



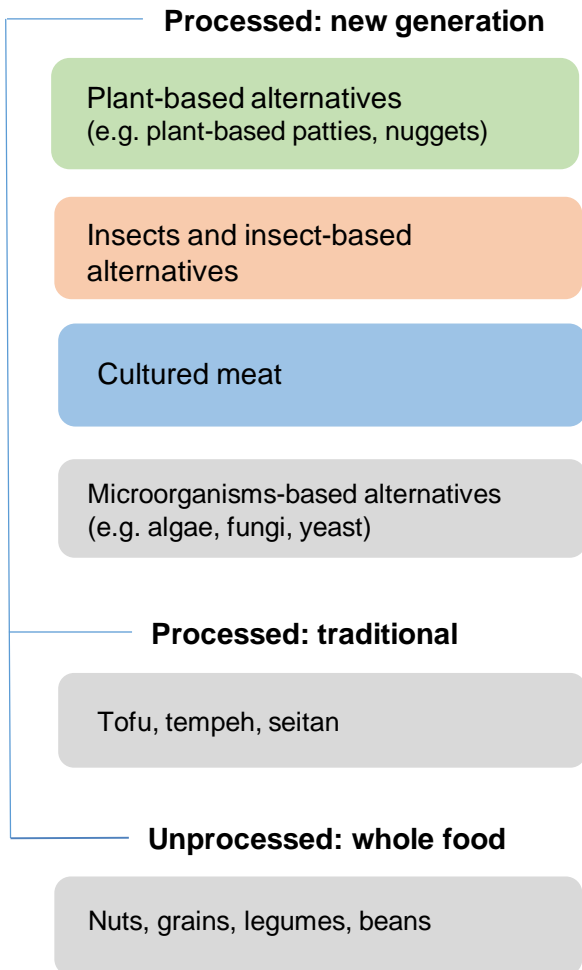
MEAT ALTERNATIVES

Opportunities and challenges for food systems' transformation

Clara Frezal
Policy Analyst
OECD, Trade and Agriculture Directorate



Meat alternatives: a definition



Processed products mimicking meats in terms of technical (taste, texture, appearance) and nutritional properties



Plant-based alternatives: meat alternatives made from plant proteins (e.g., soy, pea) and other plant-based ingredients



Insect-based alternatives: meat alternatives using insects or insect powder as main source of protein (usually mixed with plants)



Cultured meat: meat produced from animal cells and in vitro



The current market for meat alternatives



Plant-based alternatives:

- On the market for about 10 years (supermarkets, restaurants, fast food outlets)
- Global market size: USD 5-15 billion → **Less than 1% of global meat market**
 - **Western Europe: USD 2.6 billion; Eastern Europe: USD 192 million (GFI, 2022)**



Insect-based alternatives:

- On the market for about 5 years (online, some supermarkets)
- Global market size: USD 154-510 million
 - **Europe: USD 82 million (Statista, 2022); 500 tonnes on the market, 9 million consumers (IPIFF, 2020)**

