



Opportunities for predicting and manipulating beef quality

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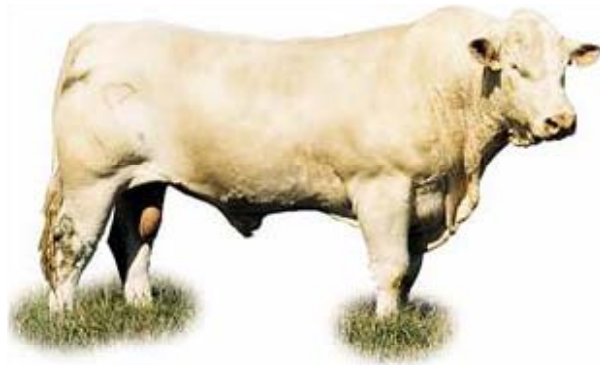
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Opportunities for predicting and manipulating beef quality

(Présentation aux étudiants et professeurs de la « Northwest A&F University » à Yangling, Chine)



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The definition of quality

Intrinsic quality refers to the characteristics of the product itself and includes safety, healthiness, sensory traits (e.g. tenderness, flavor, juiciness, overall liking), convenience, etc.

Extrinsic quality refers to traits which are associated with the product, namely (i) production system characteristics (from the animal to the processing stages including for example animal welfare, carbon footprint), and (ii) marketing variables (including price, brand name, distribution, origin, packaging, labelling, and traceability)

