Assessing GHG emissions across the Irish sheep meat value chain

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Agri benchmark Beef and Sheep Conference

Presentation overview

Farm level

Investigate the **multifunctional aspects of sheep production systems** beyond measures of output and financial return

- Environmental outputs in terms of *GHG emissions* at farm level

Sector level

Identify the **economy wide contribution of the sheep sector** and describe the sheep meat value chain

- The *macroeconomic and environmental contribution of the* sector in terms of *output, jobs and GHG emissions*

The Irish sheep sector

Sectoral level

- €255 million output in 2016 (CSO, 2017)
- 4th largest sheep meat producer in EU-27
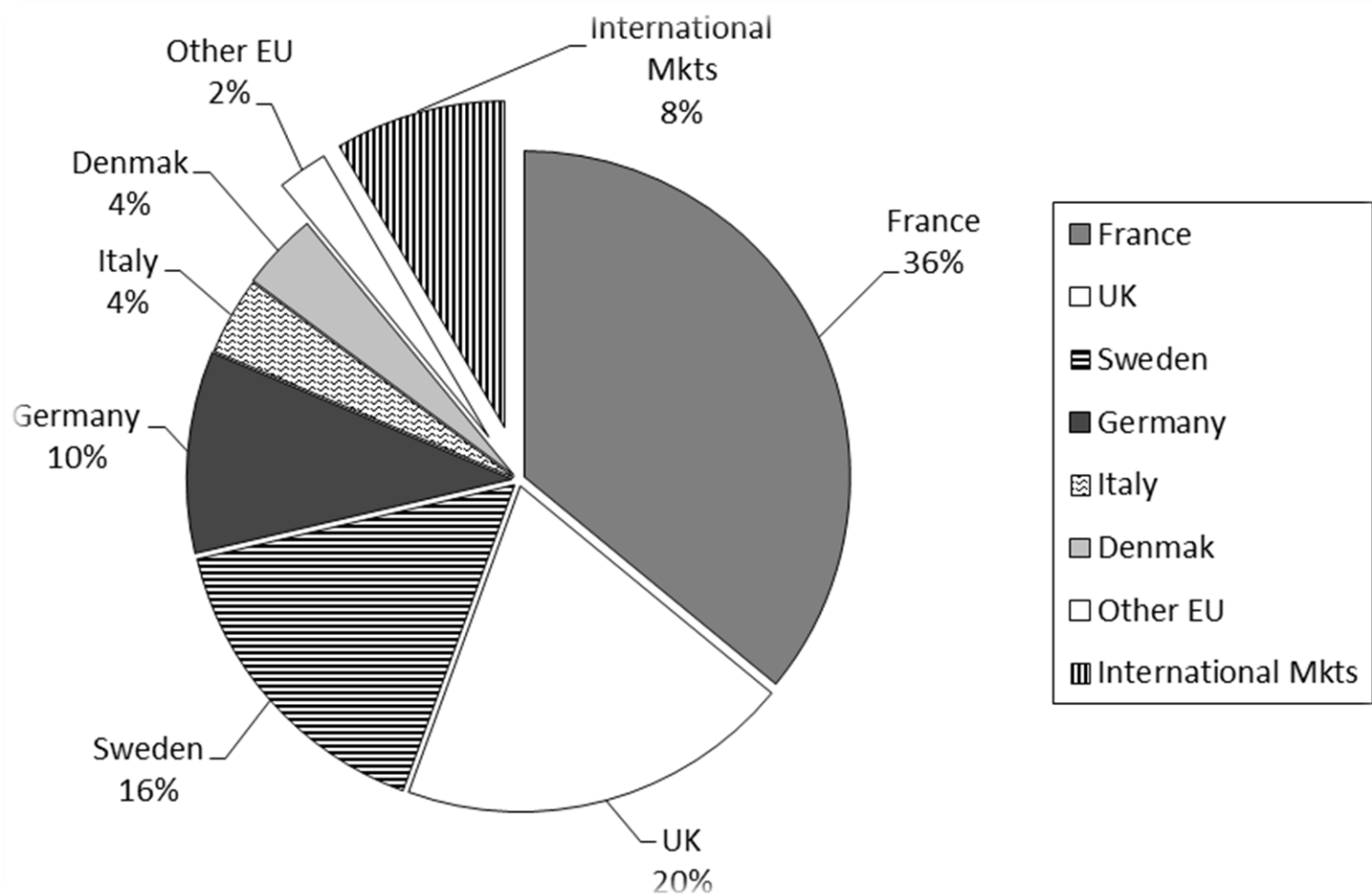- 2nd largest sheep meat exporter in EU-27

