The True Cost of Conventional Proteins

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IMPACT INSTITUTE

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ABOUT IMPACT INSTITUTE

Impact Institute is a social enterprise with the mission to empower organisations and individuals to realise the impact economy by creating a common language for impact and providing the tools to use it. Impact Institute develops open-source standards for impact measurement and valuation and provides organisations with the tools, training, and services to implement them.

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DISCLAIMER

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Content

Introduction

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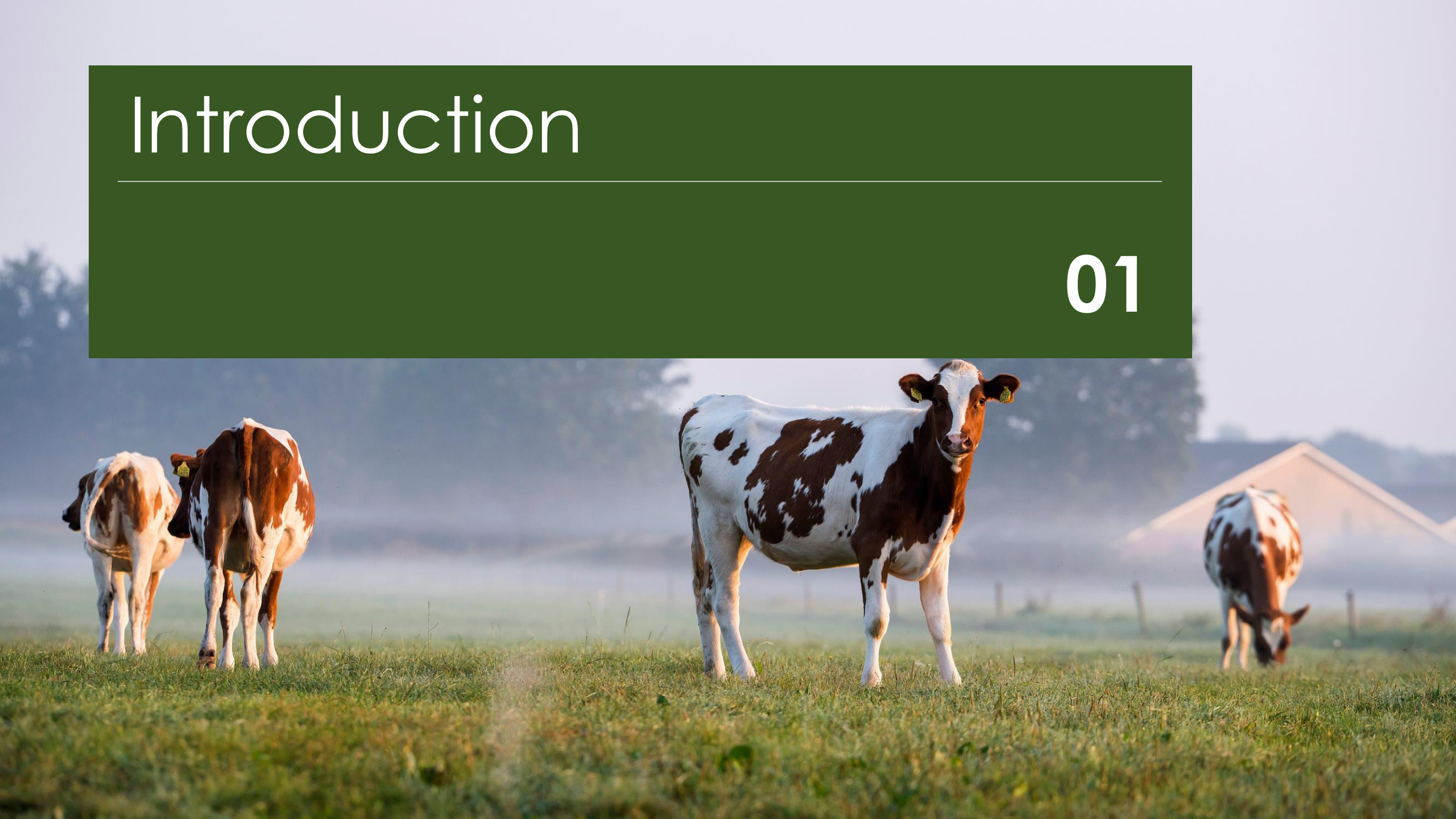
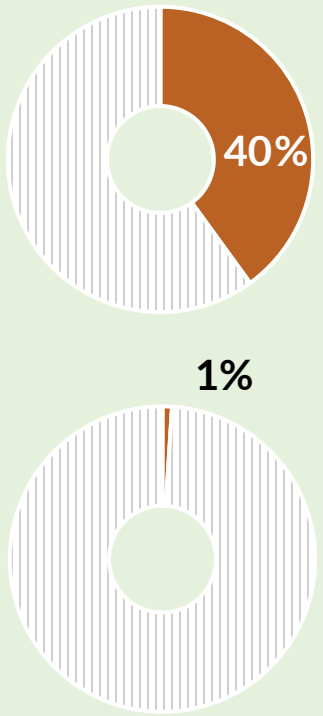


Introduction | The Major Role of Conventional Proteins

Meat and dairy play a major role in the EU economy and an even bigger role in the EU protein provision

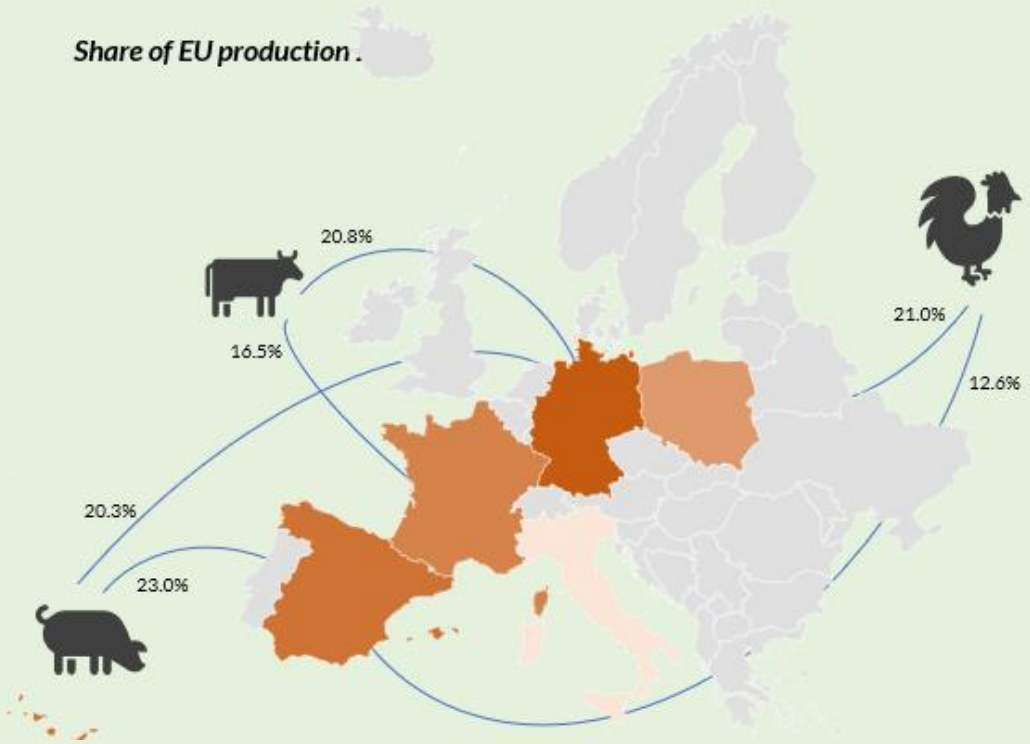


Pivotal for EU economy

The value of livestock production represents 40% of the total agricultural activity in the EU (EC, 2018).

Pivotal for EU diets

On the consumption side, **only 1% of total global protein** consumption comes from **healthier and environmentally alternative** sources (Like-A-Pro.eu, 2023).



Source: EC.Europa EUROSTAT, n.d.

Introduction | Why Is a Protein Transition Necessary

Meat and dairy play a major role in EU diets but have a large impact on animal welfare, human health and the environment

Major issues

- In the average EU diet, **83%** of all greenhouse gas **emissions** are caused by meat and dairy (Global Food Security, 2018).
- **71%** of the EU's farmland is used to feed **livestock** (Greenpeace, 2019).
- Agriculture accounts for around **93%** of total **ammonia emissions** in the EU, leading to the eutrophication of water and acidification of soils (European Commission, 2023).
- In 2020 in Europe, **11.5 billion** chickens, 328 million pigs and 39 million cows were **slaughtered** (Orzechowski, 2022).

Introduction | Impact Institute

The work of II strengthens value chain transparency and increases stakeholders' knowledge on opportunities for change

Company Mission

Impact Institute's mission is to…

Empower organisations to **realise the impact economy**

By…

Providing **innovative tools of impact measurement** and valuation - True Price and Living Wage/Income method

A key focus is …

Supporting the transition towards **an efficient, just and sustainable food system** by strengthening transparency on value chains and increasing stakeholders' knowledge on opportunities for change

Global Engagement

Focussing on accelerating the transition to a future-proof agri-food system, Impact Institute has delivered socially and environmentally focussed projects across the globe in collaboration with a variety of NGOs, IGOs and the private sector.

