fatness

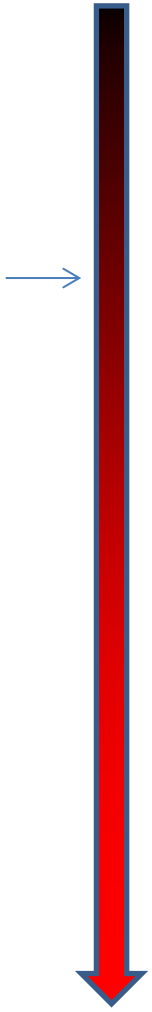
Real world:

- Shortage of animal supply means prices rise and processors no longer able to penalize for excessive fat cover.
- Farmers are not responding to the high prices by farming more sheep and cattle.

A direct prediction of yield is needed

- Yield-based carcase payment.
- Clear production goals (breeding).
- Better fit with the biology on an animal.
- Focus on efficiency > reduce fat and waste.
- Video image analysis can predict saleable meat yield in a consistent and repeatable manner.

Progress update:



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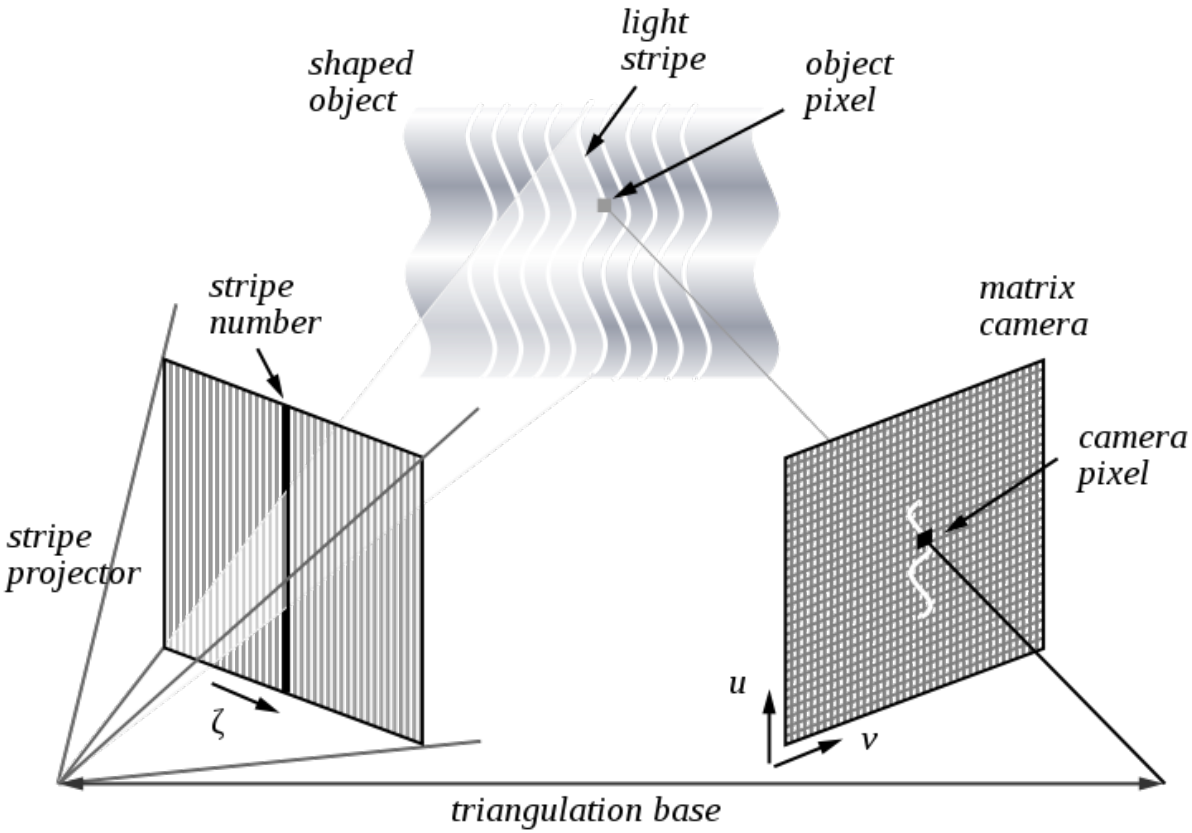
Whole-carcass VIA machines for beef