Outline

1. Intrinsic quality traits

1.1. Composition of the muscle tissue

1.2. Overall beef quality

1.3. Aggregation of measures related to the different intrinsic quality traits

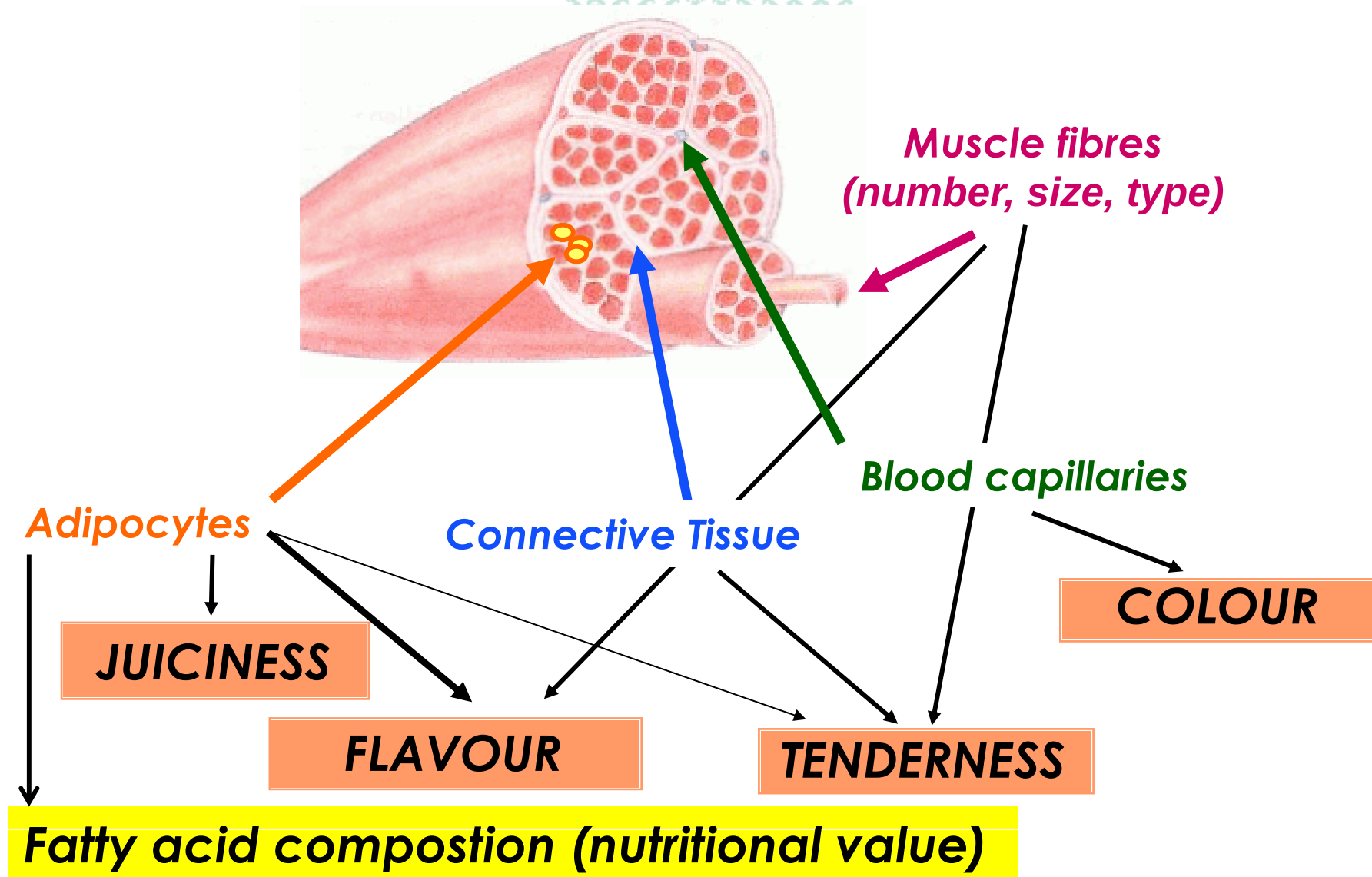
2. Extrinsic quality traits

2.1. The increasing importance of extrinsic quality traits

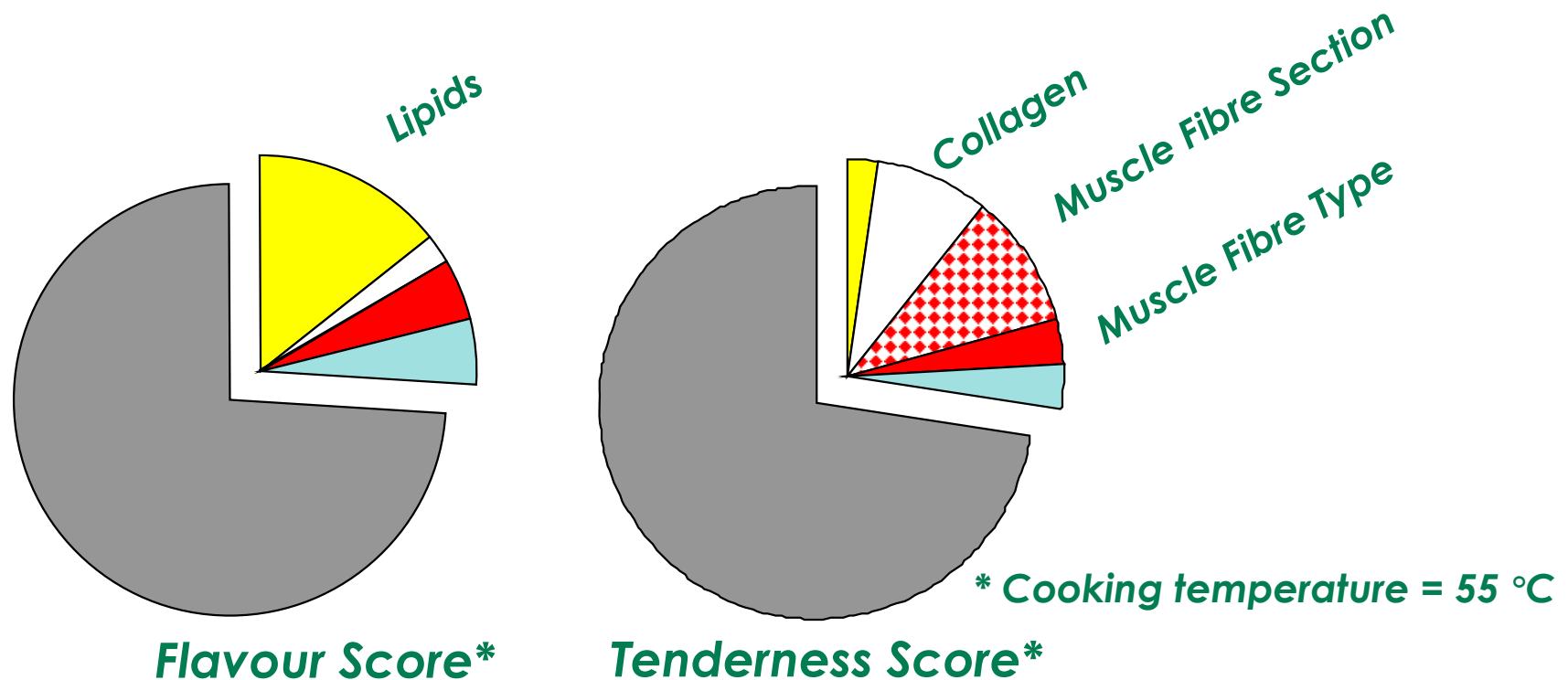
2.2. Existing quality labels with regard to extrinsic quality traits