Introduction | True Price Methodology

A unique method for capturing and reducing the environmental and social impact of commodities

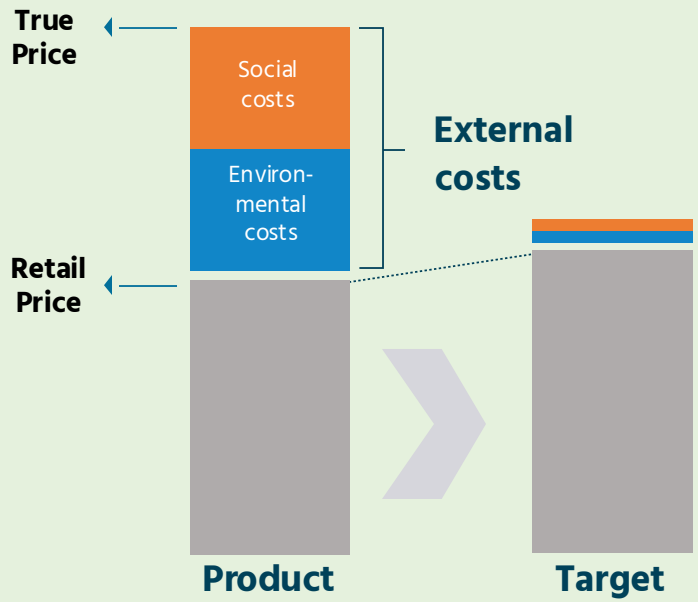
The assessment presented in this report is based on the **True Price methodology**, a unique method for quantifying, monetising and improving the negative environmental and social impacts of producing any given commodity.

The True Price of a product is defined as the **retail price plus the negative environmental and social costs** that are not part of the purchasing price but are paid by society nonetheless – for instance, the contribution to climate change, effects on water pollution or use of child labour. It therefore provides a **unique sustainability indicator**, comparable with the conventional pricing of products.

The True Price method can be **used to improve** (decrease) **the negative impact of commodities** in the following ways:

1. **Empowers consumers** to make more sustainable choices thereby incentivising producers to decrease the true cost of their products.
2. **Assists companies** in determining and prioritising improvement opportunities along their value chains.
3. Offers focus and direction for the development of effective policy measures.

Visualisation of the true price and the target product price in which external costs are decreased



Methodology

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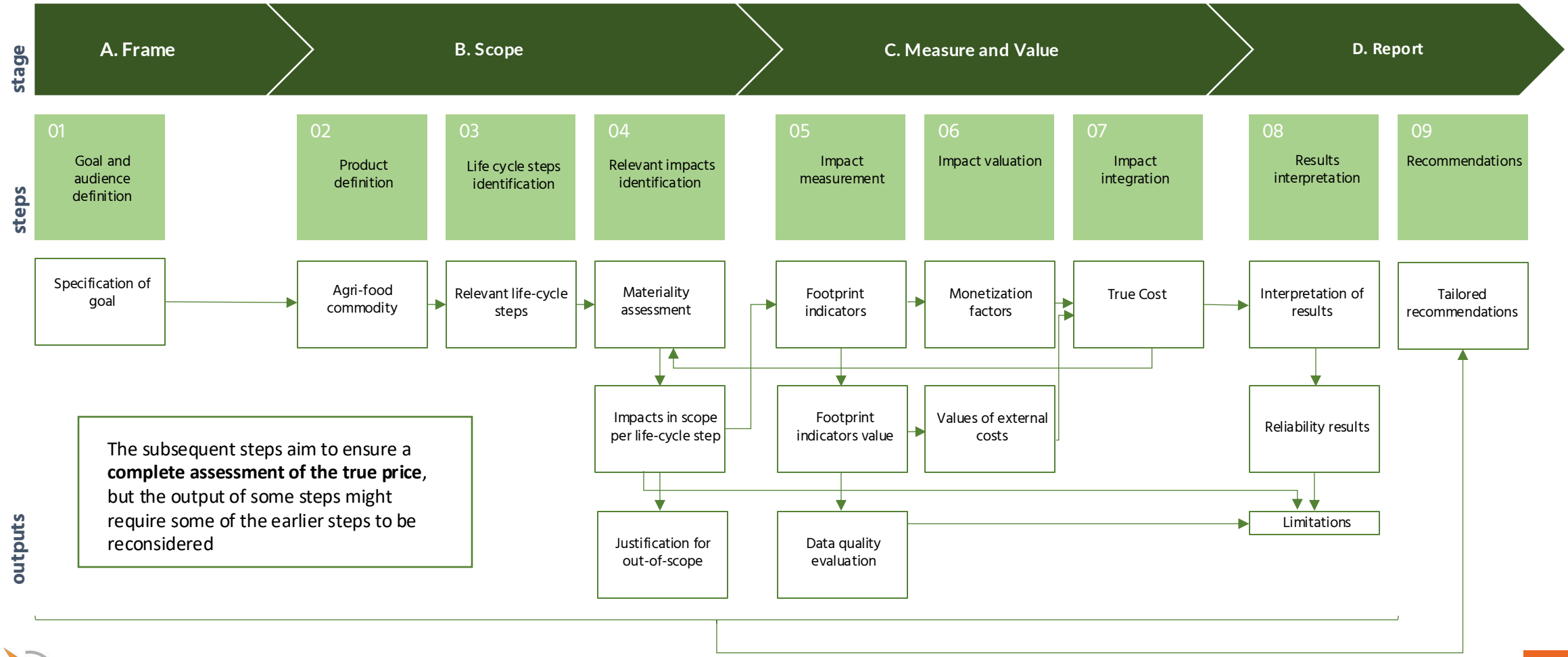
Methodology | Stages, Steps and Outputs

The four stages and nine logical steps of a True Price Assessment



Methodology | Monetisation Factors

True Price monetisation methodology

External costs = $\sum$ Footprint indicator x Monetisation factor

Impacts are measured by a set of **footprint indicators** and every footprint indicator can be converted to a monetary unit using the corresponding **monetisation factor**.

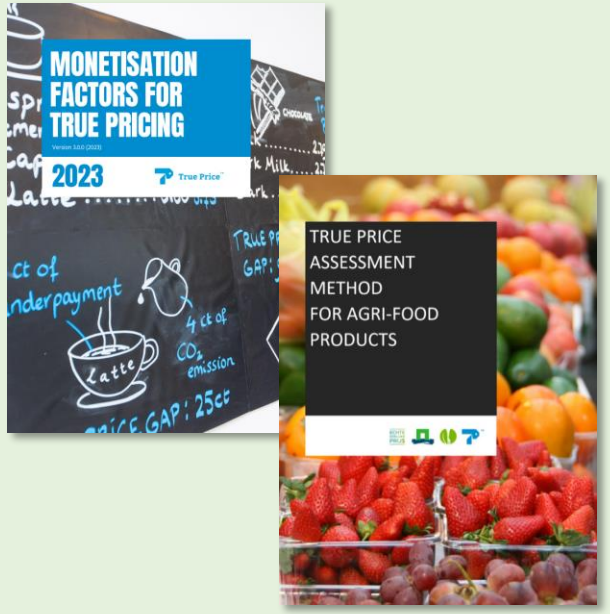
Monetisation factors are estimates of the remediation cost of the social and environmental impacts that must be included to estimate the true price of a product.

The following approach is followed to derive monetisation factors:

1. The **types of damage** that are associated with the impact are determined based on existing literature.

2. The **relevant costs are quantified, based on economic modelling and data available in the literature**, in a way that can be attributed linearly to one unit of impact, as measured by the footprint indicators.

3. The **quantified cost(s) are summed** to form monetisation factors.



Methodology | Underearning & Underpayment

The impacts of underearning and underpayment were calculated through a living income and living wage gap assessment

Living Income Assessment

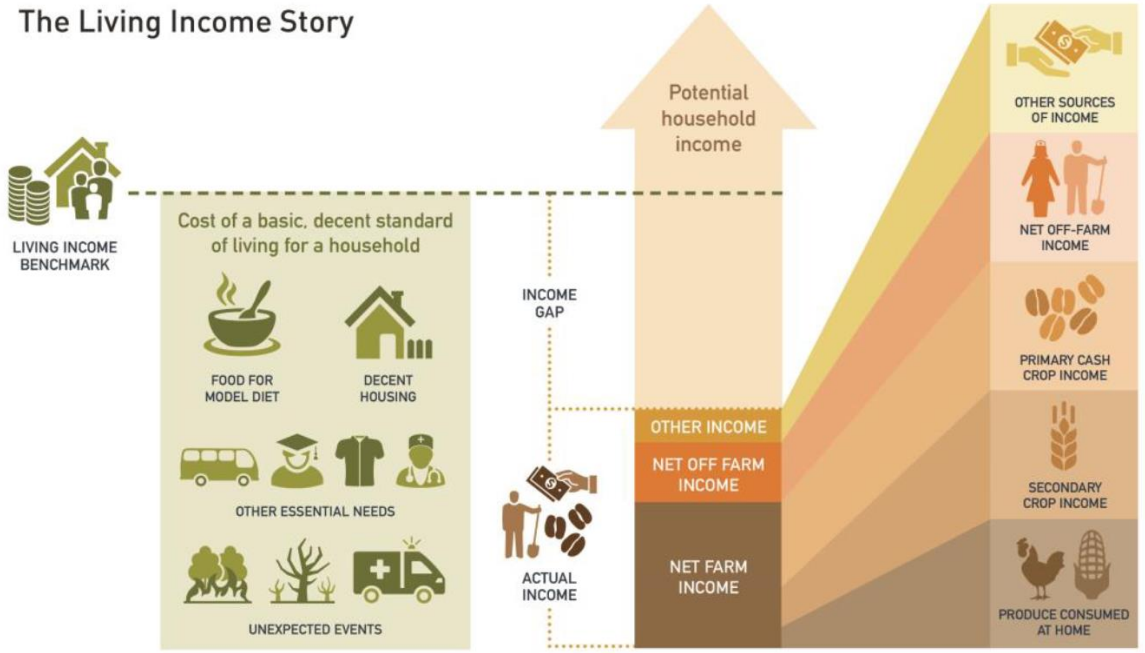
To calculate the impact of *underearning*, we compared the average income of meat, milk and soy farmers to the reference living income benchmark for France.