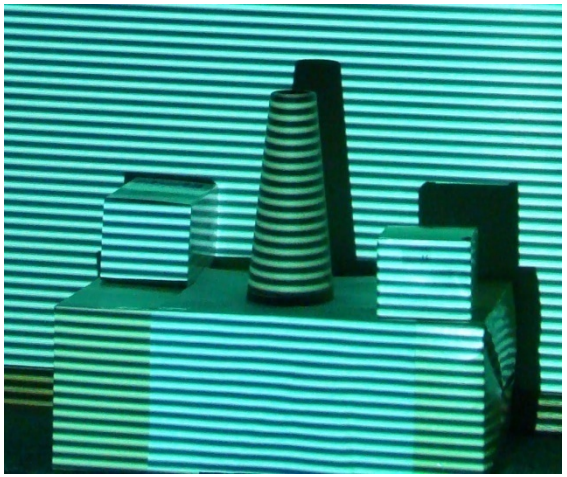
- Built to mimic visual classification.

- BCC2 – Carometec A/S, Denmark.
- VBS2000 E+V GmbH, Germany.
- MAC – Normaclass, France.

- CVS whole carcass camera system, RMS USA.
- VIAScan – Cedar Creek, Australia.

How does structured light work?



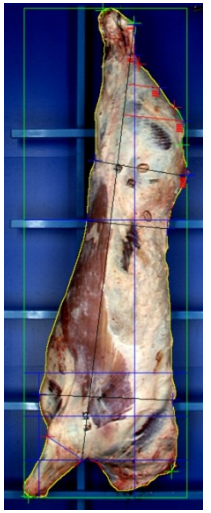


VIA prediction of yield and Classification parameters for beef

- Comparable accuracy to human assessors
- EUROP is useful for describing carcases,
- Review of literature found that the overall predictive ability of VIA is remarkably good:

Component	Median R^2
Saleable meat yield	70%
Fat %	80%
Bone %	82%
EUROP Conformation	90%
EUROP Fatness	83%

Source: Craigie, C. et al. (2012) Meat Science 92(4) 307-318



Beef VIA

- Most experiments have assessed the ability of VIA to predict conformation and fatness.
- Far fewer experiments have looked at the direct prediction of yield and the distribution of meat through the carcass.
- Need to assess this in more detail to determine whether VIA can be used to evaluate carcasses on yield of certain cuts.

Lamb VIA

- VIAscan is commonly used in NZ for lamb carcass evaluation.
- SRUC has trailed and validated the E+V VSS 2000 for the UK.
- Normaclass (France) has designed a new lamb VIA system (2 installed).
- Yield prediction with CT scan system (the one from IFIP used for pork yield calibration) with Institut de l'Elevage.

