

CS Global ESG Research

Pathways to a sustainable food and agricultural system

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Securities Research



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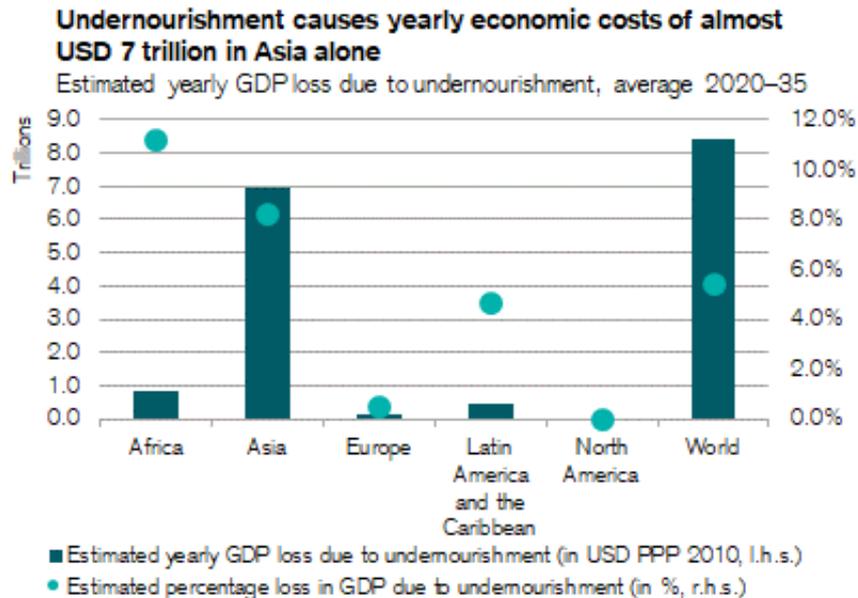
A sustainable food and agricultural system aids all SDGs



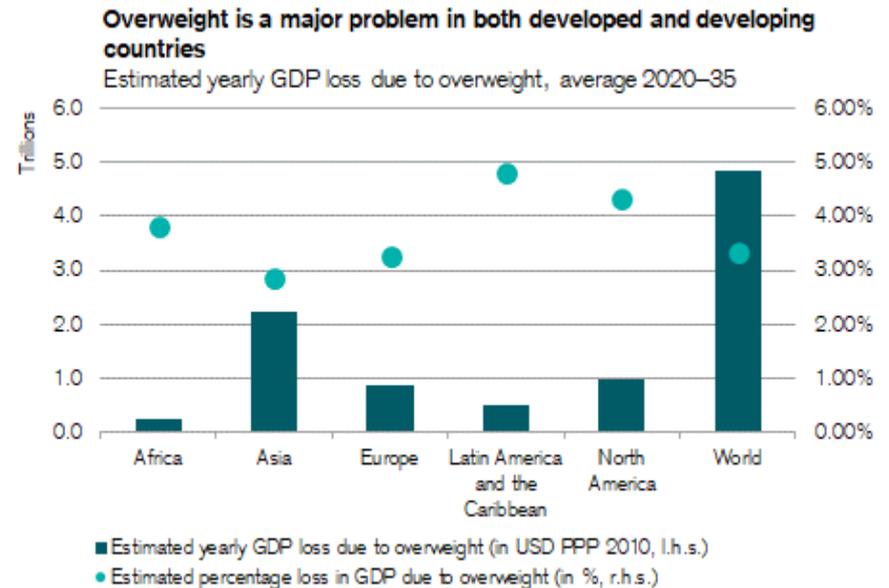
Reasons why a change is needed: 1 Malnutrition

- **A double burden:**
 - **Undernourishment:** c700m today, trend suggest 840m in 2030.
 - **Overweight/Obesity:** 1.8bn today, 60% of adults.
- **Diet-related health risks are very substantial.** Dietary risks are estimated to be the cause of more than 20% of total deaths among adults aged 25 years and older.
- **The economic impact is very substantial:** We estimate that the cost associated with malnutrition can be more than US\$13trn per year