Farm level

- 2nd most common enterprise on Irish Farms
  - 36,313 sheep flocks (CSO, 2017)
  - Highly reliant on direct income support
  - Most economically vulnerable of all farm types

Sheep meat production in EU-27 by member state - 2016
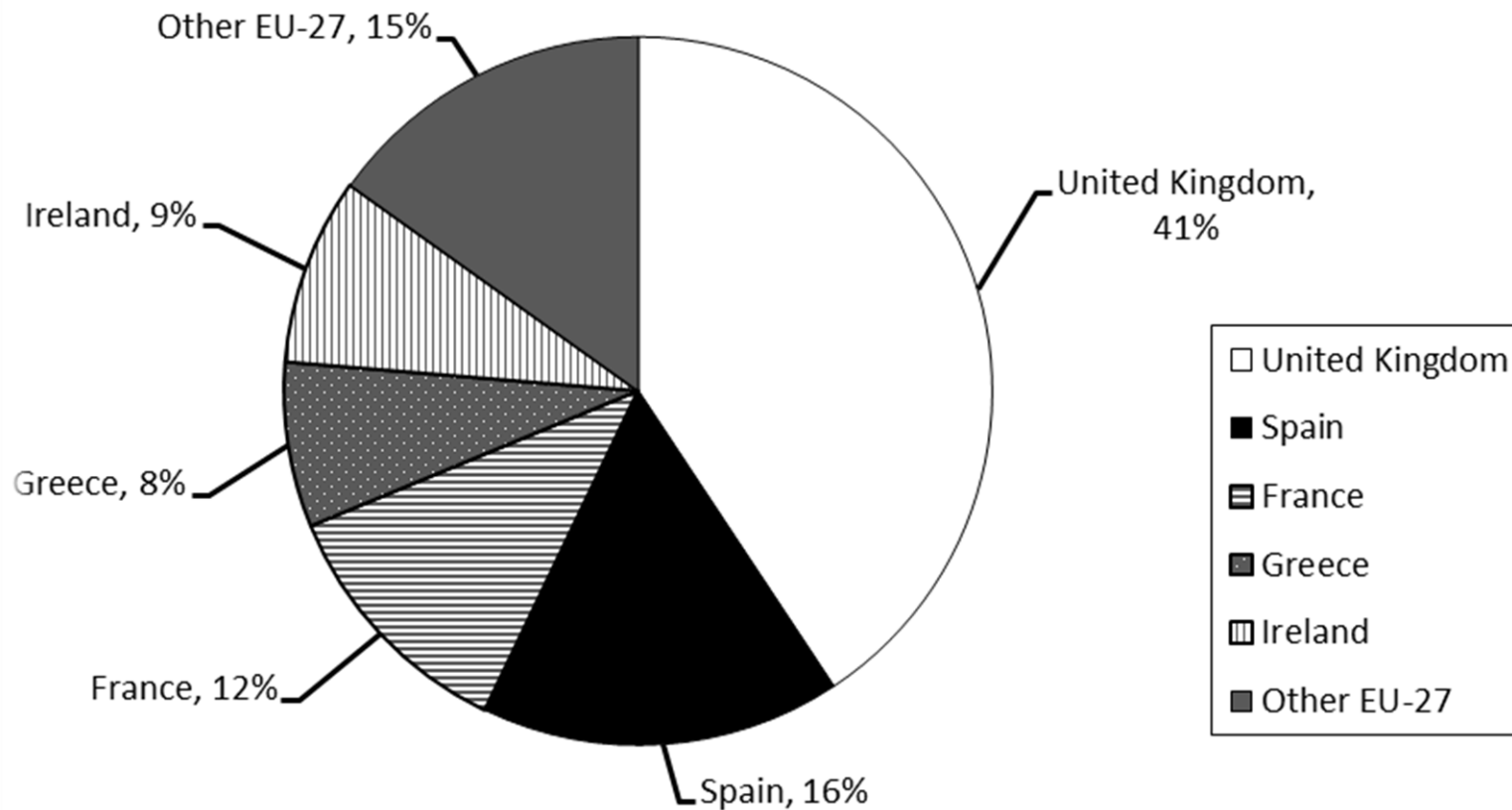
# Irish sheep meat exports by destination - 2017

Source: 'Export Performance & Prospects Report 2017/2018'

The Carbon Footprint of Sheep Farming

- Process based LCA of GHG emission of actual farms
- `Cradle to farm gate' assessment takes account of the emissions associated with:
  - Emissions from Livestock activities (enteric fermentation and manure management)
  - Inputs used in production processes (on-farm)
  - upstream emissions from the production'of inputs (off-farm)