New Normaclass Lamb VIA

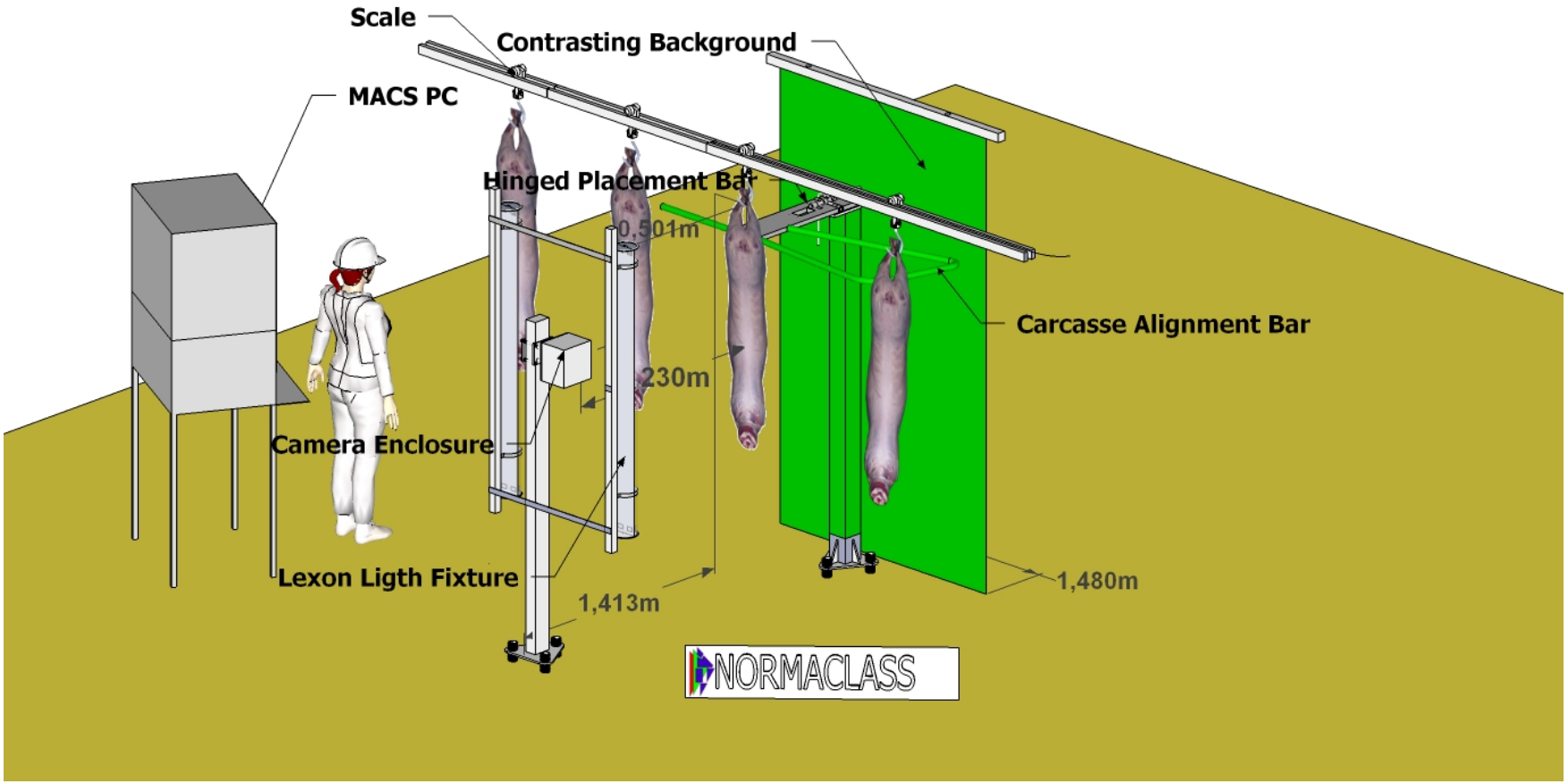