Living Income reflects the net annual income required for a household in a particular place to afford a decent standard of living for all members of that household. It includes food, water, housing, education, healthcare, transport, clothing and other essential needs, including provisioning for unexpected events (Global Living Wage Coalition, 2018a).

Living Wage Assessment

To calculate the impact of *underpayment*, we compared the average wage of farm workers to the reference living wage benchmark for France.

Living Wage reflects remuneration received for a standard workweek by a worker in a particular place to afford a decent standard of living for the worker and her or his family (Global Living Wage Coalition, 2018b).



Source: The Living Income Community of Practice

Methodology | Animal Welfare

The mental and physical well-being of non-human animals

Animal welfare is about the mental and physical well-being of non-human animals (Carenzi & Verga, 2009).

To quantify the impact of low animal welfare, we calculate the animal life years suffered as a result of rearing practices for animal-sourced food, and multiply those with the **morally adjusted monetary value of a disability-adjusted life year** (DALY) (Scherer, Tomasik, Rueda, & Pfister, 2018).

The factors accounted for the life years suffered per animal type are:

1. **Animal Life Quality**
2. **Lifetime until slaughter**
3. **Slaughter duration**
4. **Moral value based on neuron quantity**
5. **Number of animals affected per kg/output**

Methodology | Data Sources

Multiple databases were used to calculate the environmental and social impacts

Environmental impacts

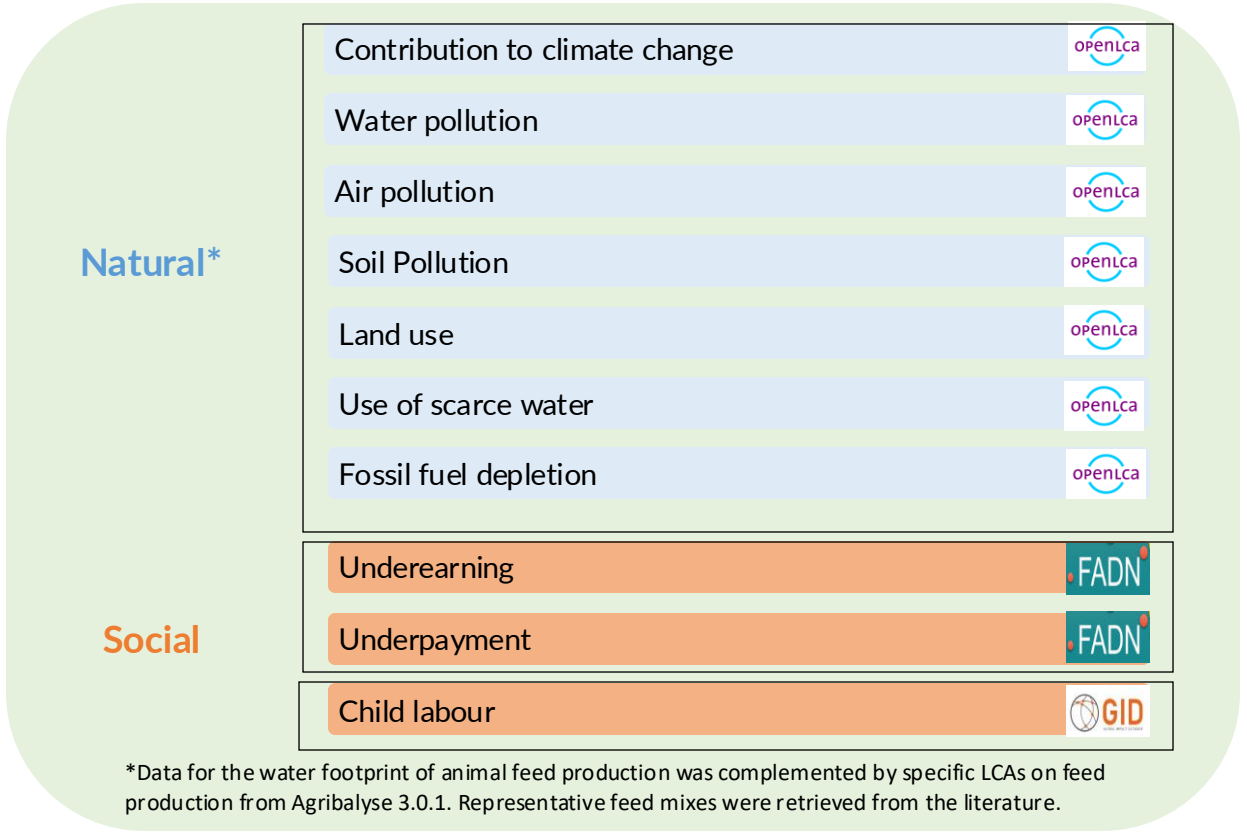
For the environmental impact assessment, we employed the OpenLCA software 2.0.2. The databases used include Agribalyse 3.0.1. The Impact method followed ReCiPe 206 Midpoint.

Impact estimates are first calculated as footprints and then monetised following the True Price Methodology.

Social impacts

For the assessment of underearning and underpayment in conventional protein production, we used the **Farm Accountancy Data Network (FADN),** an EU Database. It is a source of microeconomic data based on national surveys which monitor farm income and business activities.

For the identification of child labor in conventional protein production, we used the **Global Impact Database (GID).** This database includes a total of 20 impact indicators across multiple stakeholders and social and environmental impacts.



*Data for the water footprint of animal feed production was complemented by specific LCAs on feed production from Agribalyse 3.0.1. Representative feed mixes were retrieved from the literature.

Materiality and Scoping

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Materiality and Scoping | System Identification

Overview of the selected protein categories

Five Representative Protein Categories

- **Pork** is the most consumed meat in the EU27 with **31 kg/capita/year**
- **Poultry** meat with **23.5 kg/capita/year**
- **10.6 kg/capita/year** for **beef & veal**
- **Milk 52.81** kg/capita/year
- **Soy** (for human consumption) **60**** kg/capita/year

Pork

Chicken

Beef

Milk

Soy

European Commission (2023), FEFAC (2022), EDA (2020) and Kuepper, B. and M. Stravens (2022), Statista

**90% indirectly consumed

Geographical scope: Europe

France is the reference country, one of the top meat producers in Europe (EUROSTAT, 2023).

Production system: Conventional

Most representative type of utilised agricultural area (UUA) (90,1%) compared to total organic area (9.9%) in Europe (EUROSTAT, 2023).

Function unit: 1 kg of output

For comparative purposes the FU used is the same for all protein types. 1 kg of carcass weight is considered for pork, chicken and beef. For milk and soy 1 kg output is considered.

System boundaries: Cradle to gate

The system accounts for all inputs (e.g., feed, straw, water, cleaning), fuels and energy, transport to the farm, buildings and houses, enteric emissions and emissions due to effluent management. It excludes all processes occurring outside the farm and a full water footprint for feed production.

Materiality and Scoping | System Identification

The seven material environmental impacts selected based on materiality and data availability

Soil pollution

The impact of the release of harmful chemicals, like phosphorus or nitrogen into the soil

Water pollution

The impact on health and ecosystem, and economic costs of additional water treatment, associated with increased nutrient discharge into freshwater lakes and rivers

Air pollution

The value of effects on human health from air pollutants

Contribution to climate change

The discounted future costs of climate change for health, agriculture and economy due to greenhouse gas emissions

Scarce water use

The cost of extracting water from freshwater ecosystems with limited amounts of water

Land use

The opportunity cost of using the land, derived from the ecosystem services supplied when the land would be in its native state

Fossil fuel depletion

The impact of the use of fossil fuel in the production process

Scope definition A full environmental impact assessment was performed to account for all the potential negative externalities.

Environmental Impacts in the EU Framework

Despite the stringent regulation for animal farming in the EU, this production category is still significant to the environmental impacts (EC, 2020).

Materiality and Scoping | System Identification

The four social impacts selected based on materiality and data availability

Underearning

The cost of receiving an income lower than the income needed for an adequate standard of living.

Underpayment in the value chain

The gap between workers' wages, the local minimum wage and the local living wage

Child labour

The cost of employing underage workers in the value chain

Animal Welfare

The cost of mental and physical well-being of non-human animals

Scope definition The social impacts in scope were identified based on data availability, data quality and occurrence in the agri-food sector.

Social impacts in the EU Framework

Due to the highly regulated European labour market, human rights infringements are less likely compared to non-EU countries (EU, 2022).