2.3. Future research priorities to better predict and to enhance quality

How muscle biochemistry affects beef quality

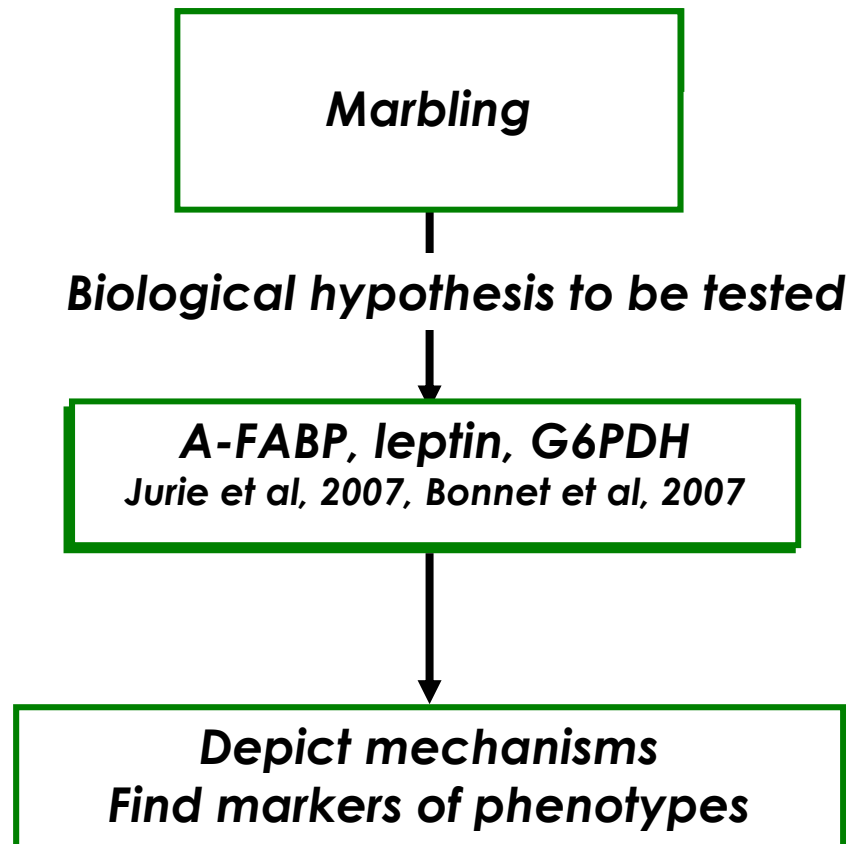


Relationships between Meat Quality attributes and Muscle Characteristics

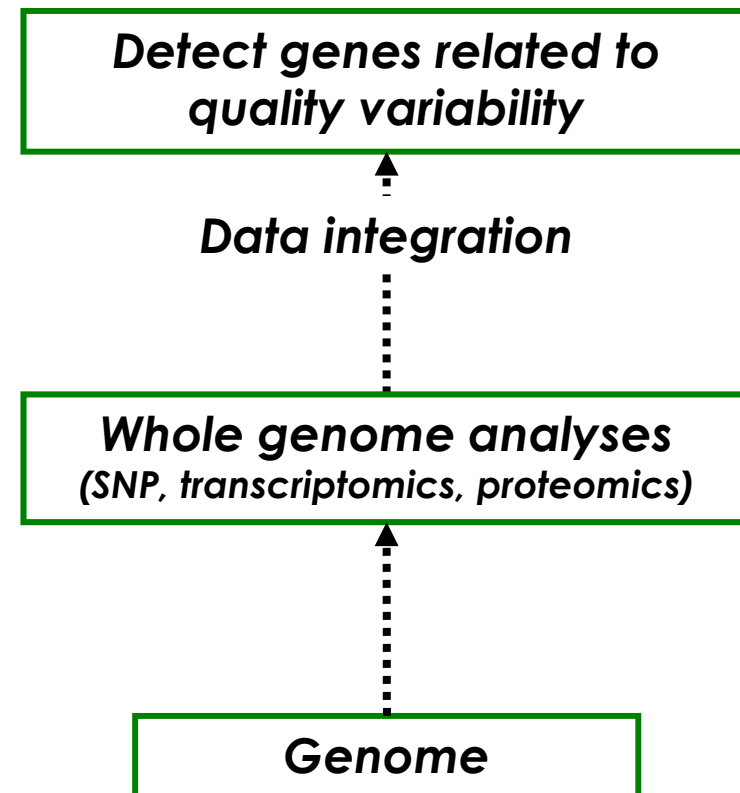


Genomics brings new markers of quality

Candidate gene approach



Genomics



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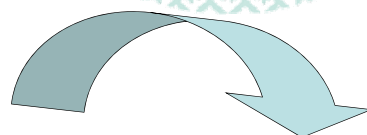
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Prediction of beef quality in Australia

the Meat Standards Australia system

Prediction



MSA2000model®

Hang (AT/TC/TS/TX)	AT
Sex (M, F)	m
Est.% Bos Indicus	0
Hump Height cms	0
Hot Std Carc Weight	200
USDA Ossification	100
Milk Fed Vealer Y/N	N
USDA Marbling	130
Days Aged (min 5)	5
Quarter Point Ribfat	5
Ultimate pH	5.40
AUSMEAT Meat Col.	2
Saleyard? (Y, N)	n
Wght/App.Maturity	1.32

Cut Description	Muscle Reference	Days Aged	Grilled Steak	Roast Beef	Stir Fry	Thin Slice	Cass-erole	Corne d Beef
Tenderloin	TDR062		5	4	5			
Cube Roll	CUB045		3	3	3	4		
Striploin	STR045		3	3	3	3		
Oyster Blade	OYS036		4	3	4	4		
Bolar Blade	BLD096		3	3	3	3	3	
Chuck Tender	CTR085			3	3	3	3	
Rump	RMP131		3	3	3	3		
Point End Rump	RMP231		3	3	3	4		
Knuckle	KNU099		x	3	3	3	3	
Outside Flat	OUT005			x	x	3	3	3
Eye Round	EYE075		x	3	3	3	3	x
Topside	TOP073		x	3	x	3	3	
Chuck	CHK078			3	3	3	3	
Thin Flank	TFL051				3		3	
Rib Blade	RIB041				3			
Brisket	BRI056				x	3	3	x
Shin	FQshin						3	

MSA2000model®

Hang (AT/TC/TS/TX)	AT
Sex (M, F)	m
Est.% Bos Indicus	0
Hump Height cms	0
Hot Std Carc Weight	250
USDA Ossification	140
Milk Fed Vealer Y/N	n
USDA Marbling	130
Days Aged (min 5)	5
Quarter Point Ribfat	12
Ultimate pH	5.50
AUSMEAT Meat Col.	2
Saleyard? (Y, N)	n
Wght/App.Maturity	0.86

Cut Description	Muscle Reference	Days Aged	Grilled Steak	Roast Beef	Stir Fry	Thin Slice	Cass-erole	Corne d Beef
Tenderloin	TDR062		5	4	5			
Cube Roll	CUB045		3	3	3	3		
Striploin	STR045		3	3	3	3		
Oyster Blade	OYS036		4	3	4	4		
Bolar Blade	BLD096		3	3	3	3	3	
Chuck Tender	CTR085			3	3	3	3	
Rump	RMP131		3	3	3	3		
Point End Rump	RMP231		3	3	3	4		
Knuckle	KNU099		x	3	3	3	3	
Outside Flat	OUT005			x	x	3	3	3
Eye Round	EYE075		x	3	3	3	3	x
Topside	TOP073		x	x	x	3	3	
Chuck	CHK078			3	3	3	3	
Thin Flank	TFL051				3		3	
Rib Blade	RIB041				3			
Brisket	BRI056				x	3	3	x
Shin	FQshin						3	

A change in marbling score from 130 to 300 changes palatability of the Cube Roll and Point End Rump

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Outside Flat	OUT005			x	3	3	3	3
Eye Round	EYE075		x	3	3	3	3	x
Topside	TOP073		x	3	3	3	3	
Chuck	CHK078			3	3	3	4	
Thin Flank	TFL051				3		3	
Rib Blade	RIB041				3			
Brisket	BRI056				x	3	3	x
Shin	FQshin						3	

How the Meat Standards Australia system works ?

- **Predictors**

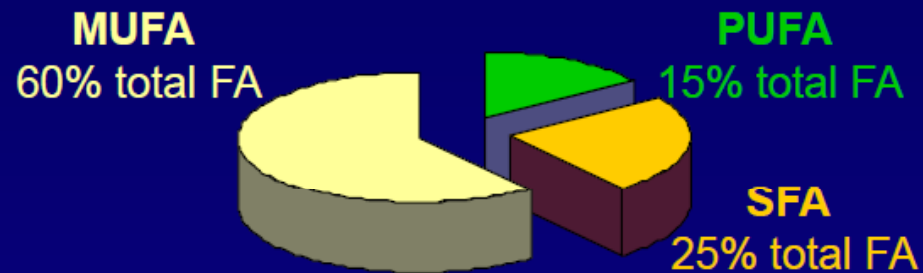
- Breed (2-10) restricted to
 - Bos indicus content
- Gender (2)
- Growth path (10)
 - carcass wt
 - ossification score
 - Milk fed veal
- Hanging (0-10)
- Marble score (2-10)
- Ageing: 5d min (0-6)
- Cooking method (0-12)
- Muscle (30)
- pHu
- Rib fat