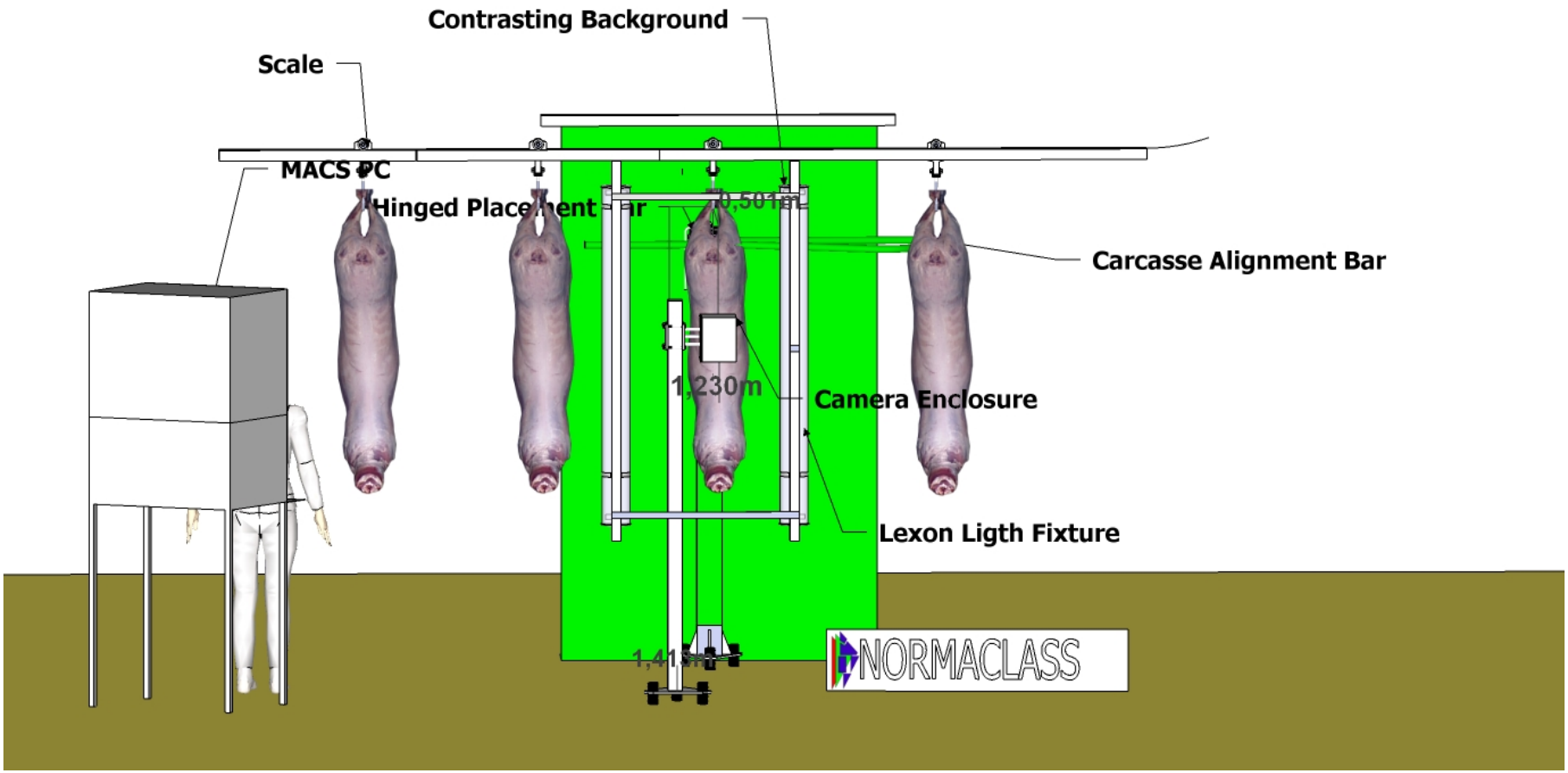