- Excludes emissions from the sheep meat value chain beyond the farm gate

`Cradle to farm gate' - Systems Boundary
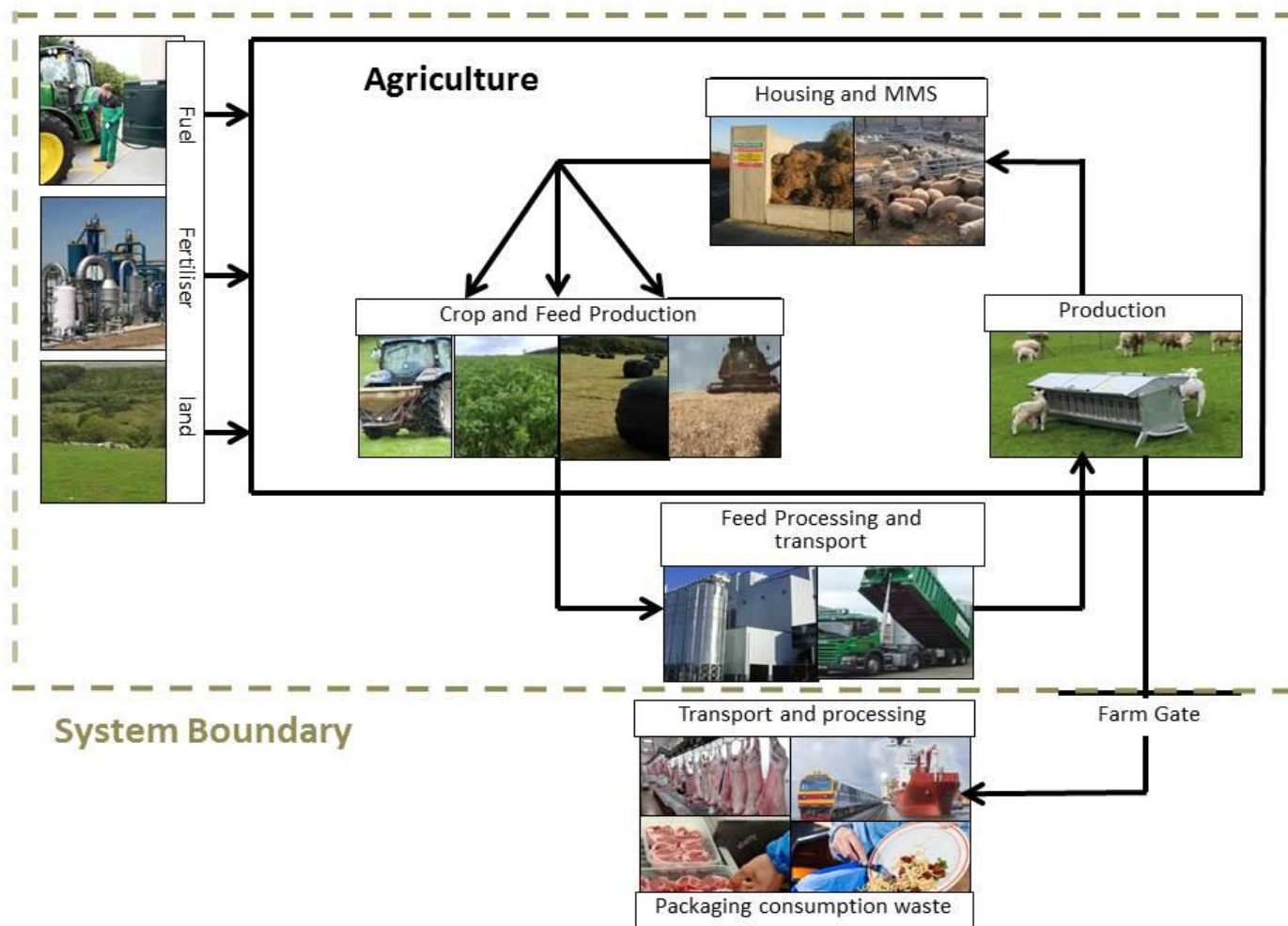
The carbon footprint of sheep farming

- Animal activities - **Enteric fermentation and manure management** comprising (64%) and (6%) of emissions respectively

- Emissions from soils (14%), emissions associated with feed production (16%)