The cost of undernourishment to the global economy



The cost of overweight and obesity to the global economy

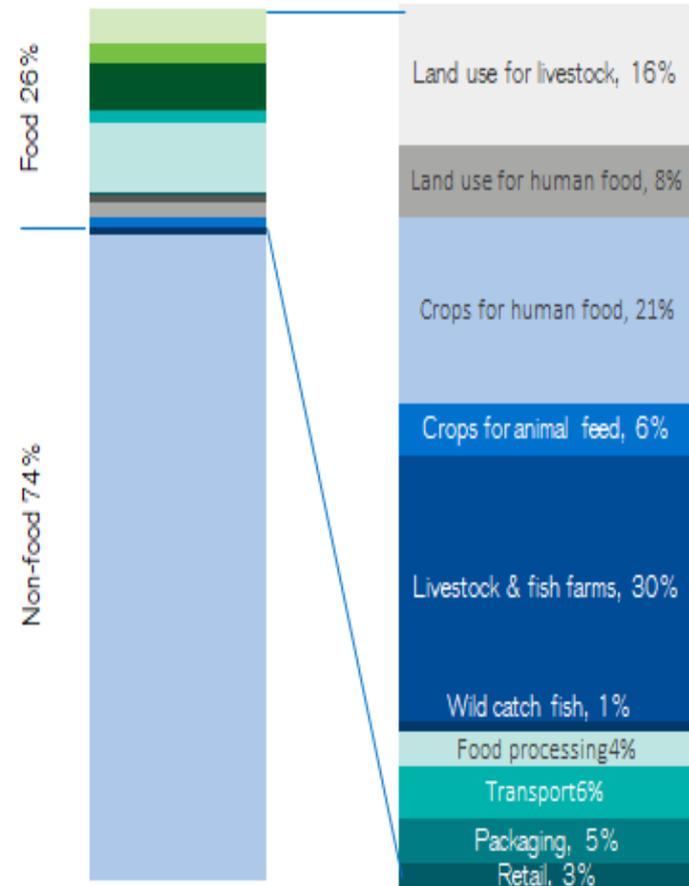


2 The food system drives the climate agenda

- At present as much as 26% of GHG emissions can be linked to the global food system.
- Food production and consumption is also highly water intense (accounts for 92% of fresh water consumption) and a major driver behind deforestation and the loss of biodiversity.
- What we eat makes a substantial difference in terms of environmental impact
- COP26 is unlikely going to be a success unless changing the food system is the 'starter, main course and the desert' of the conference

The food system drives 26% of GHG emissions

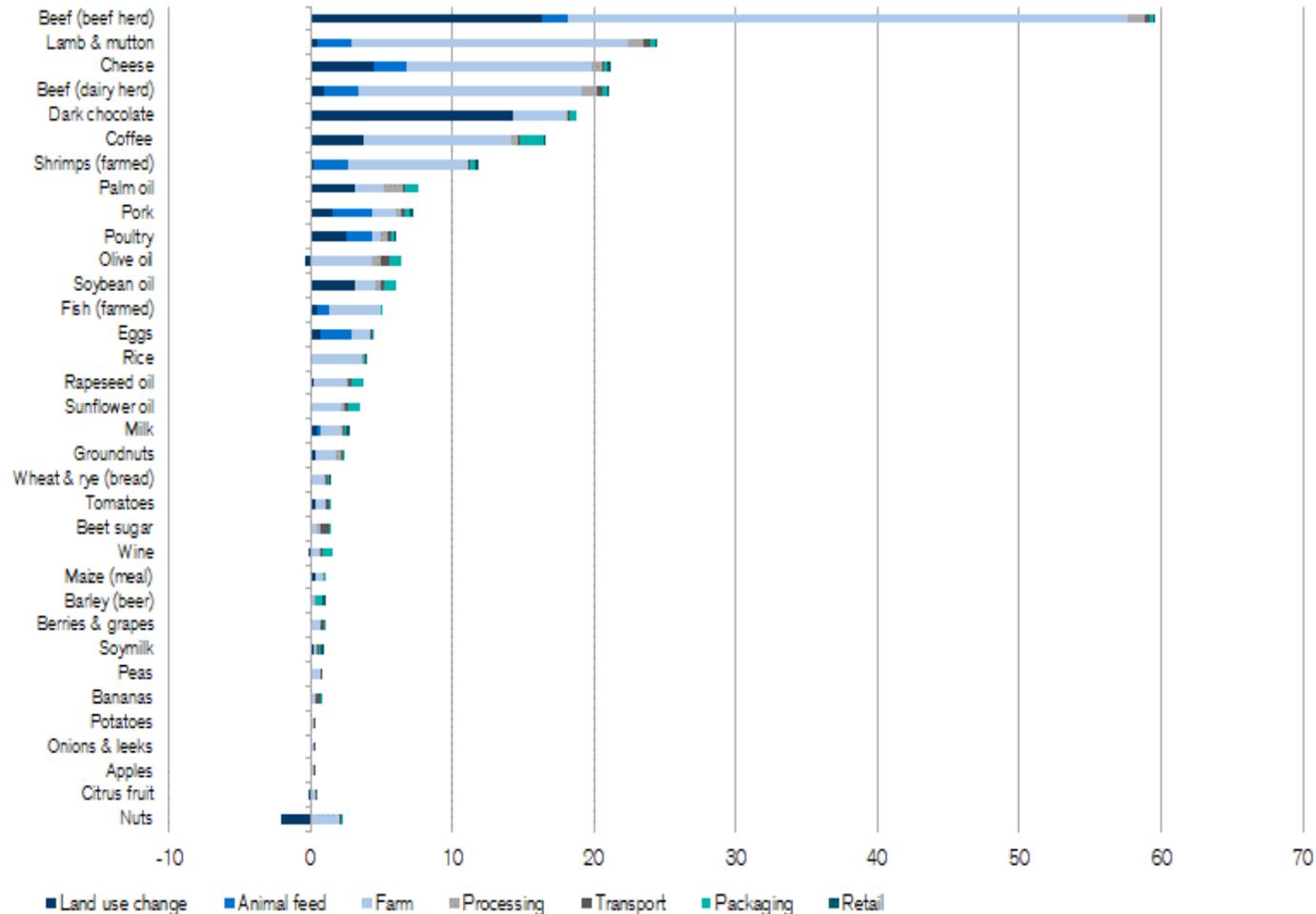
Food related GHG emissions by source globally