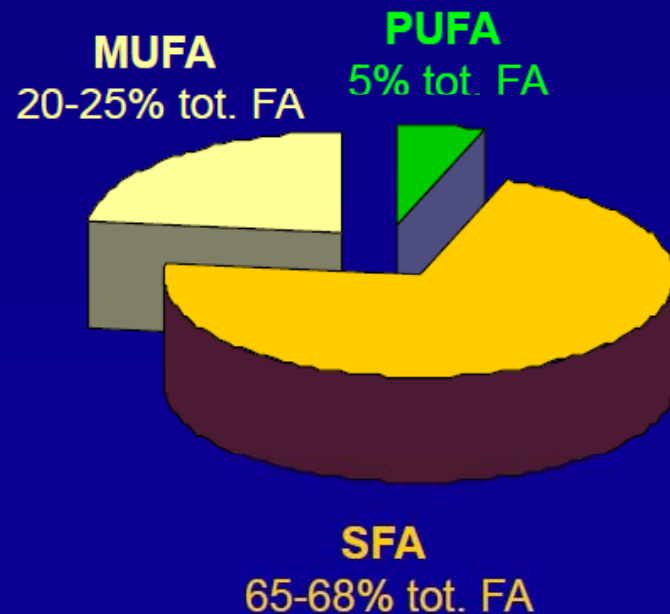
***It works in Korea,
the USA, France,
Japan, Northern Ireland
and the Irish Republic***

Fats and healthiness:

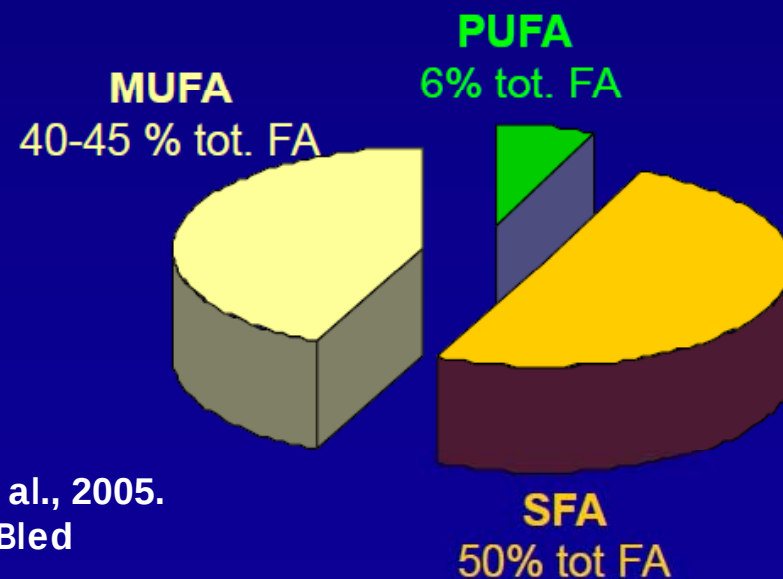
Recommended nutritional supply



MILK



MEAT



Bauchart et al., 2005.
EAAP, Bled

The nutritional value of meat

Nutrient per 100g	Beef	Lamb	Pork	Calf liver
Vitamin A				Rich source
Vitamin B ₁			Rich source	Rich source
Vitamin B ₂	Source		Source	Rich source
Vitamin B ₃	Rich source	Rich source	Rich source	Rich source
Vitamin B ₆	Rich source	Source	Rich source	Rich source
Vitamin B ₁₂	Rich source	Rich source	Rich source	Rich source
Iron	Source			
Zinc	Rich source	Rich source	Source	Rich source
Selenium			Source	Rich source
Potassium	Source	Source	Source	Source
Phosphorus	Source	Source	Source	Rich source

≥ 15% of the RDA per 100g = *Source*; ≥ 30% of the RDA per 100g = *Rich source*

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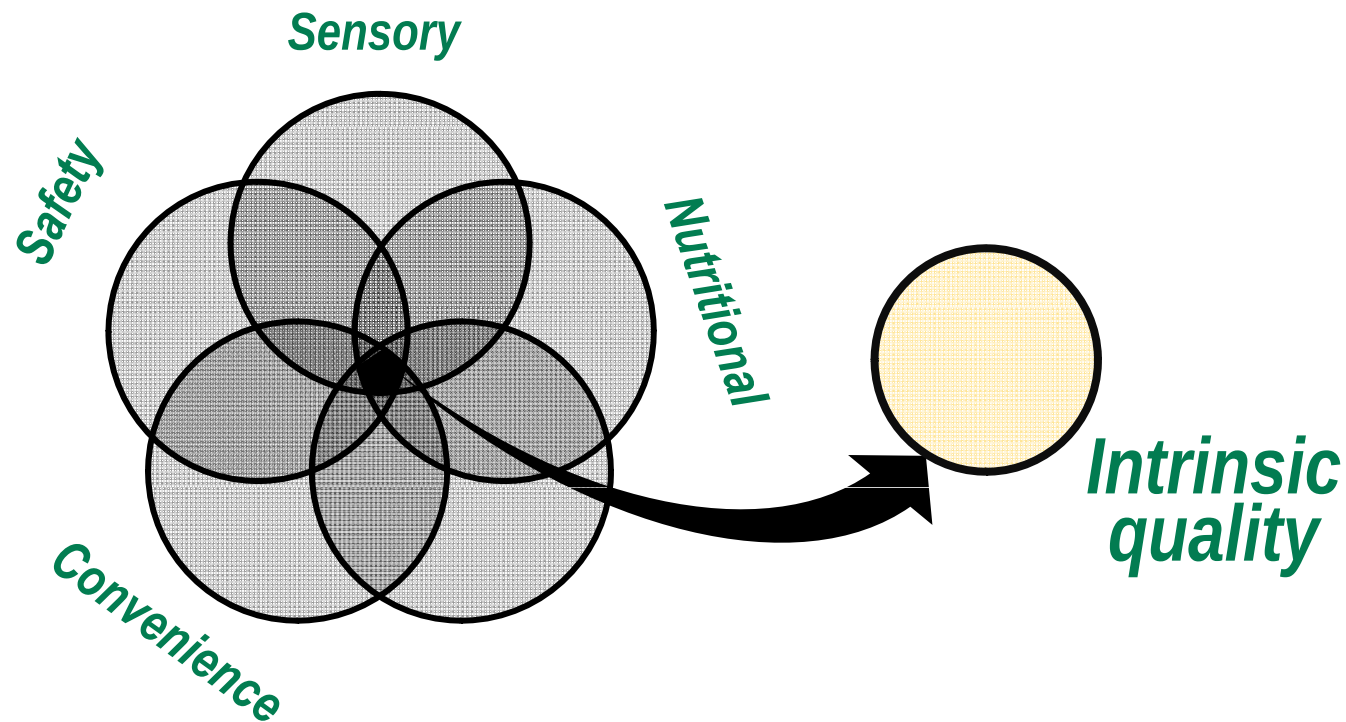
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Aggregation of measures related to the different intrinsic quality traits

The question is :
is it possible to have a fully combined criteria ?