Image courtesy of Cyrille Précetti, Normaclass



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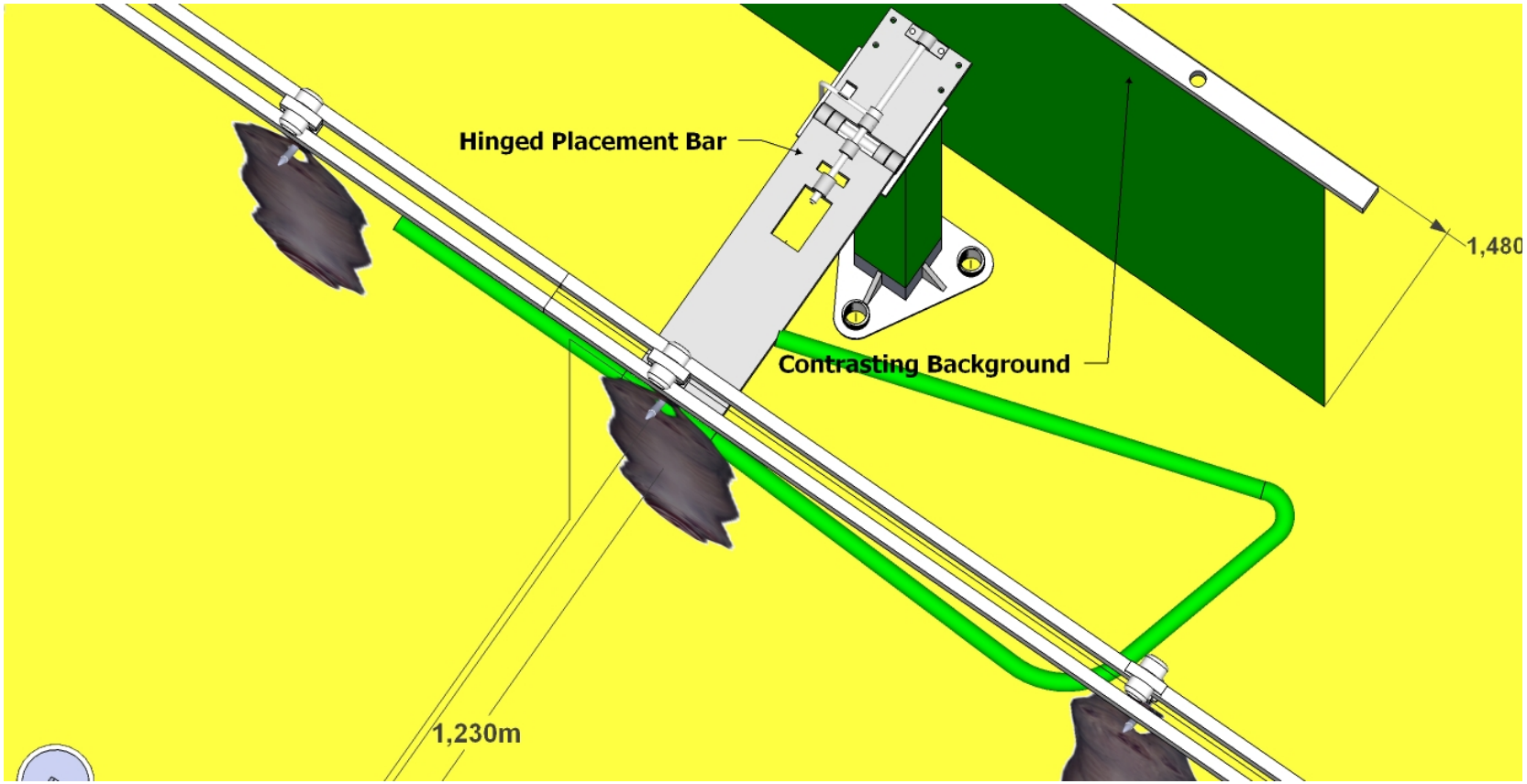

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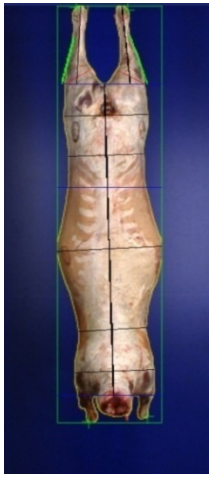
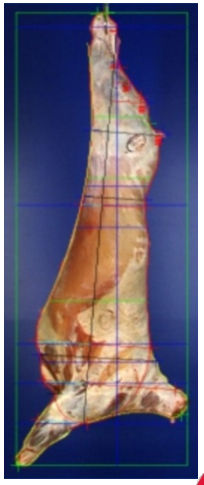
E+V lamb VIA