What we eat matters from an environmental perspective

- **The least environmentally intense food products** include vegetables, soy milk, potatoes and fruit.
- **The most environmentally intense food products** are animal-based such as meat, cheese, lamb, fish and pork.

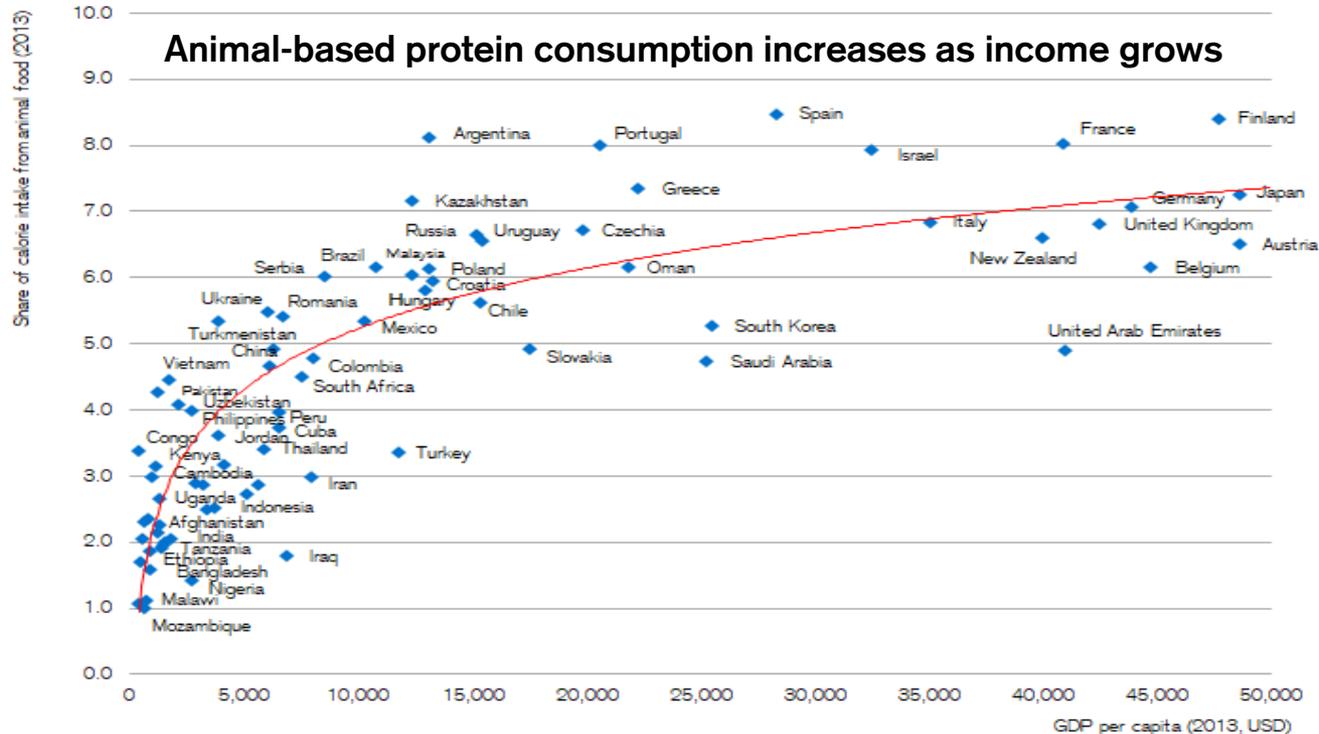
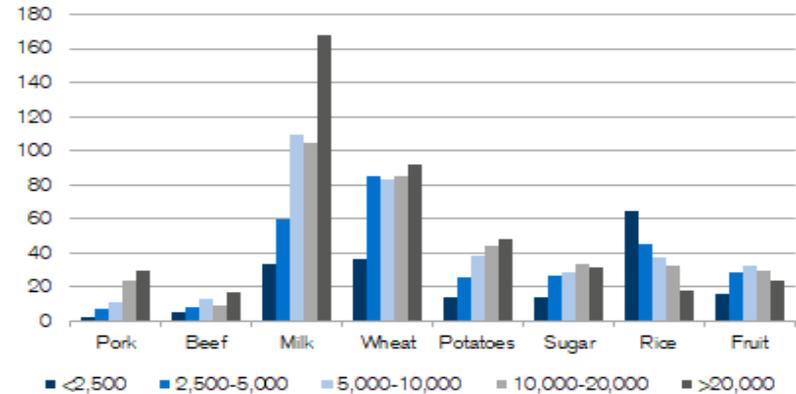
GHG emissions by food type and broken down by source (kg CO₂ equivalent per kg of product)