How to combine these different criteria of quality?

Some intuitive methods...

1. **Analysis by an expert:** done by traditional butchers in Europe. Not transparent and also not consistent across experts.
2. **Conversion of quality traits into value-scores** (e.g. quantitative information) which are then compounded (e.g. the MSA system based on a weighted sum)
3. **Other methods developed for Welfare** (Welfare Quality®)

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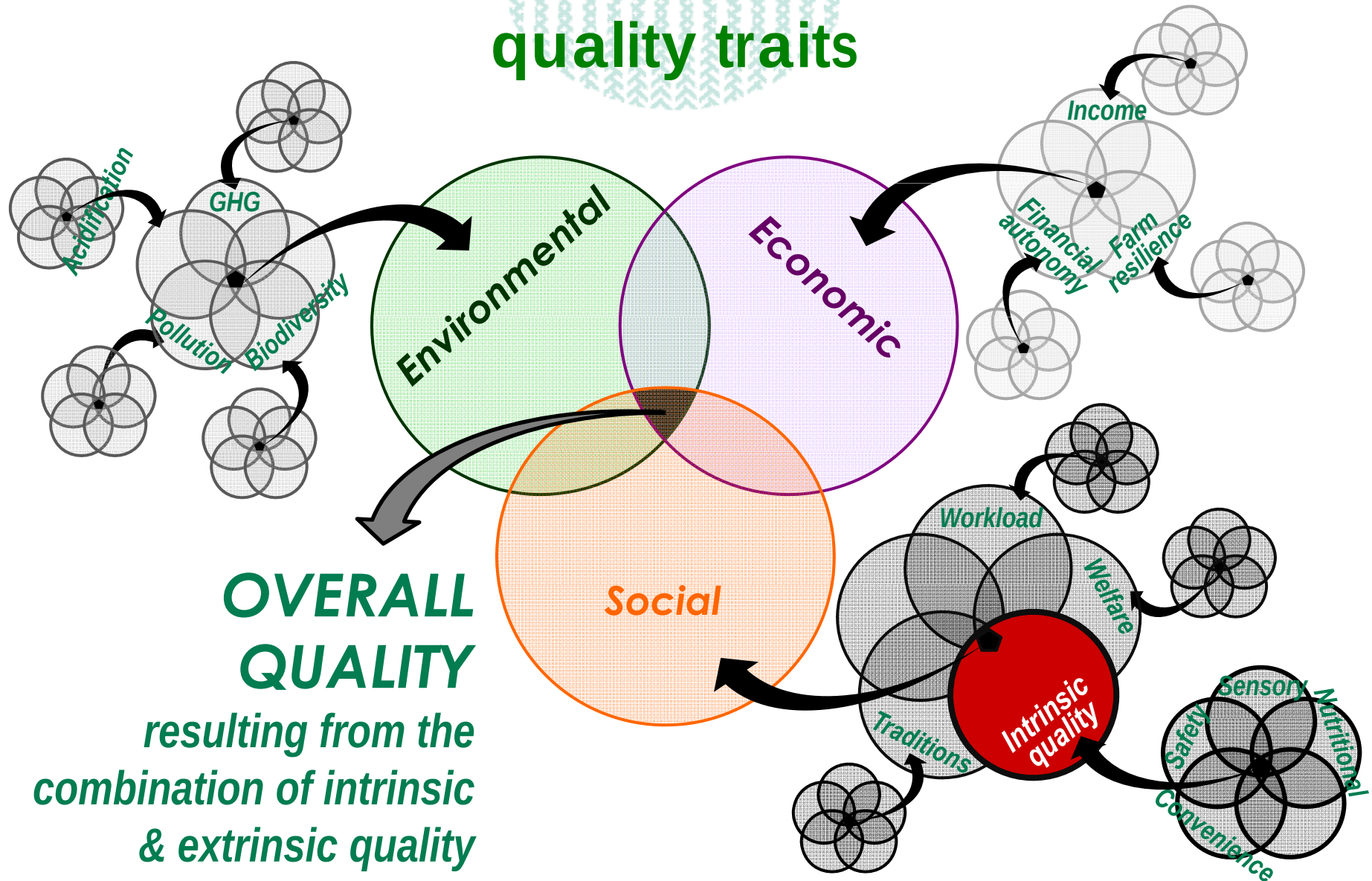
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The increasing importance of extrinsic quality traits

The demand for livestock products in the future is likely to be moderated by **socio-economic** factors such as human health concerns, the cost of the product and changing socio-cultural values (such as concerns for animal welfare and carbon footprint of the products)