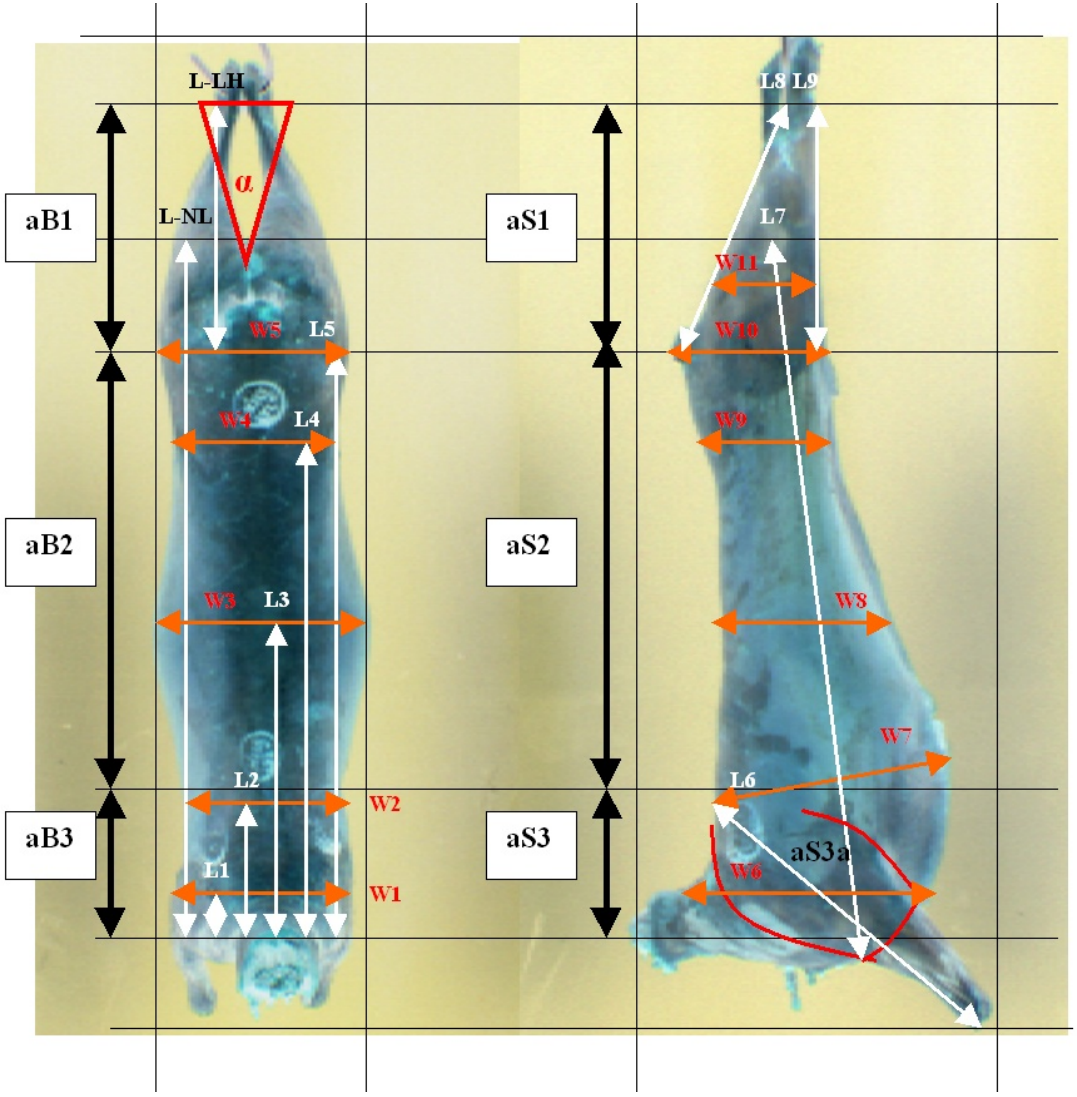
- Repeatability and accuracy (objective vs. subjective).
- Prediction of carcass composition.





Rius-Vilarrasa et al 2009 Meat Sci, 2010 Livestock Sci

Some lamb VIA dimensions



Extensive experiment at SRUC investigating VIA on lamb

Carcass Classification

Carcass dissection

MLC score

(5 point scale)

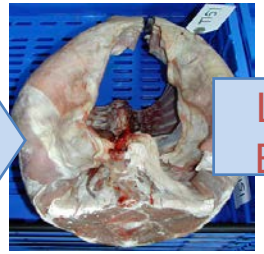
VIA traits

Legs

Saddle

Shoulders

Primals



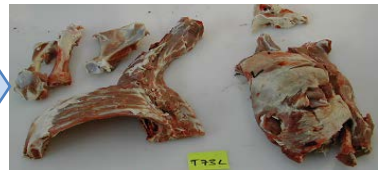
Legs & Chump

Loin & Breast

Shoulders

Trimmed primals

(Fat, lean trim & bone-waste)



Conclusions from SRUC lamb VIA work

- VIA is accurate and precise for prediction of primal yield from various primal cuts from lamb carcass.
- Heritability much higher for VIA than EUROP traits.
- VIA provides additional information useful in the selection of terminal sire rams to improve carcass quality.
- VIA technology could be the foundation for a value-based marketing system to reward producers for real improvements in carcass quality.

VIA overview

- Advantages
  - Objective, highly repeatable and reproducible.
  - Ability to predict EUROP, saleable meat yield of whole carcass, and some primal cut yields.
  - Labour saving.
  - Automatic data collection and linked to EID database possible.
- Disadvantages
  - Space requirement.
  - Not really known whether direct yield predictions can be improved upon.
  - Some cut yields (e.g. loin and fillet poorly predicted).