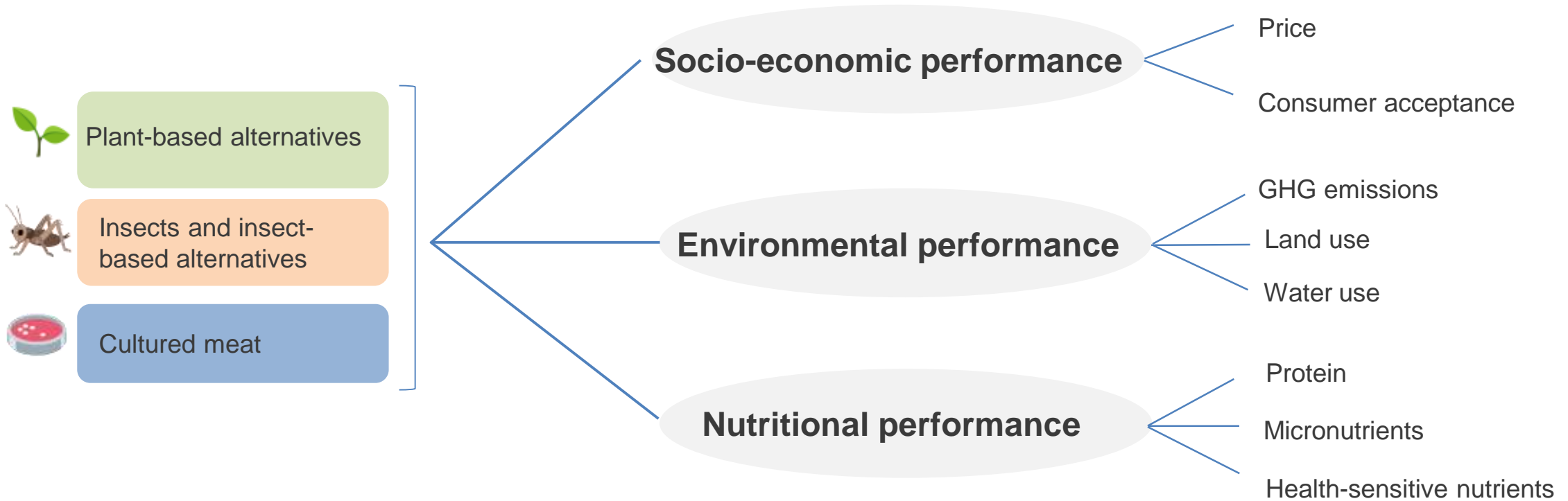


Cultured meat:

- Only sold in one restaurant in Singapore
- Dozen of companies working to bring their products to market in coming years



How do these products compare to meats?

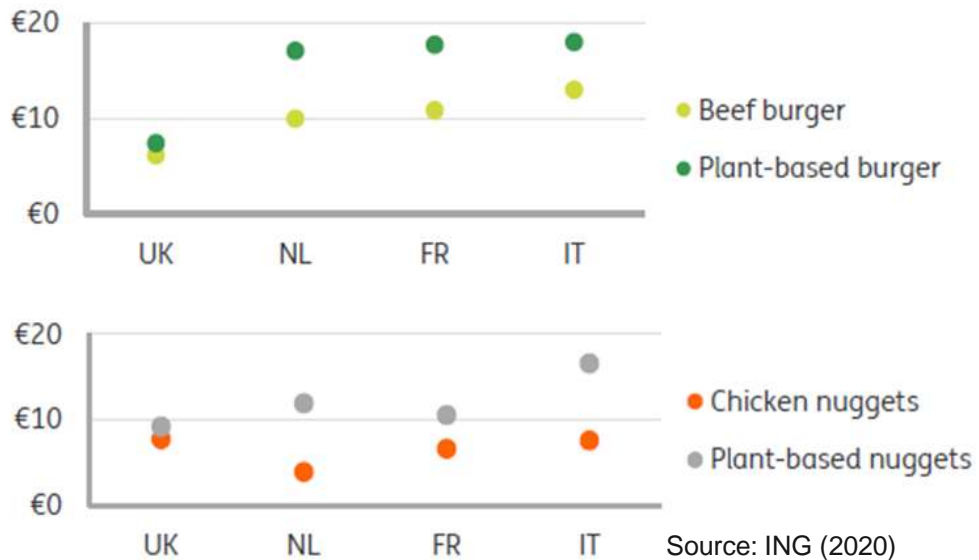




Socio-economic performance: Price

Meat substitutes are more expensive than popular meat products**

Retail price of popular meat products and plant-based alternatives per kilogram in a selection of countries



- Meat alternatives are currently **more expensive** than meats
 - Plant-based alternatives are the most affordable ones
 - High prices anticipated for cultured meat
- One reason for higher prices is **high production costs**

 Plant-based: cost of additives/flavour enhancer, processing costs, small production scale

 Insect-based: high labour costs, small production scale

 Cultured meat: production costs estimated to be at least **100 times higher than for meats**