Significant heterogeneity in performance across farms

- **`Production efficiency' as a driver of `emissions efficiency'**

The carbon footprint of sheep farming

	kg CO_2 Eq/kg LW					
				Midseason farms by GM/ha		
	All farms	Hill	Lowland	Bottom	Middle	Top
Carbon Footprint	9.88	11.33	9.84	10.47	8.44	7.47
Carbon Footprint excluding Land use change[1]	9.52	11.04	9.12	10.03	8.13	7.18
Carbon Footprint with Carbon Sequestration	8.89	9.99	8.58	9.13	7.54	6.49
[1]Nonrecurrent land use change emissions from the conversion of grassland to arable land and from the cultivation of South American soybean and southeast Asian palm concentrate feedstuffs						

The carbon footprint of sheep farming

Expanding the traditional LCA boundary
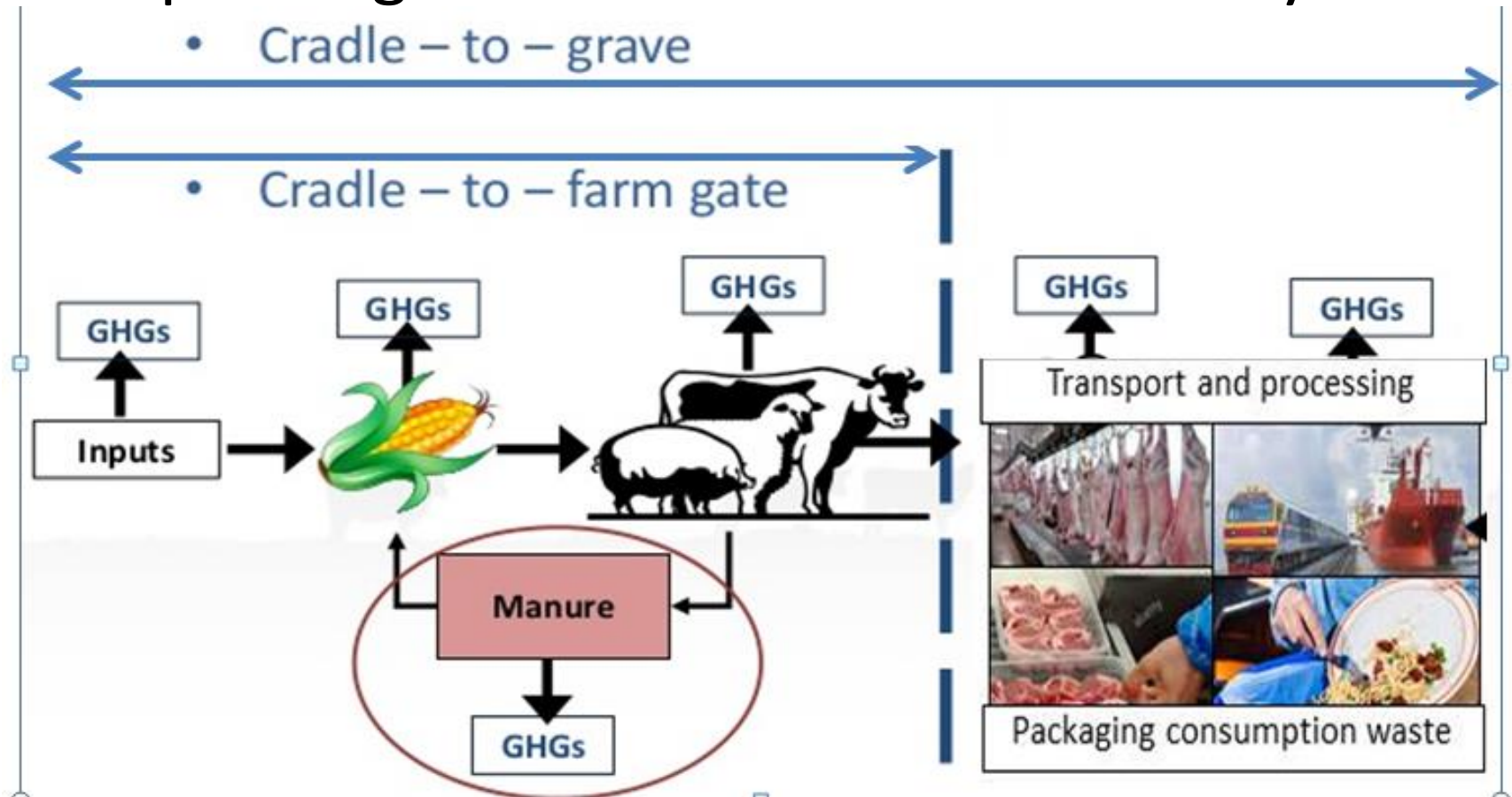
The economic contribution and environmental impacts of the sheep meat value chain