Longer term there are additional factors to consider

- **Affordability**
 - 3bn people cannot afford a healthy diet
 - Food price inflation accelerating across all food items
- **Demographics**
 - Population growth to continue (c10bn by 2050)
 - Growing EM middle class
- **Dietary patterns change with income**
 - Increased consumption of unhealthy food
 - Increased consumption of environmentally unfriendly food

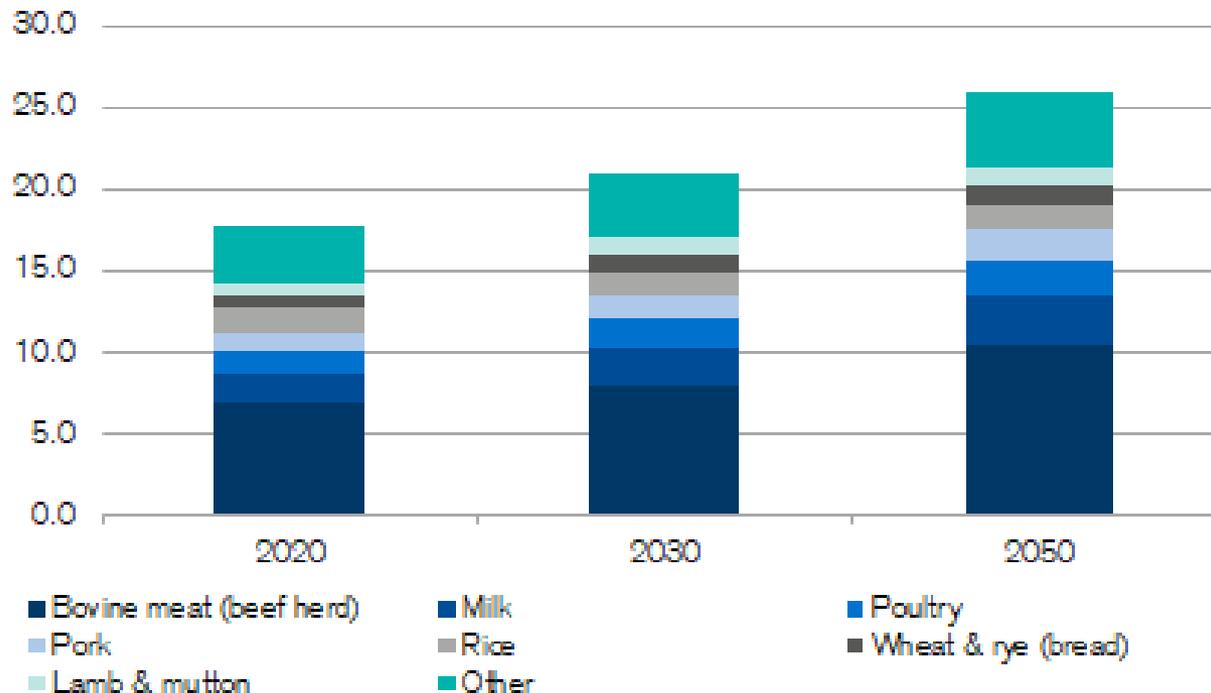
Per capita consumption (kg) of certain food items grouped by average GDP/capita (USD)



What if current trends continue?