Socio-economic performance: Consumer acceptance

- Acceptance of meat alternatives is **low compared to meat:**

Insect < Cultured meat < Plant-based

- Main consumer concerns:



food neophobia, unfamiliarity, fear, disgust, price and taste



unnaturalness, disgust, food neophobia, safety, healthiness, taste and anticipated price



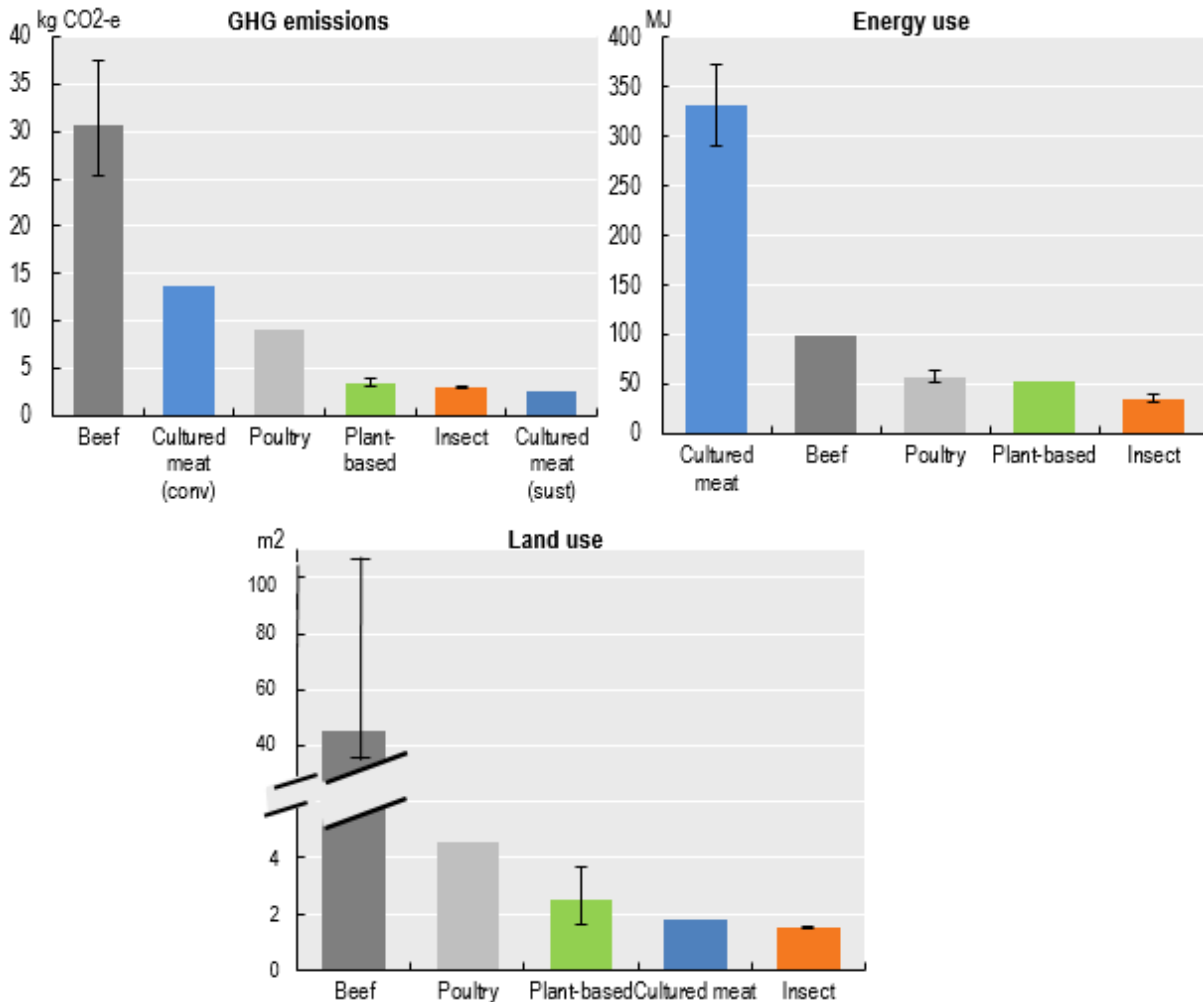
unfamiliarity, taste and healthiness (ultra-processed)