- Extending the Bioeconcomy Input-Output model (BIO) of Irish agriculture (Grealis et al 2015) to account for GHGEs
  - First IO-LCA of the Irish sheep meat sector
  - Expands farm level LCA analysis to give a sectoral description
  - Describes the sheep meat value chain in term of economic and environmental outputs
    - Emission from Livestock activities (enteric fermentation and manure management) and input use at the farm level
    - Emissions from downstream transport and processing sector activities

Economic Multiplier analysis – Sheep Meat Value Chain

Sheep farming:

- **High output multiplier** of 2.2
- **Highly embedded** in the rural economy (local input porvision)
- Supports **downstream economic activity and jobs**

Sheep meat value chain:

- attributes the highest share of value to primary inputs – 23% for sheep meat vs 18% for Dairy
- Processing has the highest share of the multiplier with 50% for sheep meat (55% Dairy)

Emissions analysis – Sheep Meat Value Chain

Distribution of emissions across Value Chains

- 84% of Emissions from sheep meat production are associated with the primary (farm level) production

- Reflects ruminant dominance of emissions from EF and MMS (vs 23% from poultry)

Emissions analysis – Sheep Meat Value Chain

Share of emissions	Primary 1	Primary 2	Secondary 1	Secondary 2	Industry	Services	Energy	Total
Beef and veal	81.7	1.3	0.3	0.0	10.2	0.0	6.4	100.0
Pig meat	46.4	0.9	1.4	0.0	25.8	0.0	25.4	100.0
Sheep meat	83.6	0.4	0.4	0.0	8.7	0.0	7.0	100.0
Poultry meat	23.2	0.9	2.9	0.0	35.0	0.0	38.0	100.0
Dairy Products	81.0	0.7	0.2	0.0	7.7	0.0	10.4	100.0

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Emissions analysis – Sheep Meat Value Chain

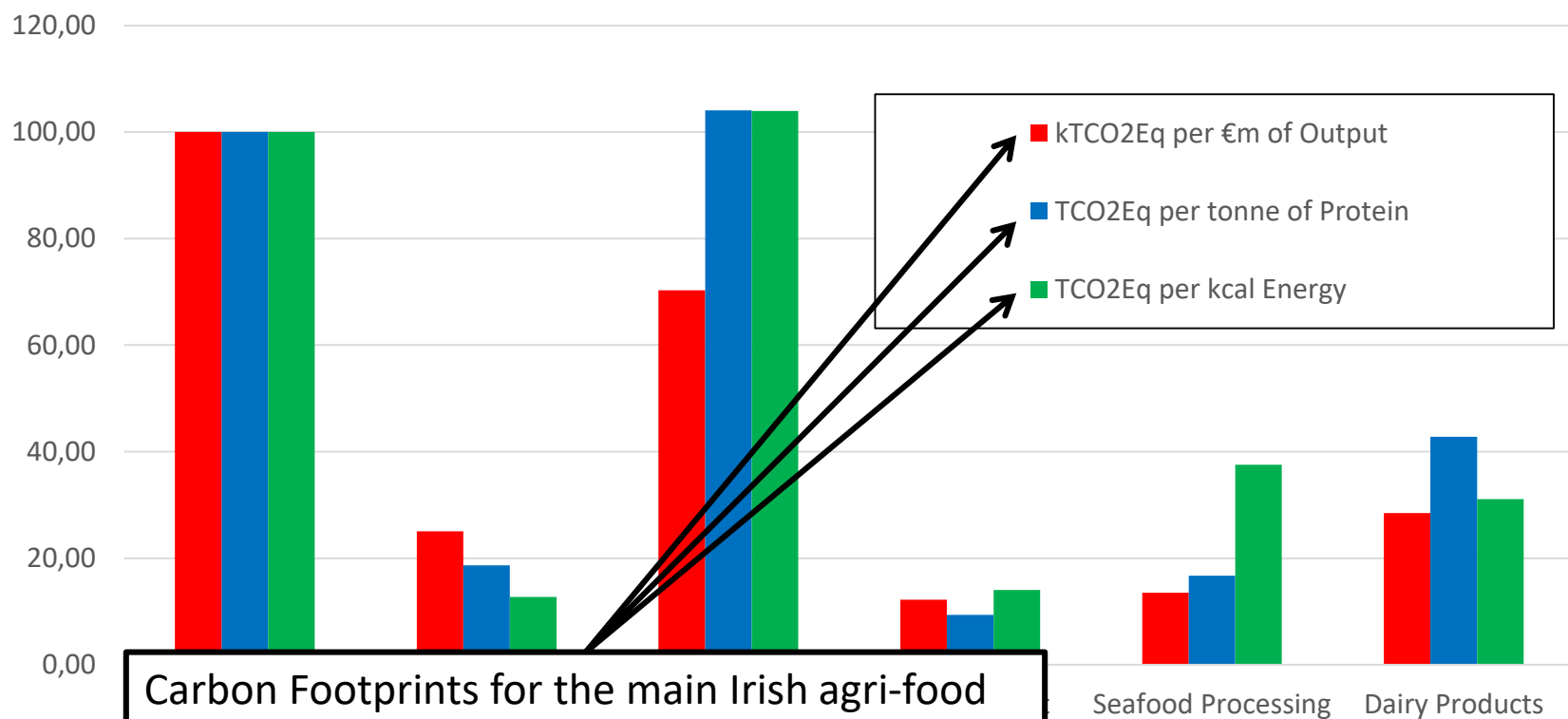| Share of emissions	Primary 1	Primary 2	Secondary 1	Secondary 2	Industry	Services	Energy	Total
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Relative carbon efficiency of agri-food production