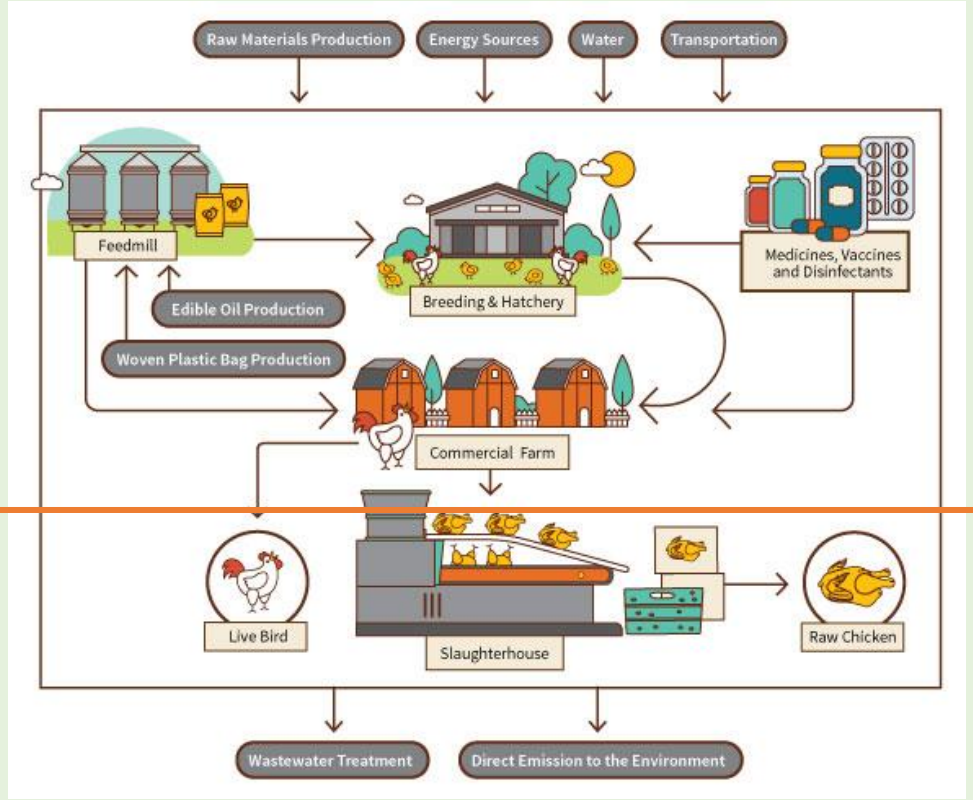
Materiality and Scoping | System Boundaries

Cradle-to-gate accounts for the product life cycle from resource extraction (cradle) to factory gate

Cradle - Gate is the reference system boundaries considered in the analysis except for the impacts of underearning, underpayment and animal welfare.

- The system accounts for all **inputs** (*e.g.*, feed, straw, water, cleaning), fuels and energy, transport to the farm, buildings and houses, enteric emissions and emissions due to effluent management.
- It excludes all processes occurring outside the farm.
- The impact of underearning, underpayment and animal welfare are limited to **farm-gate.**

Since impacts beyond the farm are out of scope, **wholesale prices are considered**.



Source: JAPFA – Life Cycle Assessment

Results

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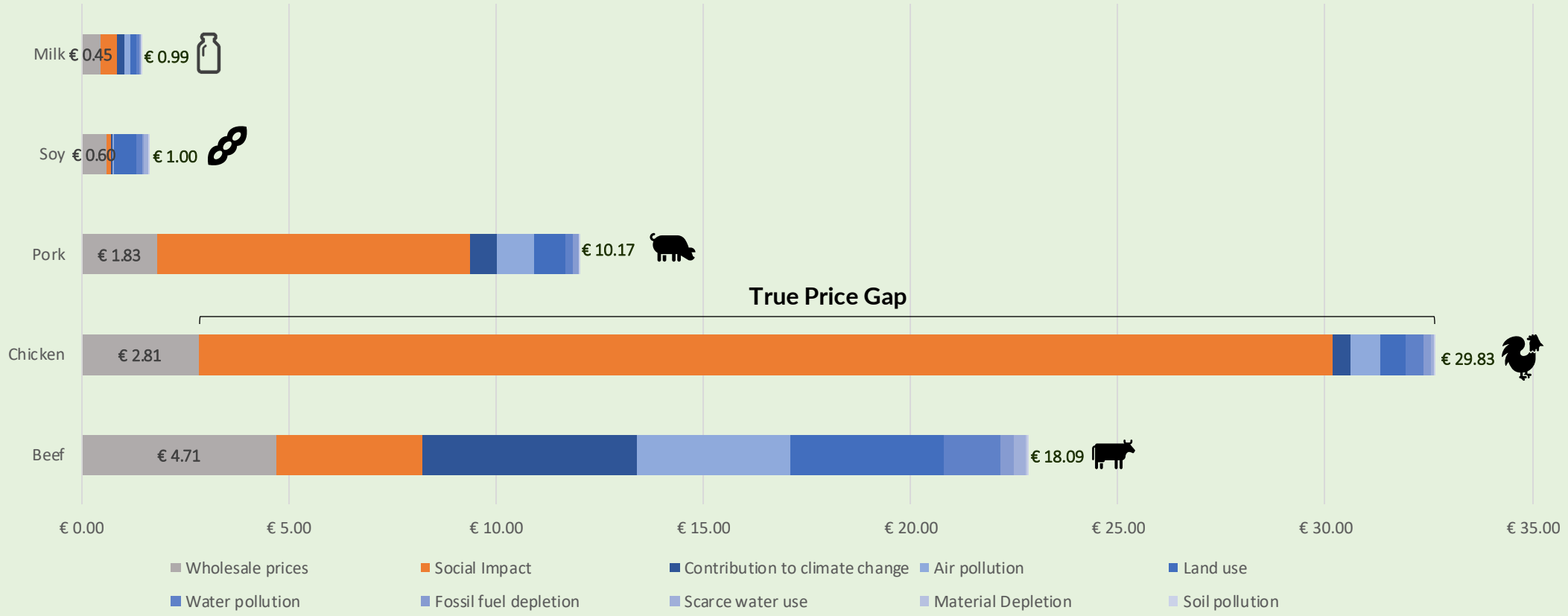
Results | True Price of Conventional Proteins

Total monetised impact per protein category



Environmental Impacts

4.1

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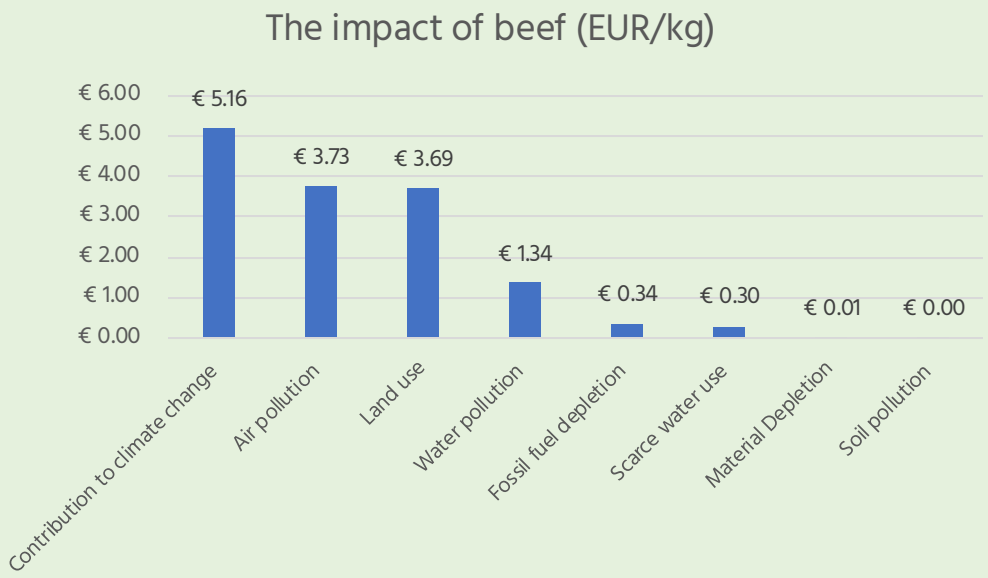
Environmental Impacts | Beef

Greenhouse gases emitted through the enteric fermentation of cattle contribute to climate change and air pollution

Beef

- The impact of **climate change** amounts to **€ 5.16/kg**. 75% of this impact can be attributed to methane emissions, a highly potent greenhouse gas released through the enteric fermentation of cattle (Heinrich Boll Stiftung et al., 2021; European Commission, 2020b).
- The cost of **air pollution** is calculated at **€3.73/kg**. This can be linked to elevated concentrations of zinc released into the environment through cattle manure. The bioaccumulation of heavy metals in the environment through the administration of animal nutrient supplements raises concerns regarding their potential impact on both human and animal health (Briffa et al., 2020).
- The impact of **land use** amounts to **€ 3.69/kg**. This is mainly driven by the conversion of natural vegetation and forestland into cropland for feed production as well as into pastureland for livestock grazing (Heinrich Boll Stiftung et al., 2021).

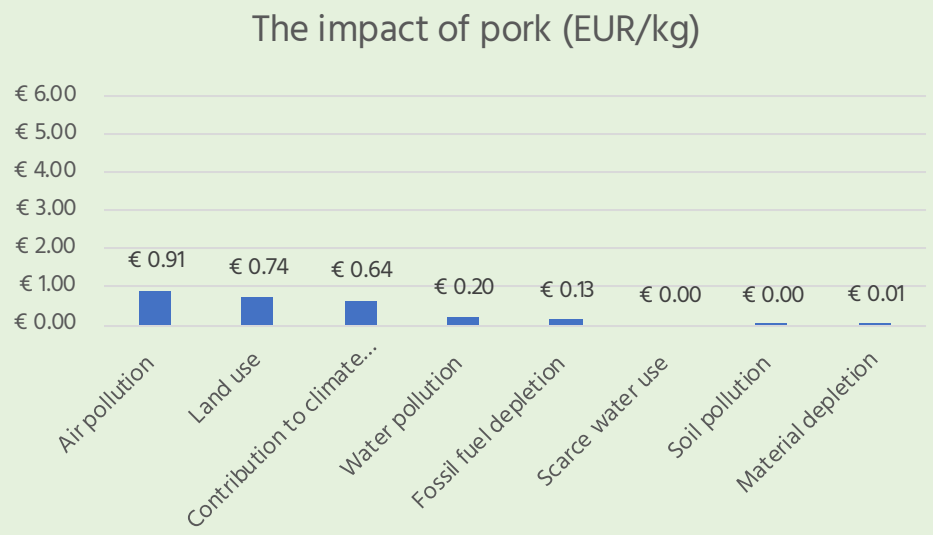


Environmental Impacts | Pork

The production of feed inputs for swine rearing has important consequences for air pollution and land use impacts

Pork

- The impact of **air pollution** amounts to **€ 0.91/kg** and is primarily driven by the release of nitrous oxide through the application of nitrogen-based fertilisers during feed crop cultivation (Menegat et al., 2022).
- Nitrous oxide has significant adverse effects for terrestrial and aquatic ecosystems as well as for human health. It has been identified as the most important stratospheric ozone depleting emission, correlated to the increasing occurrence of skin cancers (de Vries, 2021).
- The impact of **land use** amounts to **€ 0.74/ kg** and can be attributed to the occupation of cropland to produce feed inputs.
- The impact of **climate change** amounts to **€ 0.64/kg** and is related to swine waste management. Livestock manure releases nitrous oxide and methane, both of which are highly potent greenhouse gases (Philippe and Nicks, 2014).