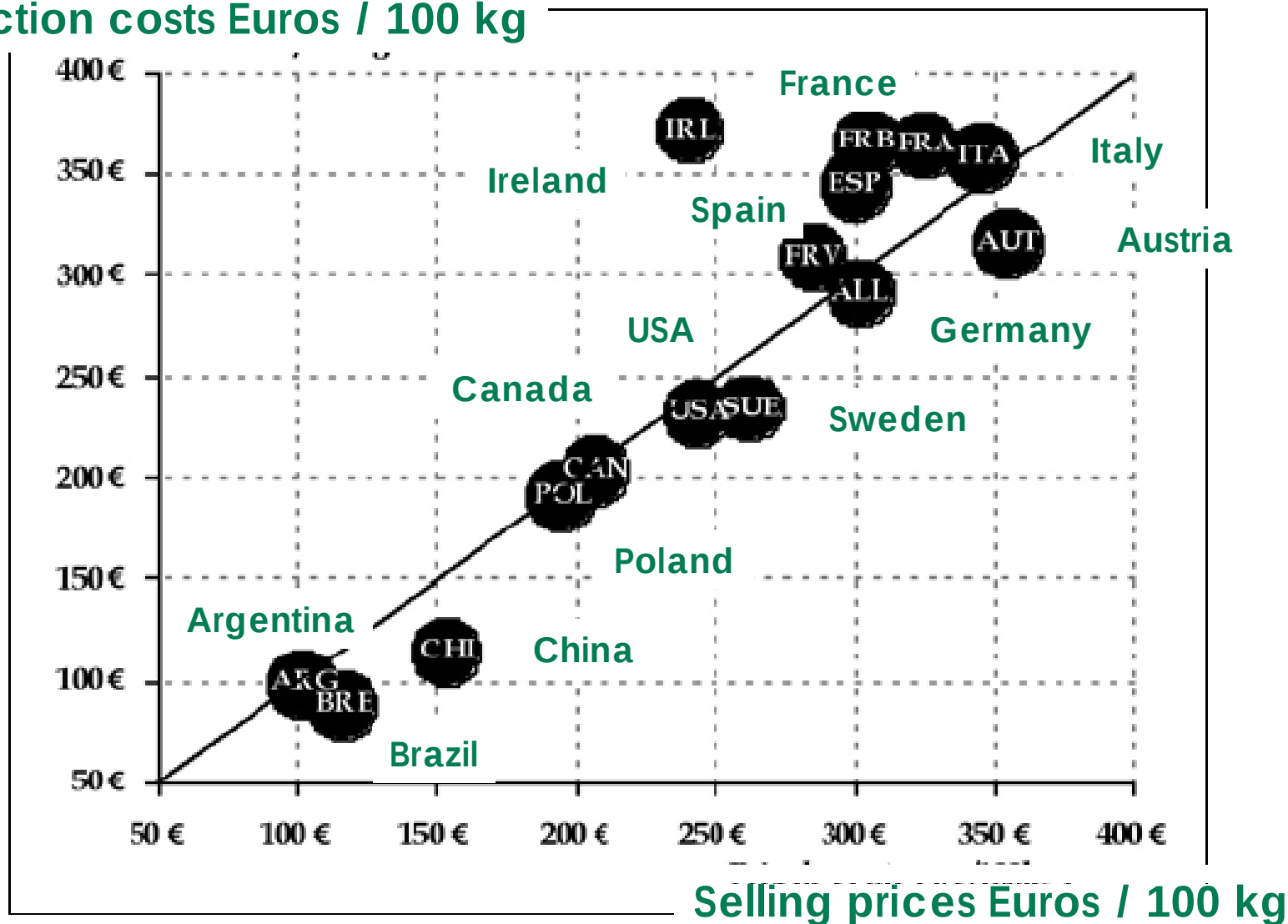
(Thornton, 2010)

The combination of intrinsic and extrinsic quality traits



Beef production costs and prices in different countries

Production costs Euros / 100 kg



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The concepts of designation of origin and geographical indication

Example:
wine production



BIOLOGICAL FACTORS
(raw material production:
varieties, breeds,...)



Regional product
(with old fame of its
geographic name)

"TERROIR"
(local area)



PHYSICAL FACTORS OF REGIONS
(geology, pedology,
relief, climate, ...)



HUMAN FACTORS
(collective set of
techniques and
customs)

The different official quality marks in Europe and France

	Protected designation of origin (PDO)	Protected geographical indication (PGI)	Traditional Speciality Guaranteed (STG)	Organic farming	Label Rouge
EU					
France					

The four PDO beef meat products in France (niche markets)



La viande AOC Maine-Anjou concerne des élevages situés dans les six départements suivants : Loire-Atlantique, Maine-et-Loire, Mayenne, Sarthe, Deux-Sèvres, Vendée.

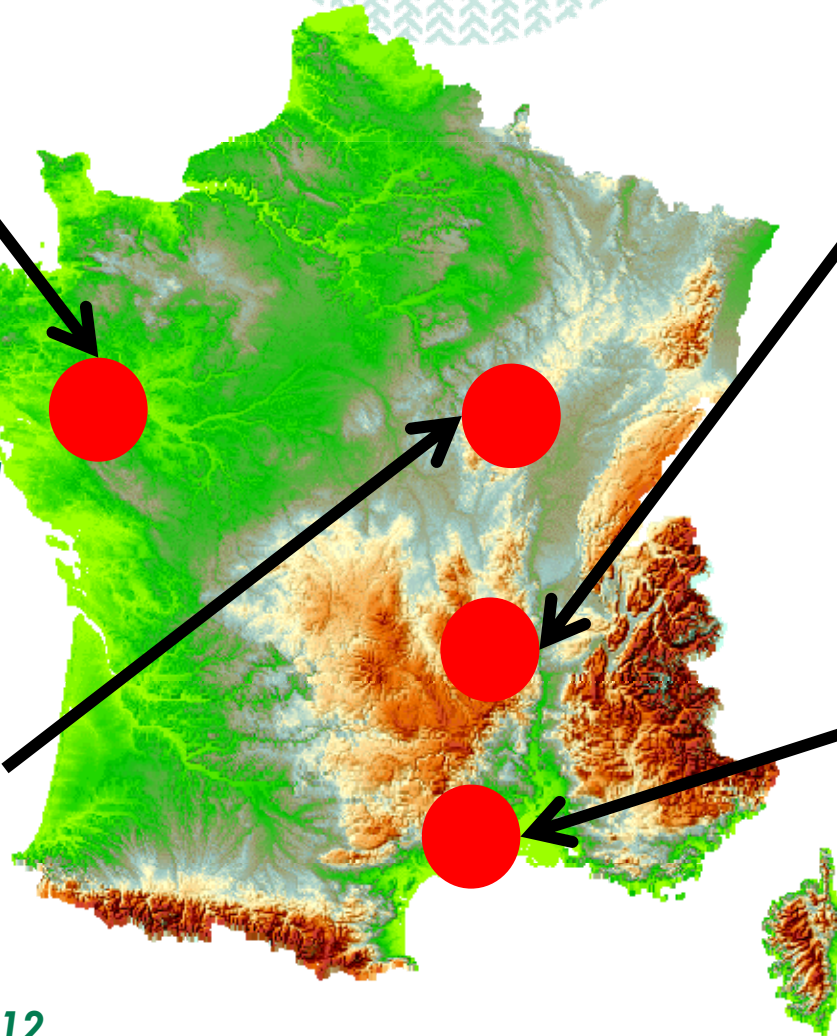
2004 / 2010

≈ 200 producers
≈ 2500 animals in 2011
≈ 20 supermarkets
and ≈ 12 restaurants



2010

≈ 120 providers
≈ 1000 animals in 2012
≈ 71 sale points (butchers)