- **Two scenarios**
 - Base case: Incomes increase and that dietary patterns continue to differ between income bands.
 - Worst case: Diets converge to that currently consumed by people with average incomes of at least US\$20,000.
- **Base case: c50% increase in land demand** driven largely by increased meat consumption. Total **GHG emissions would increase by c46%** between 2020 and 2050.
- **Worst case: Land demand and emissions would double** while water usage would increase by more than 50% between 2020 and 2050.

Total GHG emissions associated with our convergence scenario rise 46% by 2050 (Gt CO₂ eq)



Solution 1: Moving towards a plant-based diet

- **Moving to a plant-based diet works from an environmental perspective**

A vegan diet, consisting of plant-based ingredients supplemented with some consumption of sugar and oil products, would cut a person's overall dietary footprint by close to 90%.

- **National diet guidelines exist but do not go far enough.** Exposure to processed and unhealthy food remains too high whereas virtually all national dietary guidelines have an unsustainable environmental footprint.

- **A full plant-based diet is not even necessary**

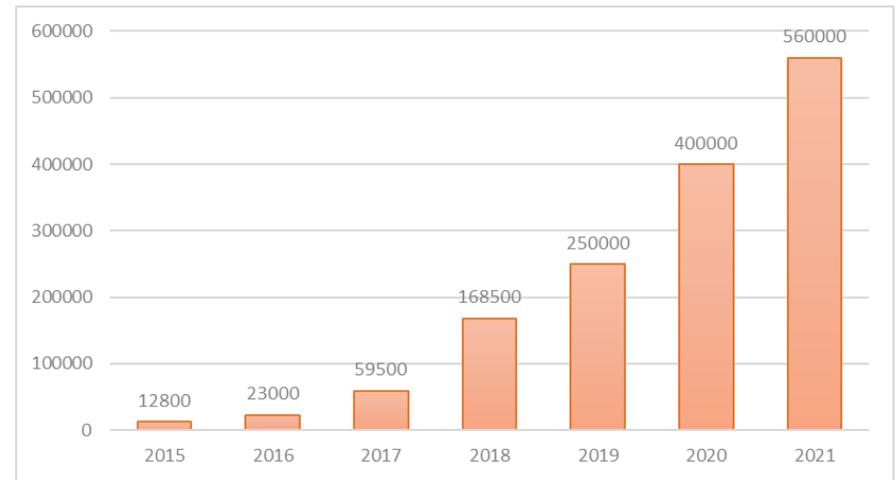
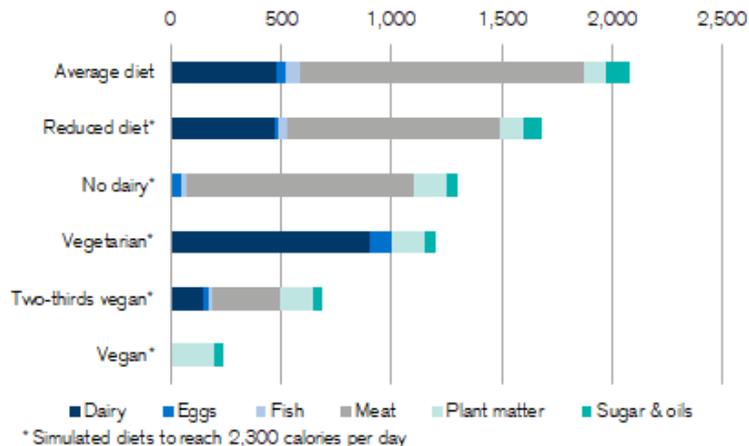
The key challenge is to change people's behaviour

The GHG footprint of a vegan diet is c1/8th of that of an average diet in the US

The growing popularity of Veganuary in the UK suggests that a plant based diet might not be impossible