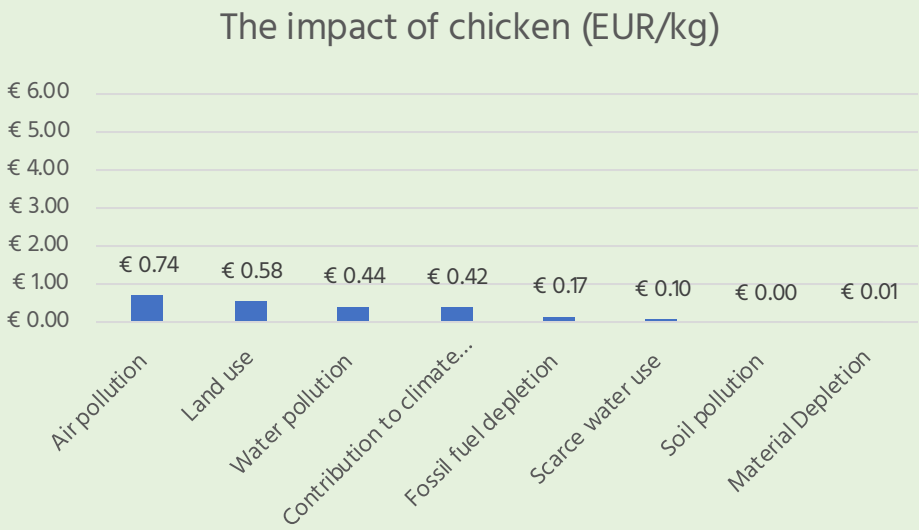


Environmental Impacts | Chicken

The harmful gases released during broiler production contribute significantly towards air pollution

Chicken

- The environmental impacts of chicken meat are driven by endogenous factors such as the feed use efficiency or the harmful gases from poultry farming which can affect health of humans, animals and the environment (Naasem et King , 2018; Boggia et al., 2019). Exogenous factors are mostly related to feed production and transportation from abroad.
- The impact of **air pollution** amounts to **€ 0.74/kg** and its greatest driver is the emission of harmful gases from poultry manure. Given their protein rich diet, chicken manure typically has a high nitrogen content which when broken down, releases nitrous oxide and ammonia into the atmosphere (Vilela et al., 2020). When deposited on the soil, both soil and water become acidic, leading to eutrophication.
- The impact of **land use** **€ 0.58/kg** is mainly driven by feed production. The reference feed mix selected for this analysis is primarily made of wheat, maize and soy.

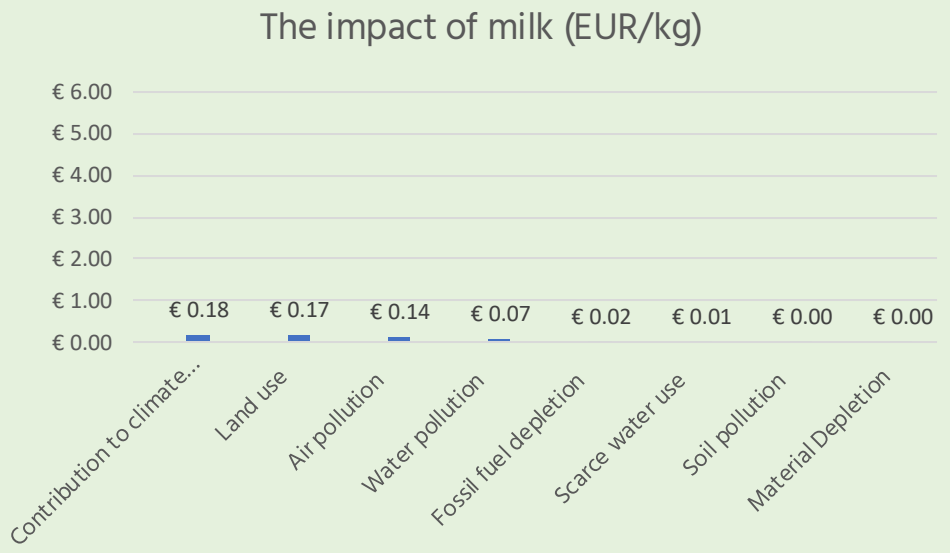


Environmental Impacts | Milk

The most significant impacts resulting from milk production are climate change and land use

Milk

- Milk farming systems are a major source of **nitrous oxide,** a greenhouse gas with a global warming potential 298x higher than CO2**.** The major inputs of nitrogen in Western Europe dairy farms are the synthetic used to produce animal feed as well as from manure decomposition (Velthof et al., 1998).
- Similarly to beef production, further contribution to **climate change** stems from **methane emissions**, released during manure degradation and the enteric fermentation of dairy cattle.
- The occupation of land for cattle grazing and for producing feed drives the **land use** impact. An estimated 16 m^2 of land is used per kg of beef.
- The environmental cost of milk production at € **0.60/kg** is noticeably lower than beef production. Given that a dairy cow produces far more milk than meat within her lifetime, 1 kg of milk, is less impactful than 1 kg of beef.

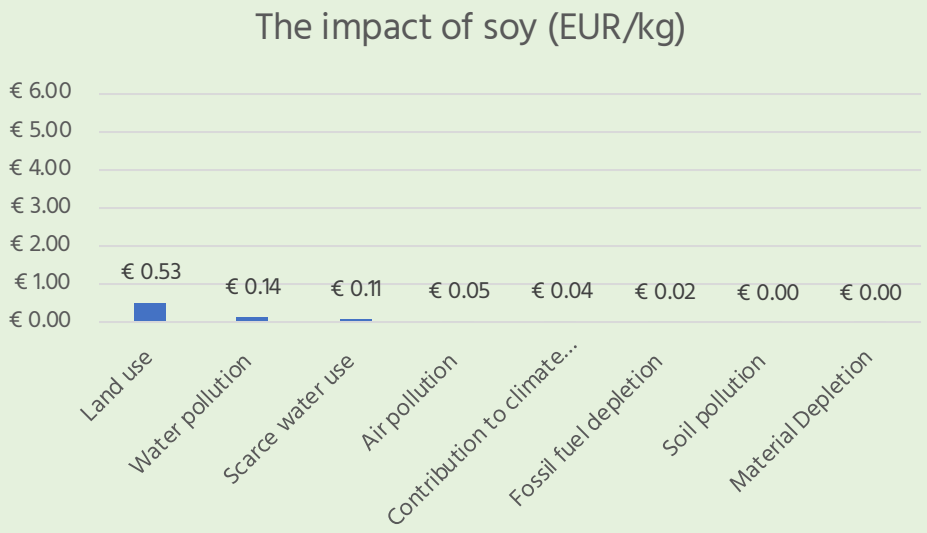


Environmental Impacts | Soy

The impact of soy production stems from high intensity of land use in the cultivation of soy.

Soy

- The impact of soy produced in Europe for human consumption, is primarily driven by **land use** which amounts to **€0.53** per kg. **Land use** represents the decreased availability of land for purposes other than the current one, through land occupancy (Galgani et al., 2021).
- The **conversion of forested land** for soy cultivation displaces or destroys habitats and ecosystems leading to biodiversity and ecosystem service loss (Galgani et al., 2021).
- A justification for less severe environmental impacts can be found in:
    - Soy crop benefits to soil - ***Nitrogen Fixation***, reduces the need for synthetic nitrogen fertilizers and can improve soil health (LSU, 2022).
    - The **regulation of soy in place at the EU level**. The EU has legislation on grains, pulses and oilseeds which sets Maximum Residue Limits for pesticide use (EU Regulation, 2019).