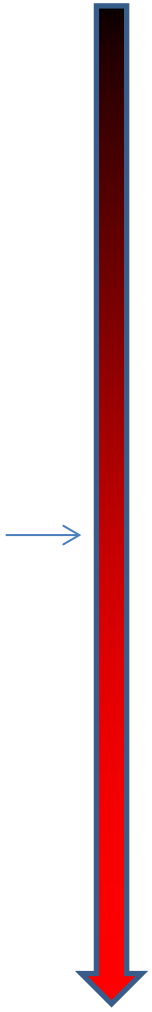
Challenges VIA

- Variable trimming leads to variable saleable meat yield.
- Conformation and fatness remain important for carcass evaluation, fatness class prediction is often poorer than conformation.
- This is important for carcass description but not necessarily for evaluation purposes.
- Large space requirement for some VIA systems.
- High sheep and cattle prices and a shortage of supply means uptake is slow.

Opportunities VIA

- VIA use increases the objectivity and consistency in the carcass evaluation process.
- It is possible to extract more information from VIA than from human classifiers.
- VIA information could be used to improve value-chain efficiency if a yield-based payment was used.
- VIA traits are moderately heritable in beef and sheep.

Progress update



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Value-based marketing

- No standard definition - dependant on context.

Within the realms of meat, the idea of VBM is to include - in the return to the producer - an element of the value of the final product sold by the processor to the retailer (Palmer, 1996).

we propose that:

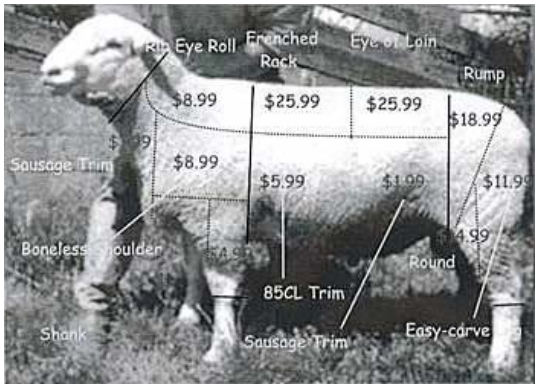
The paradigm of VBM is a system of determining value of a product based on an accepted description that, when multiplied by the value per unit, constitutes, to some extent, both the customer purchase price and supplier remuneration rate.

For meat producers and processors, that requires:

- Parameters must be measurable and marketable.
- A shift from producing a commodity to producing a product.
- An appreciation of certain, intrinsic meat quality attributes (e.g. tenderness).

We need to be able to measure and quantify valuable aspects

- Because some cuts are worth more than others.



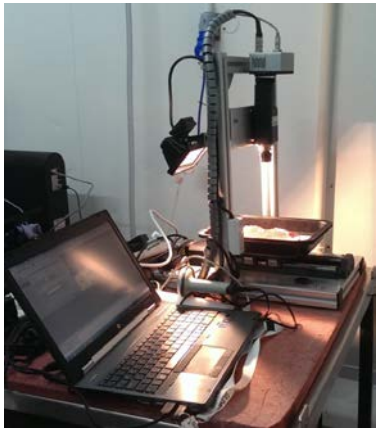
- To facilitate a more targeted carcass evaluation.
- VBM is theoretically possible, but is it practically possible?
- Is there a large enough incentive to align to customer/consumer demand?

Challenges: Value based marketing

- Value Based Marketing of meat is difficult to achieve in a subsidised market.
  - Producers not responding to price incentives.
- Assumption that meat processors sell all cuts for a profit.
- If price differentials between cuts are related to perceived quality then we need to quantify this.
- All or nothing approach for processors:
  - profit from good value carcasses can offset loss from bad value carcasses.
  - Passing losses back to producers not an option.

Opportunities: VBM

- It is now possible to establish the saleable meat yield of an individual carcass under commercial processing conditions.
- Farmers could be paid in this way.
- First step to value-based marketing.
- Quality-based payments depend on our ability to measure them!