2006

≈ 100 producers
≈ 600 animals in 2012
≈ 100 butchers



1996 / 2010

≈ 100 producers
≈ 600 animals in 2012
≈ 100 butchers



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(from a workshop held in Theix, France, Sept 9-10, 2009)

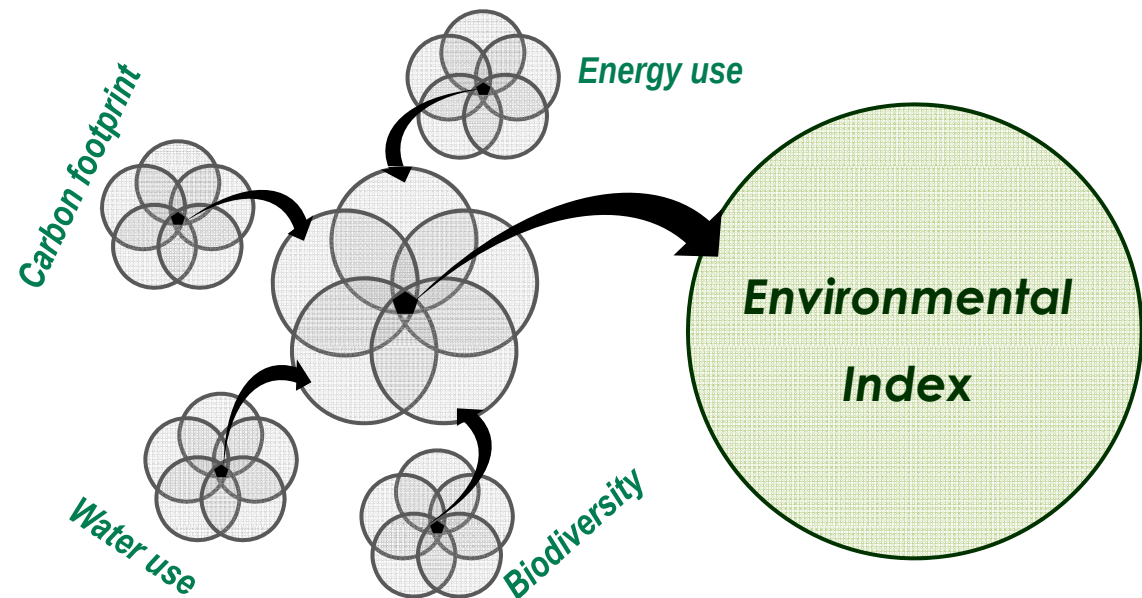
Future priorities to better predict beef quality

- ✓ The existing knowledge is not fully applied for economic, social or political reasons and progress should be made in that direction.
- ✓ The beef industry is generally conservative and thus reluctant to any change.
- ✓ A great change in mindset is required to develop payment on the basis of beef quality instead of quantitative meat production or carcass conformation and fatness alone.

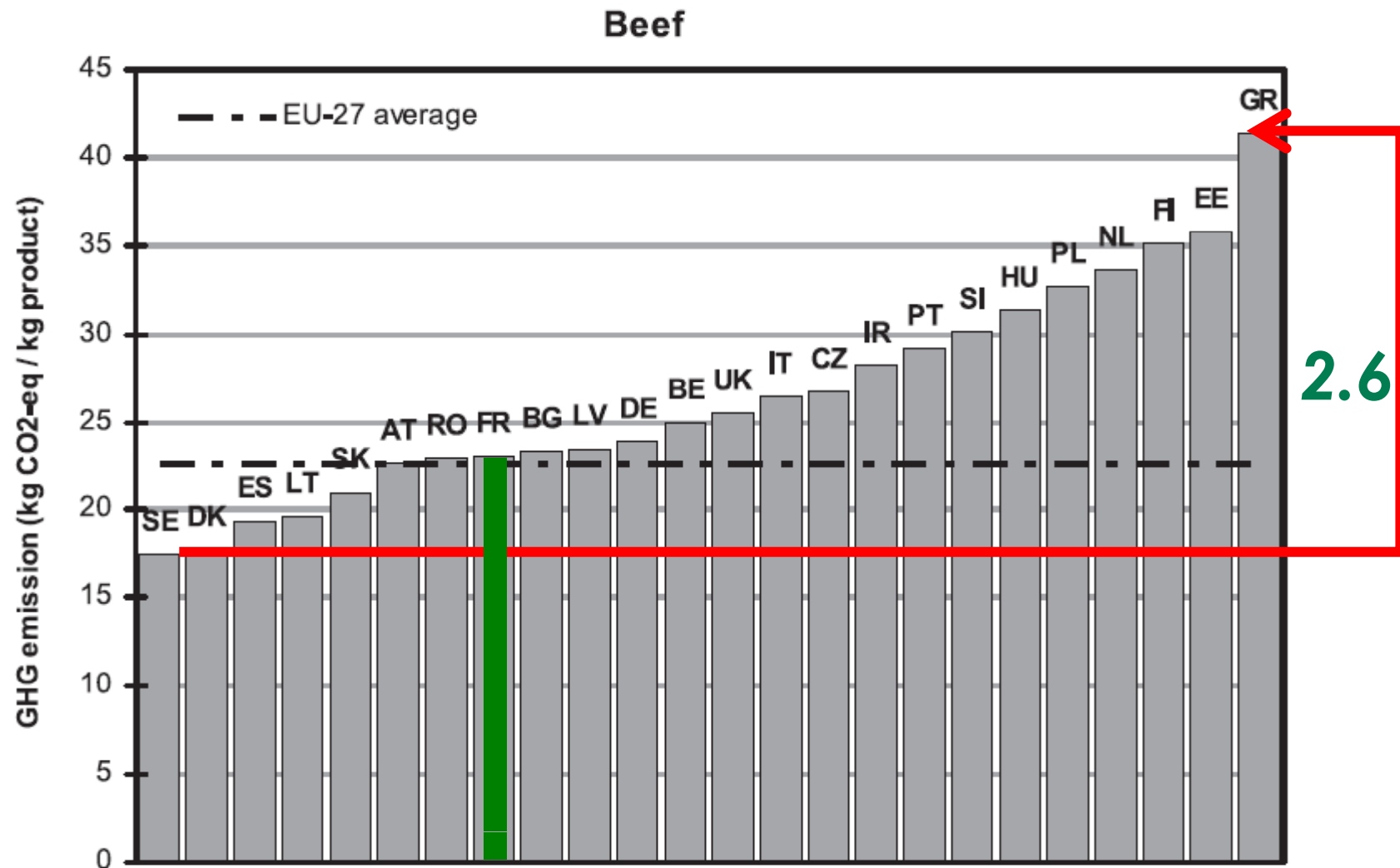
Future priorities to better predict beef quality