Emission intensity can be greatly reduced

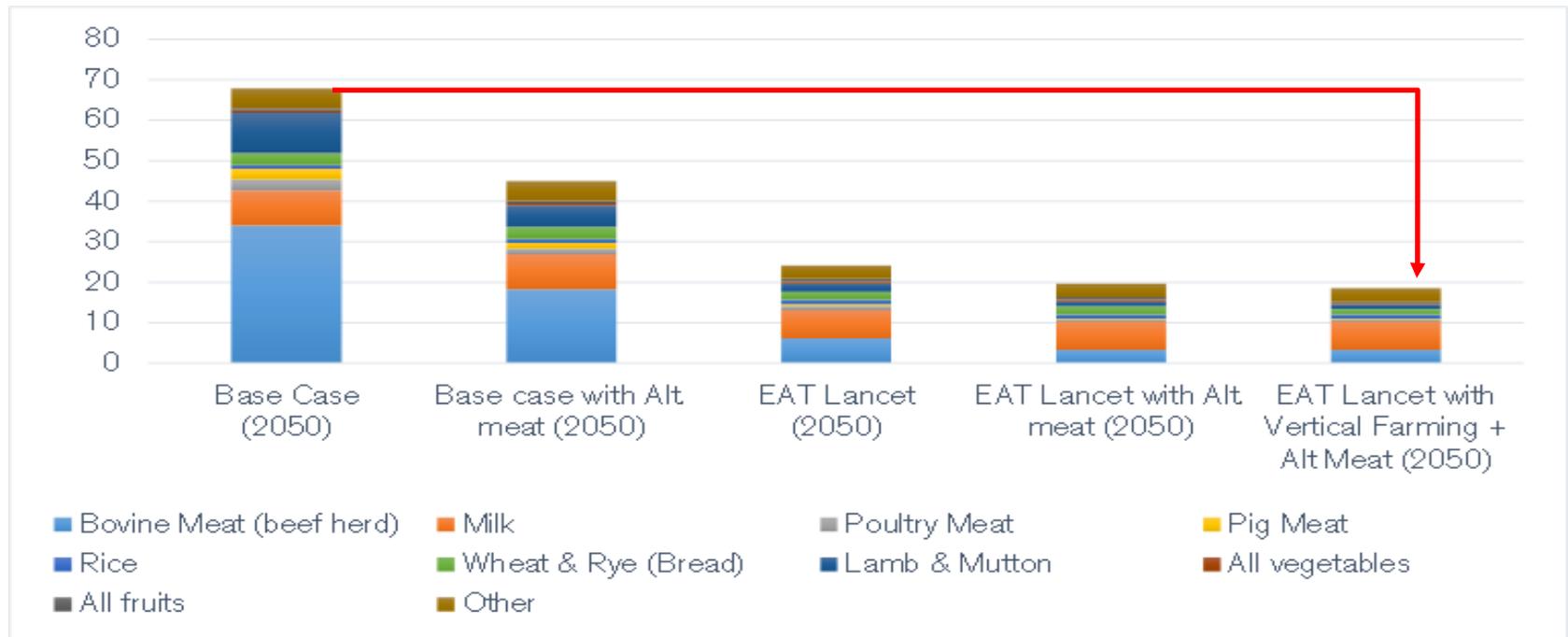
United States, greenhouse-gas footprint kg of CO2 equivalent per person per year



A plant-based diet can be a catalyst for reforestation too

- **Deforestation data provides a worrying picture**
 - Since 1990, a total of 420 million hectares of forest has been lost due to deforestation (c8x the size of France or c50% of the US).
- **Reforestation freed-up agricultural land has enormous potential**
 - Moving to a plant based diet would have the potential to free up a substantial amount of land.
 - Using average carbon storage per tree and a 30-year replanting scenario, we calculate that 80% of current anthropogenic emissions could be captured.