Social Impacts

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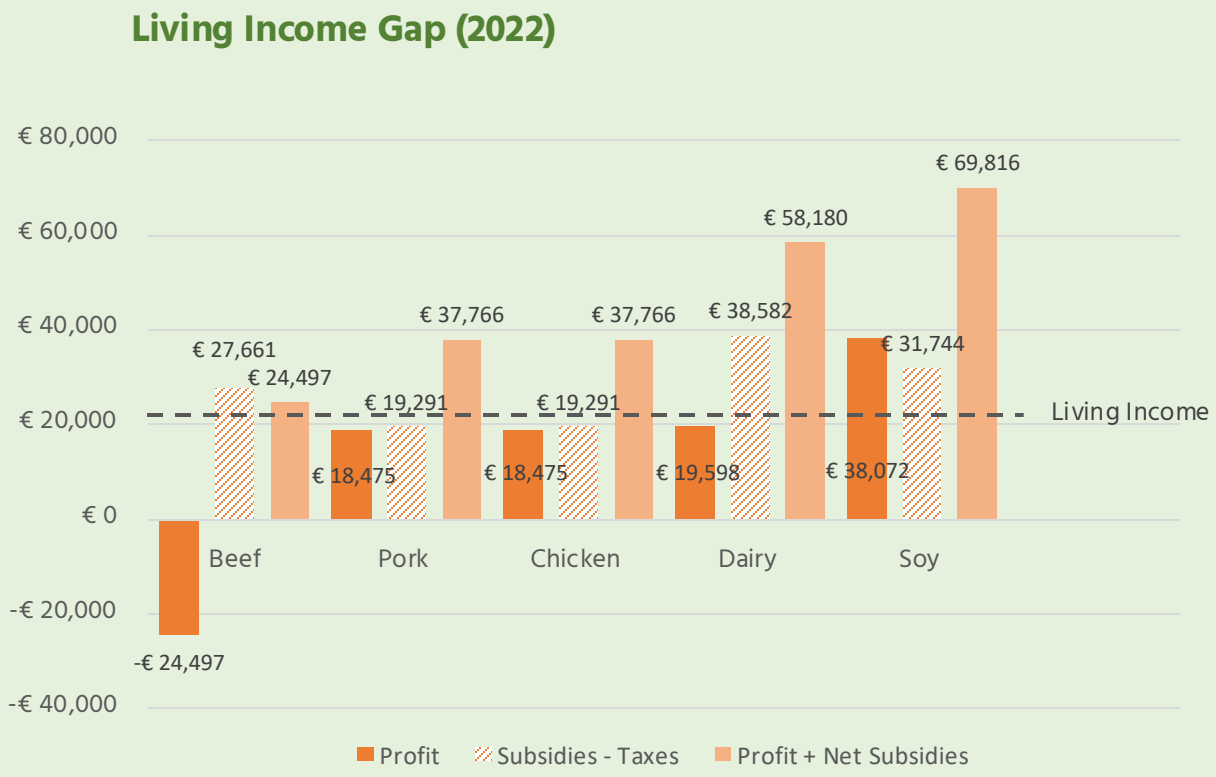
Social Impacts | Underearning

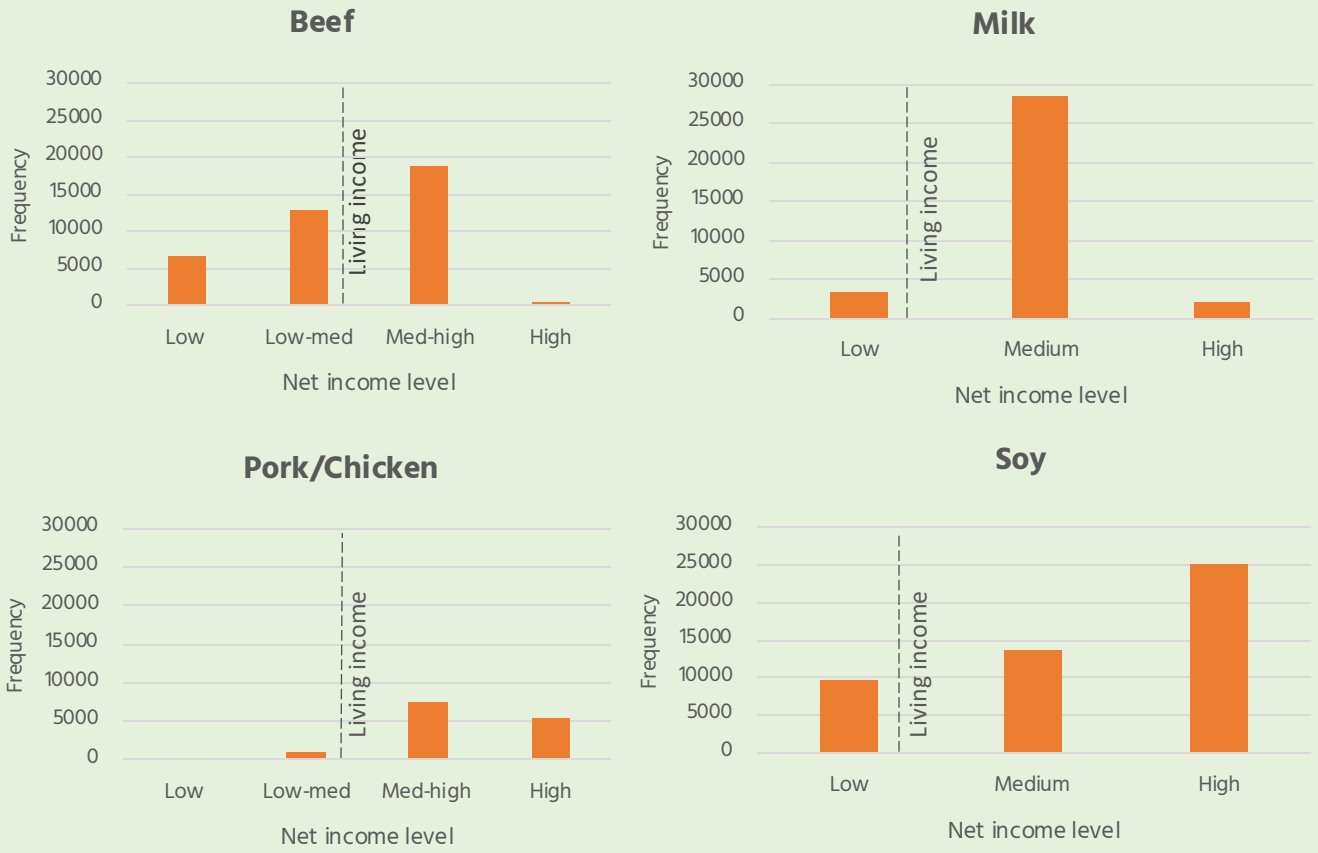
The ability of meat and dairy farmers to earn a living income is largely dependent on receiving farm subsidies



- The **average income** per farming household across all protein types is **higher than the living income** for France (€ 22768).
- The graph indicates, however, that apart from soy, the **largest portion of farmer income comes from subsidies.**
- Farmers are thus **unable to achieve a living income from their net profit alone.**
- In the case of beef, the average farmer earns **a net loss**. The average net income for beef farmers is therefore **€27661.**
- It should be noted that the scope of this assessment did not cover feed production. It is therefore possible that this impact has been underestimated.

Social Impacts | Underearning

A frequency distribution was plotted to capture the potential underearning of lower-income farmers



To capture the potential underearning of lower-income farmers, a frequency distribution was plotted.

- Averages may obscure the impact of more extreme income values, both high and low leading to a potential underestimation or overestimation of the impact of underearning.
- Accordingly, we plotted a frequency distribution of farmer income to capture the potential underearning of lower-income farmers.
- The graphs on the left demonstrate the frequency of different income levels/farm for each protein type
- Based on this assessment, we found that approximately 50% of beef farmers, 10% of pork and chicken farmers, 10% of dairy farmers and 20% of soy farmers earn under a living income.

Social Impacts | The Role of Subsidies

The EU has received scrutiny for artificially increasing the profitability of the meat and dairy sector through CAP subsidies

EU Subsidies to Agri-food System

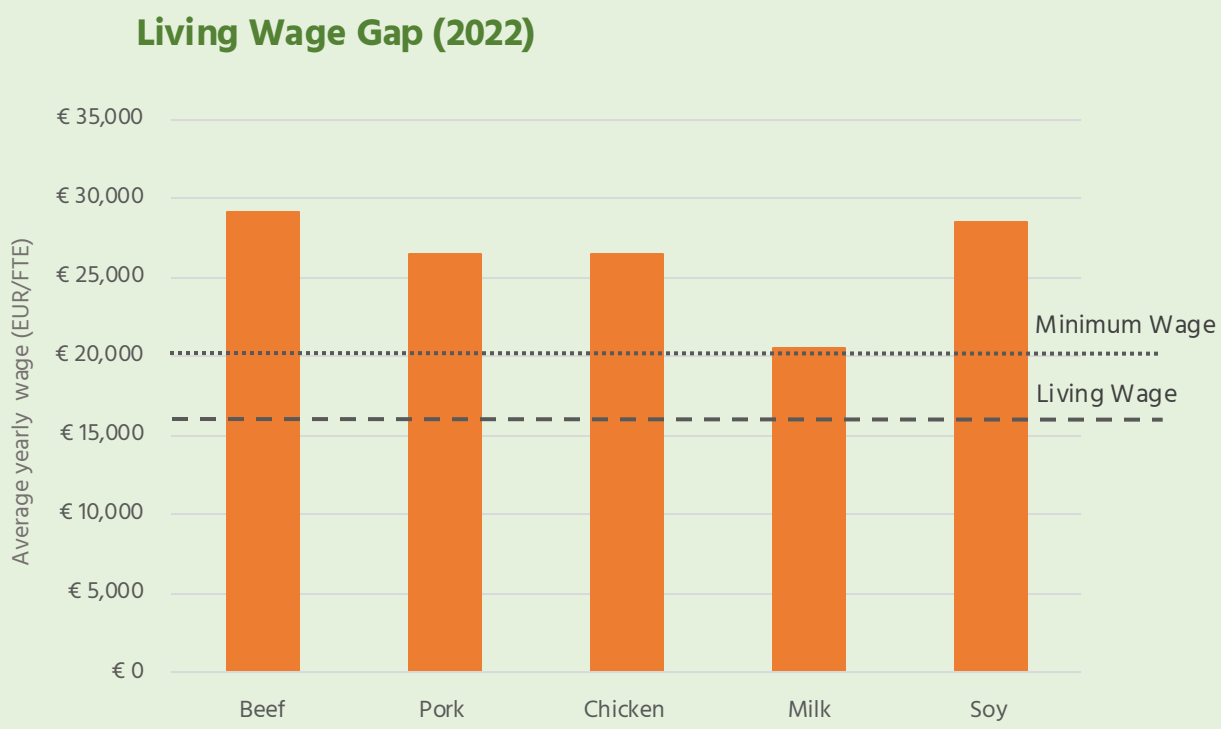
- Farmers within the EU are entitled to receive subsidies through the **Common Agricultural Policy Framework (CAP)** depending on the size of their farms and the type of crops or livestock produced (European Commission, 2023).
- The main objectives of this policy are to **provide income support to farmers, guarantee food security, maintain market stability and promote rural development** (European Commission, 2023).
- **France is the largest beneficiary** of this policy of which, the beef and dairy sector are the most heavily subsidised (ARC 2020, 2019).
- The EU CAP policy has faced considerable scrutiny for **artificially increasing the profitability** of the meat and dairy sector and subsequently, exacerbating the environmental impact associated with livestock farming (The Guardian, 2019).