An environmental index should be developed for animal products to take into account the carbon footprint, water, energy use and also the fact that ruminants turn low quality raw material (cellulose/low quality protein) such as grass into highly nutritious food.

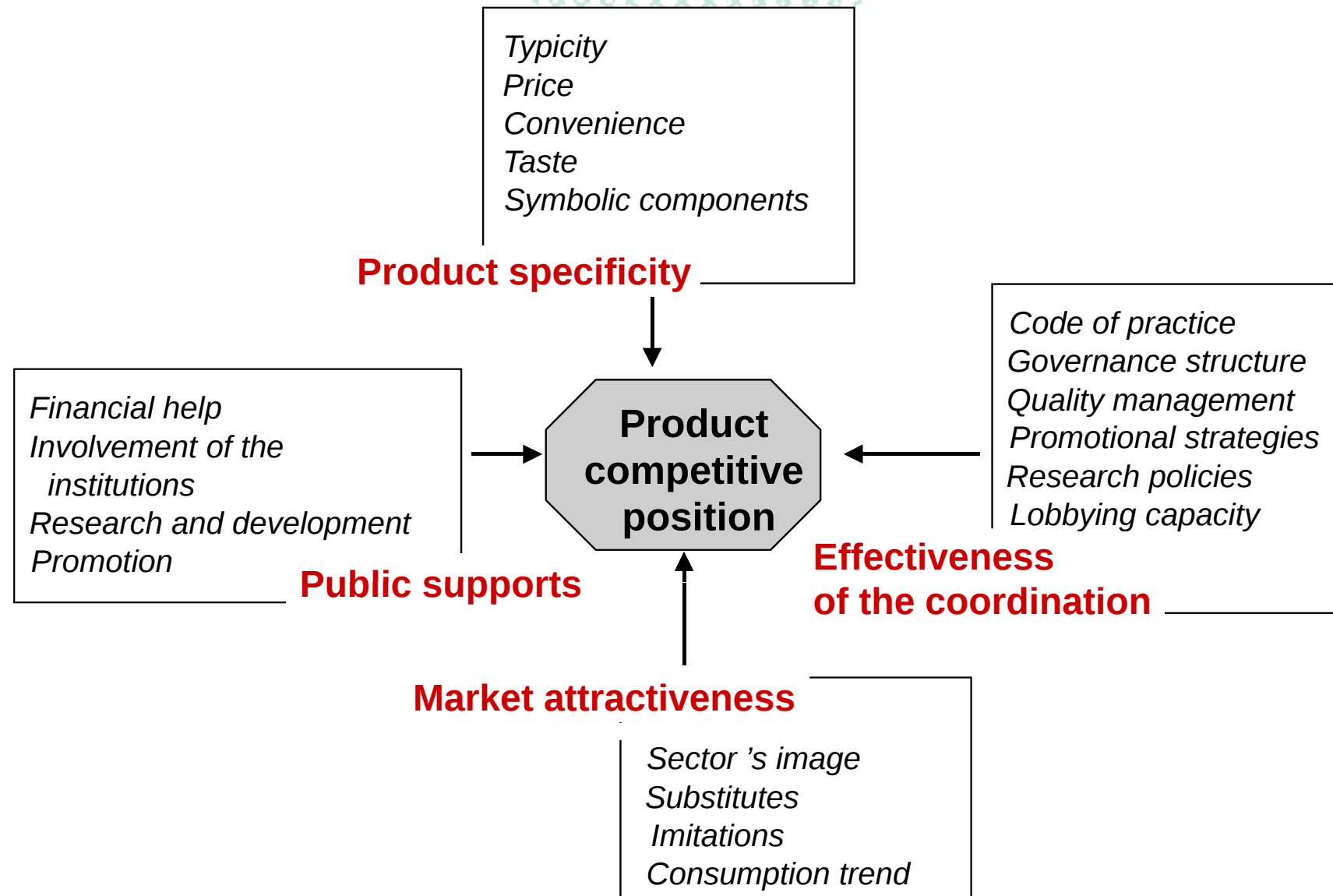
This implies the development of an aggregation of environmental measures.



GHG emissions/kg of beef for EU member states



The determinants of the Product Competitive Position



CONCLUSIONS

- ✓ **Consumer satisfaction** when eating beef is a complex response based on **objective** and **emotional** assessments of the product.
- ✓ **Combining intrinsic and extrinsic** quality traits by relevant and new methods is a key driver for the future.
- ✓ The **MSA system** can predict with a good accuracy the palatability of beef.
- ✓ **Combining** the **MSA system** and the **PDO/PGI system** is a practical way to ensure palatability and to satisfy the symbolic demand of consumers and citizens related to images of origin. **Both systems are not in competition but could help each other.**

**One efficient method
to improve beef consumption is Communication.
We must have consumers
wanting to buy beef.**

**Don't be afraid to
say I love beef**