- Acceptance vary between age groups, gender, education level, countries



Environmental performance

The environmental impact of 1 kg of meats and meat alternatives



➤ Comparison based on **Life Cycle Assessment**

• Plant and insect-based alternatives



- Lower carbon footprint than all meats
- Lower land use requirements
- Lower water footprint

• Cultured meat



- Lower carbon footprint than beef and lower than all meats if **switch to renewables**
- Lower land use requirements
- Lower water footprint than beef only

Sources: Plant-based=plant-based burgers (Beyond/Impossible) (Khan et al., 2019; Heller and Keoleian, 2018); Insect=insect-based meat substitute (Smetana et al, 2015); Cured meat (CE DELFT, 2021); Poultry=global average (CE DELFT, 2021); Beef=US beef burger (Khan et al., 2019; Heller and Keoleian, 2018);



Nutritional performance

Nutritional composition of the Beyond and Impossible burgers (100g), of an insect burger (100g), and a beef burger (100g, 80% lean meat 20% fat)

	US Beef Burger (USDA)	Beyond Burger	Impossible Burger	Insect Burger (Bugfundation)
Calories (kcal)	254	252	212	282
Protein (g)	17.2	17	17	21
Saturated fat (g)	7.58	5.6	7	2.1
Fibre (g)	0	1.3	2.7	1
Iron (mg)	1.94	4	3.7	n.a.
Cholesterol (mg)	71	0	0	n.a.
Sodium (mg)	66	345	327	1600
Sugar (g)	0	0	0	1.4



Insect-based alternatives:

- Insects are considered good sources of human nutrition
- Nutritional data available for some insect-based alternatives (Table)

 Cultured meat: no nutritional data is currently available

- Meat is a complete source of protein and contains key nutrients
- Meat alternatives aim to provide **similar to superior nutrition** as meats



Plant-based alternatives:

- Leading brands try to match nutritional profile of meat (Table)
- Studies looking at wide of products: mixed impact from substituting meats with plant-based alternatives
 - More fibre, vitamins E and B9
 - Less vitamin B12, zinc, iron
 - Increased share of **ultra-processed foods**

References

Tso and Forde (2021), Unintended Consequences: Nutritional Impact and Potential Pitfalls of Switching from Animal- to Plant-Based Foods

Salome et al (2021), Substituting Meat or Dairy Products with Plant-Based Substitutes Has Small and Heterogeneous Effects on Diet Quality and Nutrient Security: A Simulation Study in French Adults



Current performance (simplified)

		Plant-based	Insect-based	Cultured meat
Socio-economic	Price	-	-	-
	Consumer acceptance	-	-	-
Environmental	GHG emissions	+	+	≈
	Land use	+	+	+
	Water use	+	+	≈
Nutritional	Protein	≈	+	?
	Micronutrients	≈	?	?
	Saturated fat	≈	+	?
	Salt	-	-	?



Impact on food systems

- Depends on the **market share meat alternatives will capture**
 - If they remain “niche products”: implications for society will be small
 - If they capture significant market share: could have wide consequences for environmental, health, and ethical outcomes and for actors along the livestock value chain
- **Strong growth** in meat alternatives market projected in coming years, but starting from a low base

Actual growth will be contingent on:

- Cost reductions
- Technology development
- Enabling regulatory frameworks
- Broad consumer acceptance

	Current market (2021)	Projected market (2030)
Plant-based	USD 5-15 billion <1% of meat market	USD 25-140 billion <10% of meat market
Edible insects	USD 154-510 million	Up to USD 8 billion
Cultured meat	0	USD 5-25 billion



Thank you!



- **1st OECD report on meat alternatives**
- Published in September 2022
- Includes both:
 - A literature review
 - A scenario analysis using a partial equilibrium model for global agriculture

<https://doi.org/10.1787/387d30cf-en>