The CAP in numbers

- The CAP accounts for **33.1% of the 2021 EU-27 budget** (EUR 55.71 billion). Direct payments and market measures (CAP pillar 1) represent 76.8% of agricultural appropriations (EUR 40.4 billion), and rural development measures (CAP pillar 2) 23.2% (EUR 15.3 billion) (European Parliament, n.d.).
- On average, over the last 10 years, **income support from the CAP represents nearly half of farmers' income** (European Commission, 2023).

Social Impacts | Underpayment

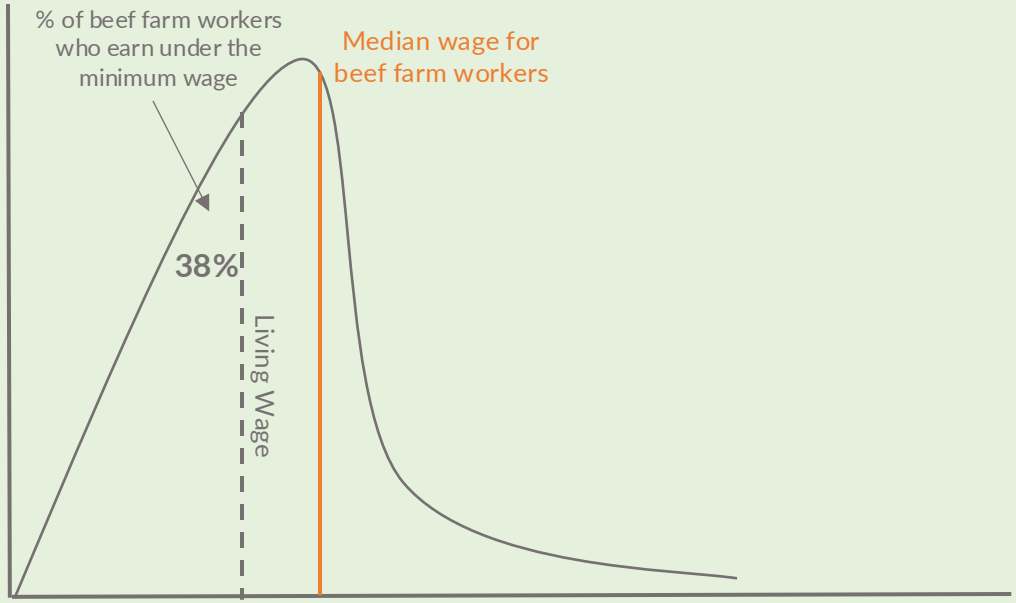
The ability of meat and dairy farmers to earn a living income is largely dependent on receiving farm subsidies



- The **average wage** per worker across all protein types is **higher than the *living* wage** for France (€ 16, 541).
- The **average wage** per worker across all protein types is **higher than the *minimum* wage** for France (€ 20,496).
- It should be noted that the scope of this assessment **did not cover feed production or processing stages**.
- Animal **feed production** within the EU is heavily **reliant on the soybean meal predominantly sourced from South America** (IDH, 2020). Given variations in wage standards, underpayment within the meat value chain may have been underestimated.
- Moreover, recent news articles highlighting the poor working conditions and low wages faced by meat plant workers indicate that **underpayment may be equally prevalent in the processing stages** of meat production (McSweeney and Young, 2021).

Social Impacts | Underpayment

A distribution analysis was carried out to capture the potential underpayment of lower-income farmers



To represent the potential underpayment of lower-earning farm workers, a distribution analysis was carried out

- Averages may obscure the impact of more extreme wage values, both high and low leading to a potential underestimation of the impact of underpayment.
- Accordingly, we carried out a normal distribution analysis to demonstrate the potential underpayment of lower-income farm workers.
- Based on this assessment, we found that **38%** of beef farm workers, **44%** of pork and chicken farmers, **60%** of dairy farmers and 40% of soy farmers earn under the minimum wage.

Social Impacts | Child Labour

The small impact of child labour is likely related to upstream feed production

Child Labour

- The European Union has a **zero tolerance against child labour** and has implemented several policies, regulations and initiatives to eliminate it both across member states and equally across international value chains.
- Examples include the EU Strategy on the Rights of the Child which commits towards eradicating all EU supply chains of child labour as well as the EU Directive on the Protection of Young People at Work (94/33/EC) which prohibits the employment of children under fifteen or still in full-time compulsory education (European Commission, 2023b, 2023c).
- Given the stringency of these efforts, it is unsurprising that the impact of child labour was found to be very low across all protein types (€ 0.003 for soy, € 0.004 for milk, € 0.009 for pork, € 0.019 for chicken, € 0.024 for beef).
- The little impact that was calculated is likely more related to upstream feed production.

Feed Production

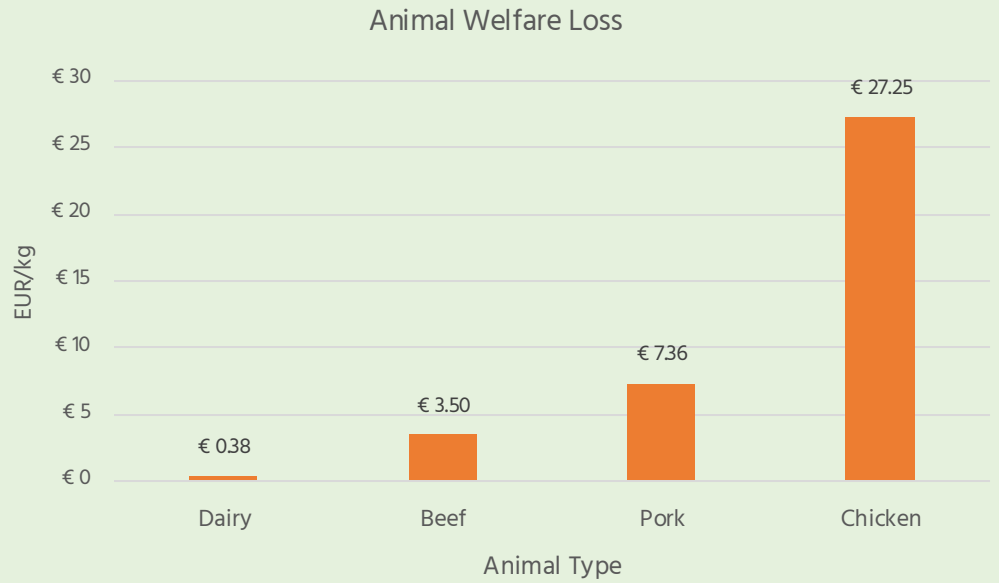
Animal feed production within the EU is heavily reliant on the **soybean meal predominantly sourced from South America**. Approximately **60%** of soy imported to the EU comes from Brazil (IDH, 2020). In 2020 US department of labour reported that approximately **1.8 million children** were subject to some form of child labour in Brazil, **56.5%** of the incidents were related to some form of agricultural practice (US Department of Labour, 2020).