- Beef and sheep meat demonstrate highest CFs

- CF of lamb lower on an output basis than beef

- Slightly higher in both macronutrient terms (Protein, calorific basis)

  - price differential/sheep meat premium

  - environmental sustainability is not a single issue and cannot be determined by one metric alone

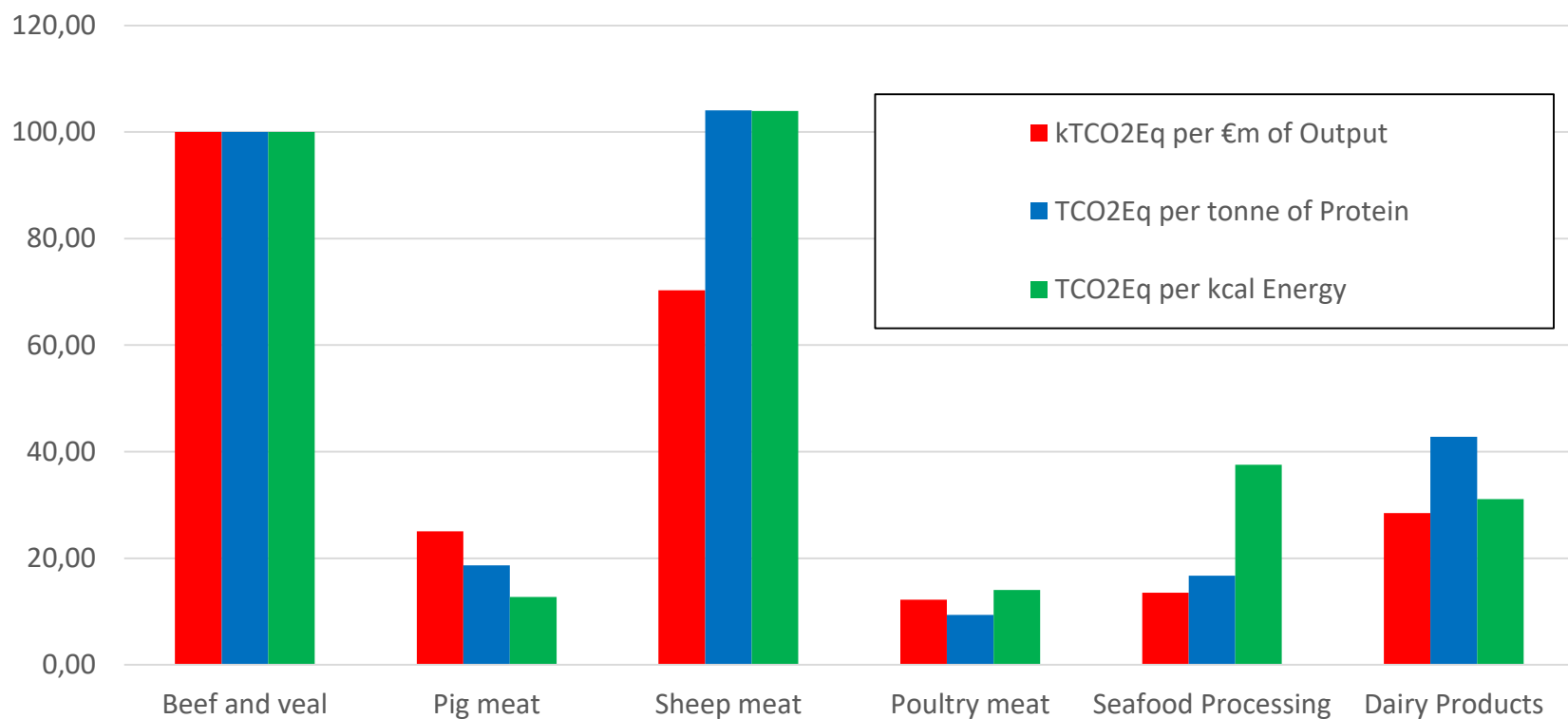# Carbon Footprint of agri-food output

Carbon Footprint of agri-food output

Legend:
- kTCO2Eq per €m of Output (red)
- TCO2Eq per tonne of Protein (blue)
- TCO2Eq per kcal Energy (green)