Talk Progress

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Summary

- Carcass evaluation underpins the transaction between producers and processors.
- Evaluation based on EUROP is not working well in a time of short supply as processors cannot penalize for excess fat.
- VIA has the potential for facilitating yield-based carcass evaluation.
- VIA carcass traits have a higher heritability than visually assigned EUROP scores.
- Value-Based Marketing requires a focus on the product rather than commodity.
- **VIA can tell us “how much” but not “how good it is”**

Acknowledgement

- Farm Animal Imaging (FAIM) cost action FA1102.

Questions?

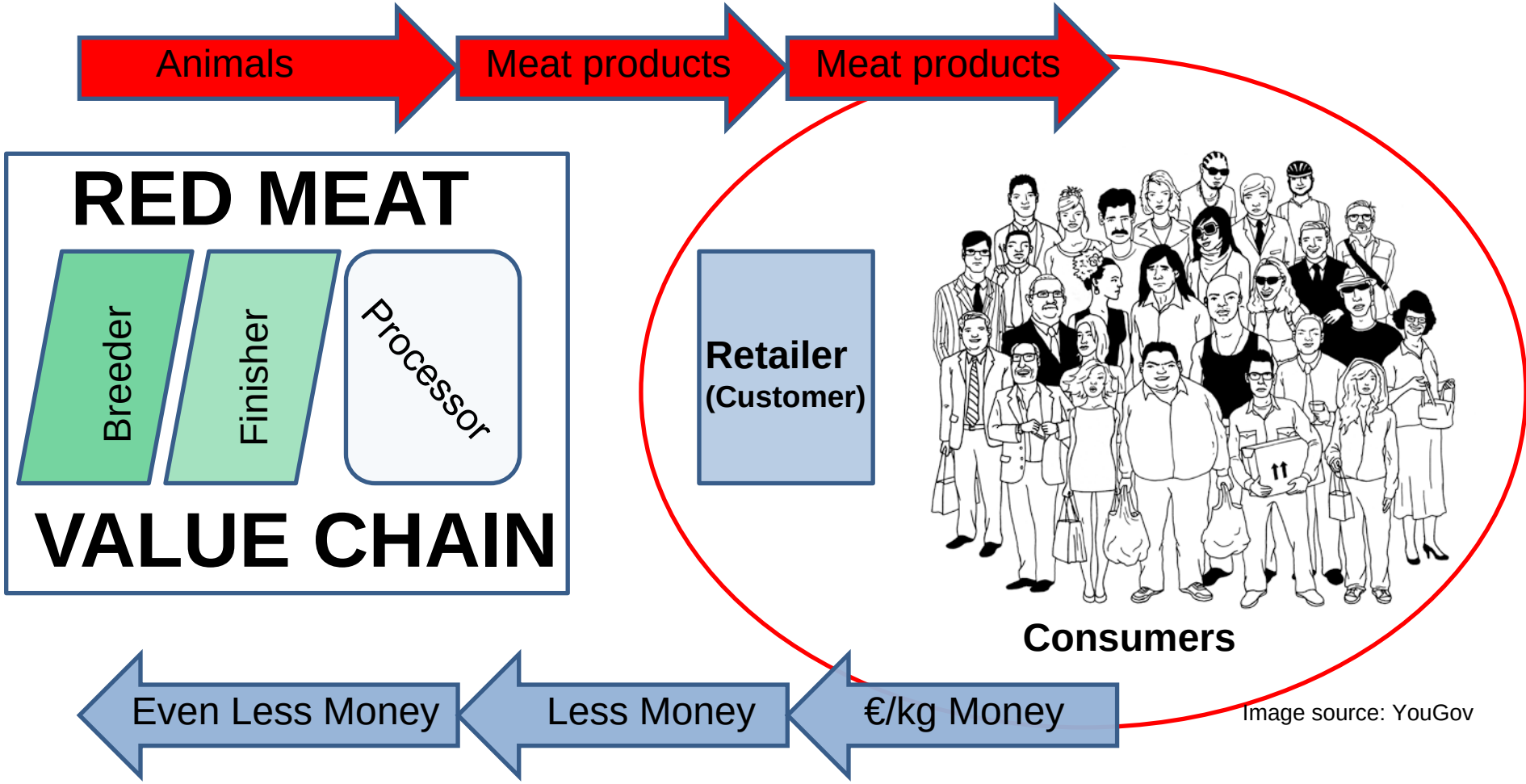

Image source: YouGov