Social Impacts | Animal Welfare

The small impact of child labour is likely related to upstream feed production

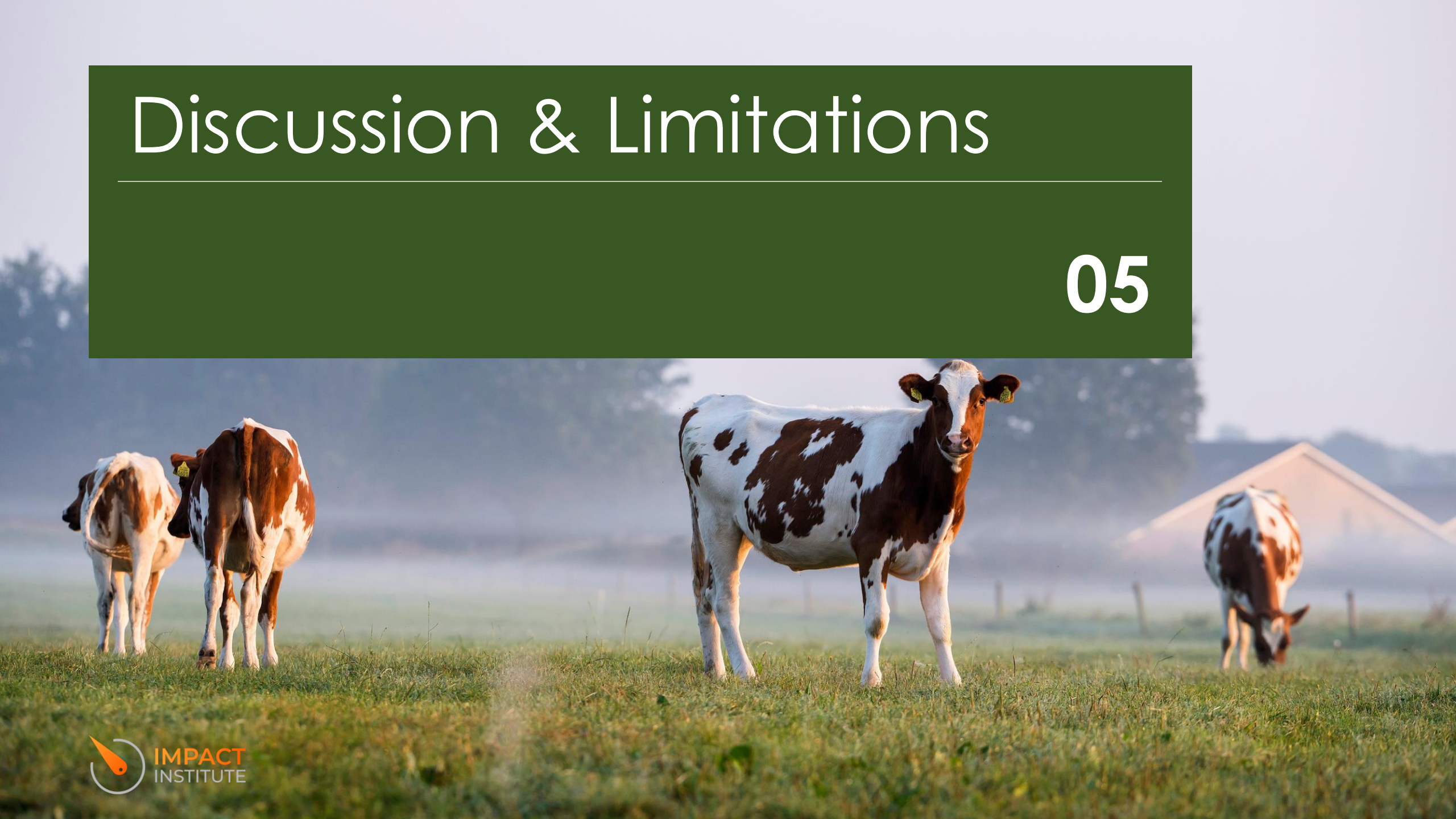
Animal Welfare

- The impact of animal welfare was found to be the **most significant impact across all protein types.**
- This impact is largely driven by the intensive nature of livestock farming which prioritises efficiency and the maximisation of output, often at the expense of animal welfare.
- Chicken demonstrated the **highest animal welfare impact (27.24 €).** This can be attributed to the challenging living conditions faced by broilers
- However, it's crucial to recognise that **the disparity in welfare impact among different protein sources is highly influenced by the number of animals required to produce 1 kg of meat.** Whilst an average chicken yields 1.3 kg of meat, an average dairy cow produces 13,648 kg of milk in its lifetime. These outcomes can potentially distort our understanding of animal welfare



Discussion & Limitations

05



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Discussion | Environmental Impacts

The severity of environmental impacts far from a harm-free protein production

- The severity of environmental impacts contrasts with the **relatively milder social impacts**. However, this **does not imply a harm-free conventional protein production**.
- The hampering of the environment due to emitted pollutants - primarily *CH4* from enteric fermentation and *N2O* from soils, demands urgent attention, considering the **dual impact on global warming and human health**.
- Environmental impacts are substantial for all proteins even before factoring in post farm-gate slaughtering and processing. Considering the potential additional impacts in subsequent stages, **the overall environmental consequences are likely to be even higher.**
- **Potential spill-over effects** in third-party countries indirectly linked to European animal farm production (*e.g., according to 2019 estimates the EU is responsible for 10% of world deforestation EC, 2019b*).

The EU Effort-Sharing Regulation (ESR)

- Agricultural emissions are covered by the ESR, which annually sets targets for each Member State. The ultimate aim is to reduce the total EU emissions from the agricultural sector by **30% by 2030**, compared to 2005 levels (EEA, 2023).
- Between 2005 and 2021 emissions decreased slightly (3 %) but Member States need to reduce substantially emissions in other ESR sectors to meet national targets (EC, 2020).

Discussion | Limitations I

A number of limitations should guide the interpretation of results

Scope

- **Value chain cut-off** – no estimates of impacts occurring after farm-gate
- **No spill-over effect** of the impacts on third parties

Data

- Due to data limitations, data from oilseed and protein crop farms was used as a reference for the underpayment and underearning impact of soy
- For underearning and underpayment of chicken and pork the same data points were used in the **absence of more disaggregated data**
- It is assumed that the ratio between average and median wages and income for farms is the same as the national ratio for France
- For **child labour** the oilseed data category for France and the animal products category for chicken and pork were used in the absence of more disaggregated data
- **Old data** from Agribalyse (2009-2015) – not up to date with latest EU regulation (Green Deal 2019, Farm to Fork Strategy and EU Biodiversity Strategy for 2030 both released in 2020)
- Average income and wage data was used to calculate the impact of underpayment and underearning which may obscure more extreme values, both high and low
- It is assumed that the average farmer has an average French family size and has a partner who works according to the national average employment rate

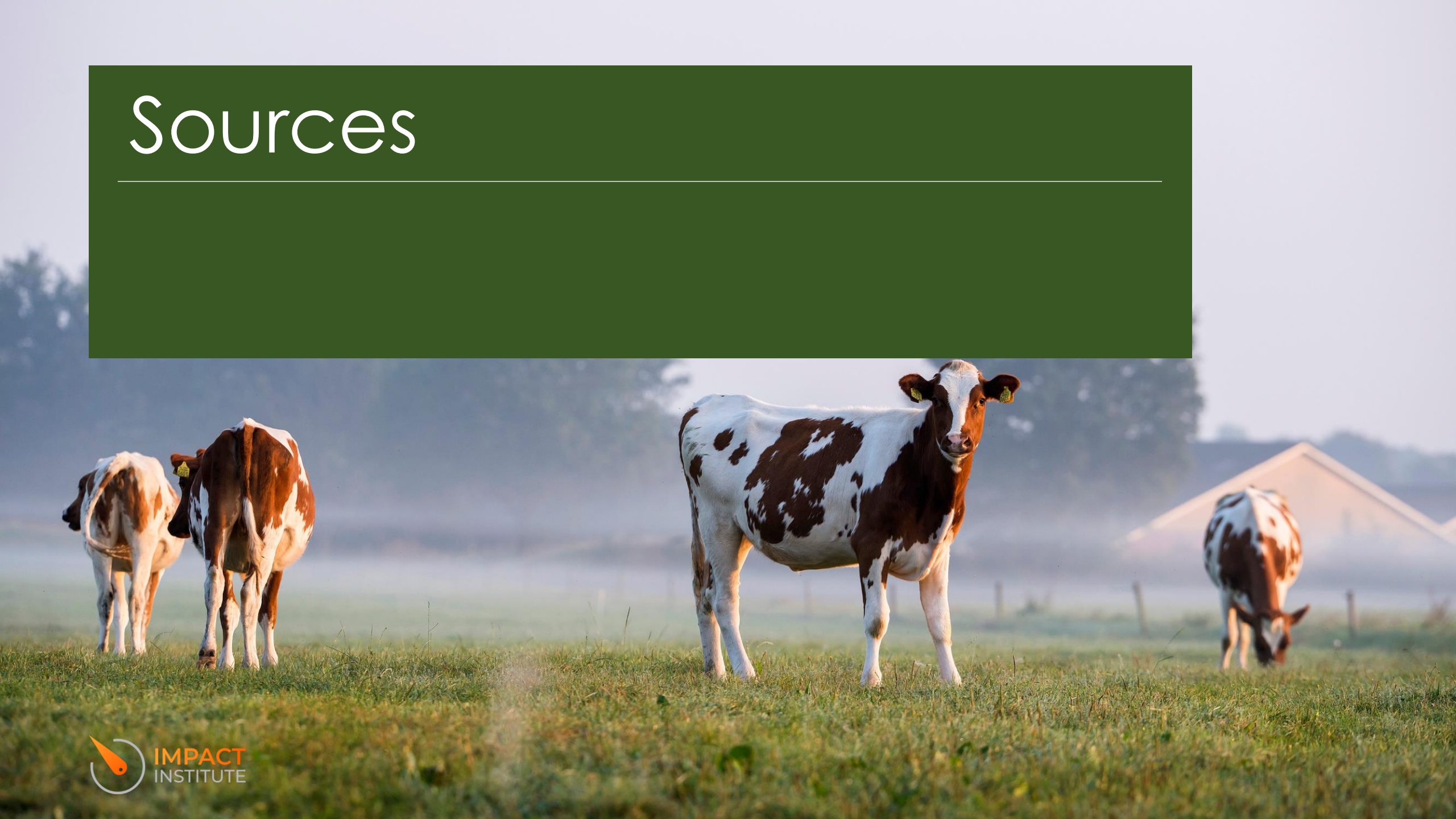
Discussion | Limitations II

A number of limitations should guide the interpretation of results

Method

- **The protein content of the selected animal-sourced food was not taken into account**
- Results for this kind of assessment, are **highly dependent on the chosen system boundaries and selected functional unit**. Literature comparison is quite challenging if the models' underlying assumptions are not extensively described
- The animal welfare method is underpinned by the assumption that there is a **moral distinction between humans and animals**, with varying moral value attributed to different species. This is a human-centred approach and is based on the expected intelligence relative to humans (Sherer et al., 2018).
- The animal welfare method does not factor in the welfare loss associated with death. It operates on the **premise that for animals, death may represent a relief from suffering** thus emphasising the duration of suffering as the focal point

Sources



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