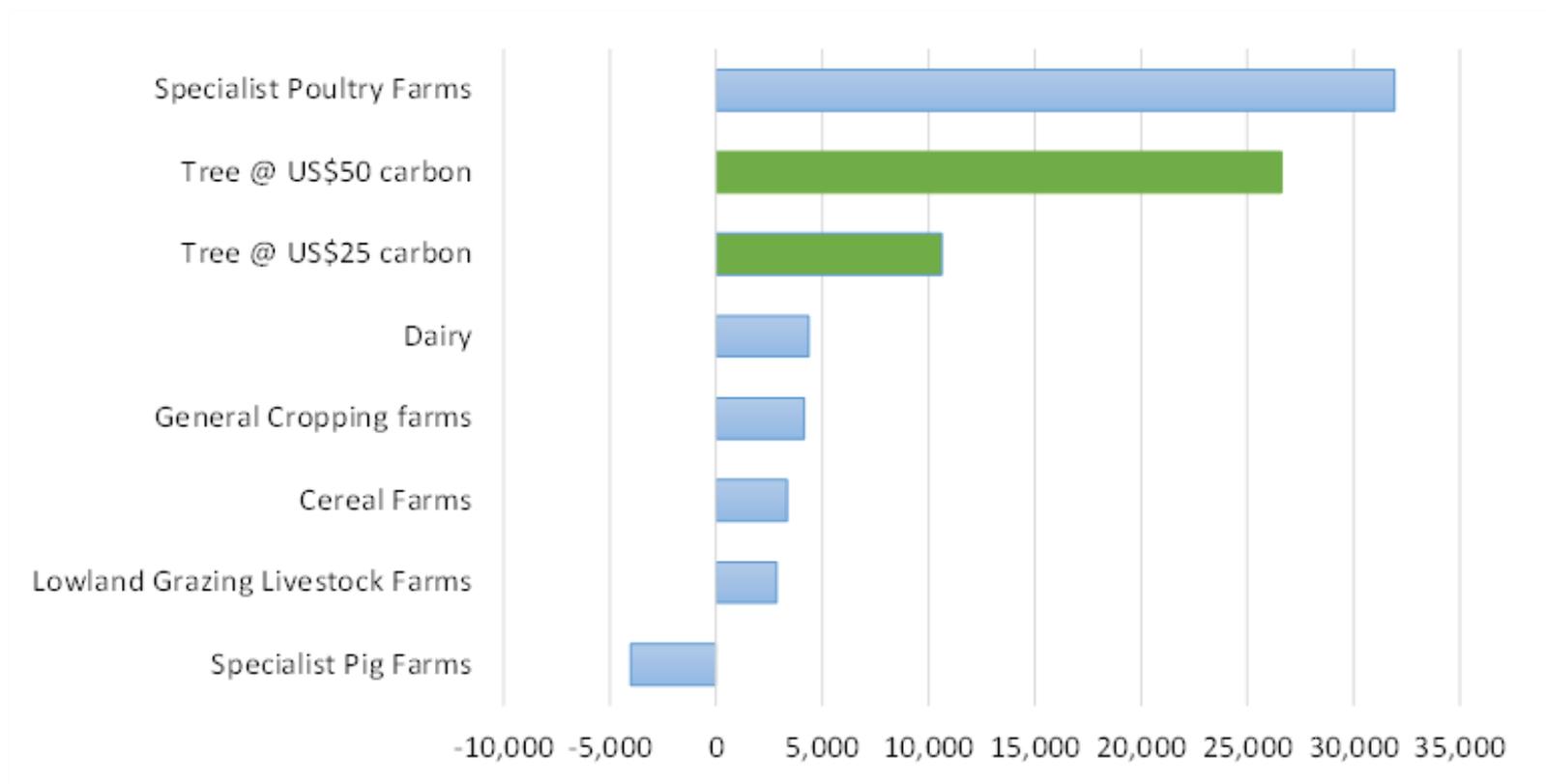
The amount of land needed to feed the global population will drop as i) people change diets, ii) adopt alternative meat and iii) use vertical farming. This land can be used for reforestation



To tree or not to Tree: it is not even a question, in our view

- **We believe that farmers should consider planting trees**
- **The value of a tree**
 - We have calculated the Net Present Value of a Tree using a 55-year lifecycle and a discount rate of 5%. We have done the same for traditional farming activities
 - At US\$50 for each ton of carbon stored, we value a hectare of trees at over US\$26,000 this is c7x the value of most farming activities.
 - Even a much lower carbon credit of US\$25/ton would still value a hectare of trees at well over that of most farming activities.

We have calculated the NPV of one hectare of trees and compared it to the theoretical value of different farming activities. (US\$)