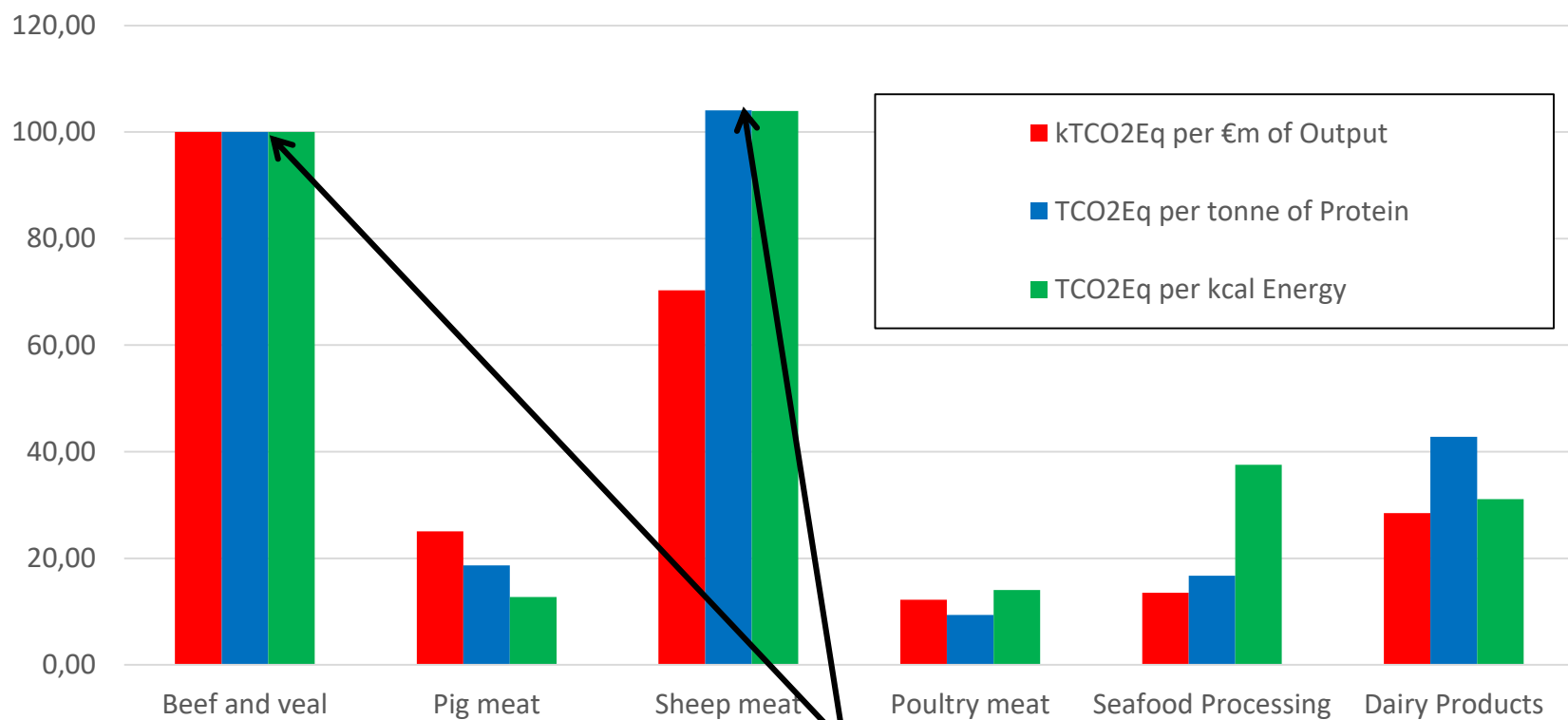Categories: Seafood Processing, Dairy Products
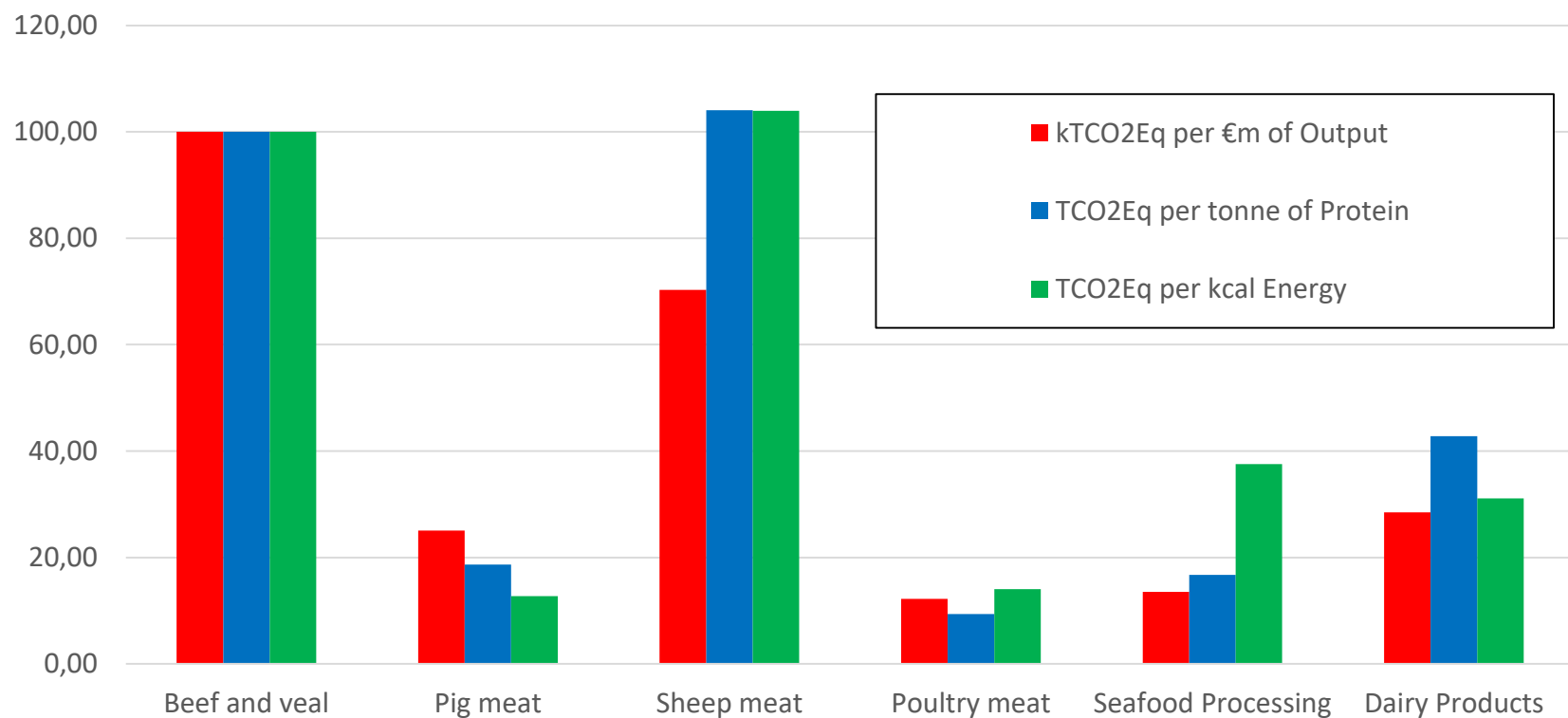
Carbon Footprints for the main Irish agri-food products are estimated according to three different functional units: emissions intensity per output value and per protein and energy content

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Carbon Footprint of agri-food output

Carbon Footprint of agri-food output

When emissions are compared on a standardised macronutrient basis, the CFs for been and sheep meat are broadly in line

Sustainability is not measured by one metric alone!

Sustainability is not measured by one metric alone!

- Preservation of traditional farming
- Sustaining rural economies
- Preserving cultural Heritage
- Landscape management
- Preservation of biodiversity
- Water Quality
- Economic viability
- Household vulnerablility

Conclusions

- **CAP Pillar I and Pillar II** policy supports underpin financial viability
  - Consistently low and negative average market return
  - Reliance on the Single Farm Payment for income
  - Sheep farming provides a range of ecological services and public goods,
  - Located in severely LFAs and highly embedded in rural economy
- **Environmental impact assessment**
  - Production efficiency related to improved emissions efficiency per unit output
  - Sustainability credentials - export orientated sheep meat sector
  - Identification of `hotspots' across the value chain

Future Developments

- Holistic LCA of production systems is required to avoide 'burden shifting'

    - Extend analysis to additional measures of sustainability and constraint

        - Biodiversity

        - Land use / occupation

        - water/nitrogen balance

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