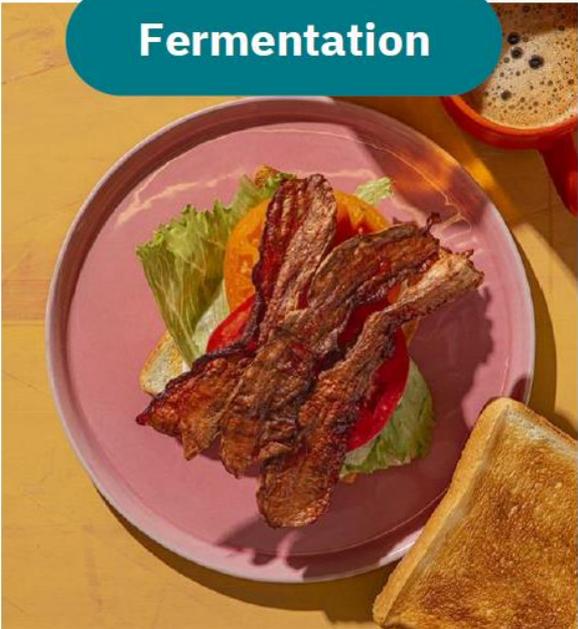


Solution 2: Developing alternative protein

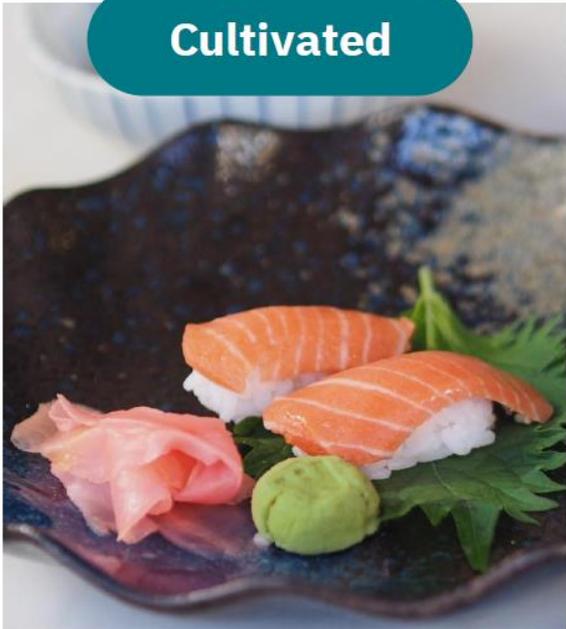
Plant-based



Fermentation



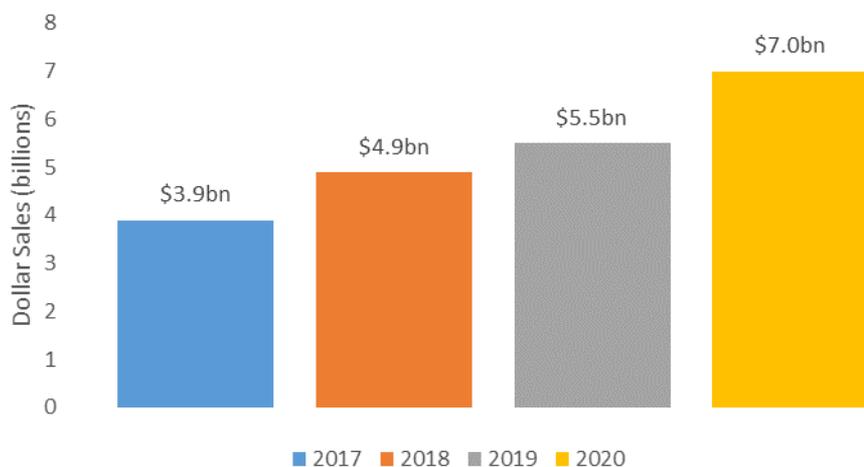
Cultivated



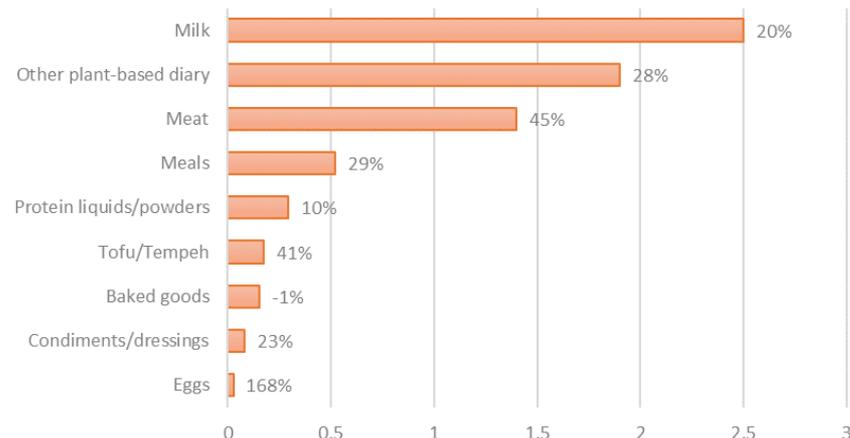
Plant based food market

Growth accelerating but large potential remains

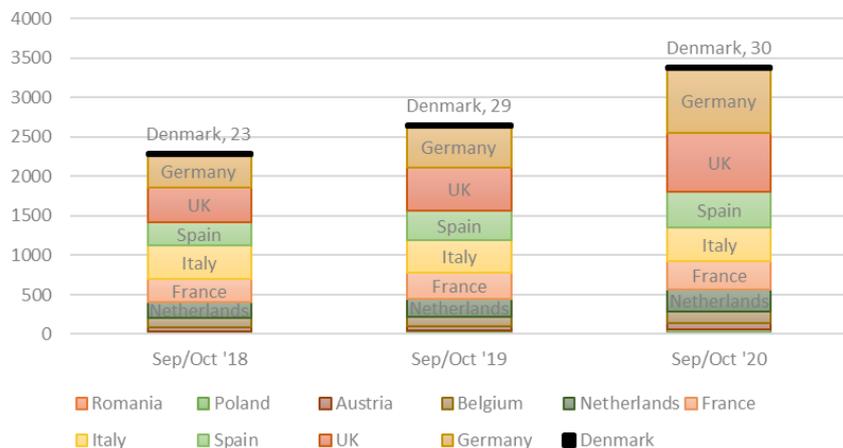
Total US Plant Based Food Market



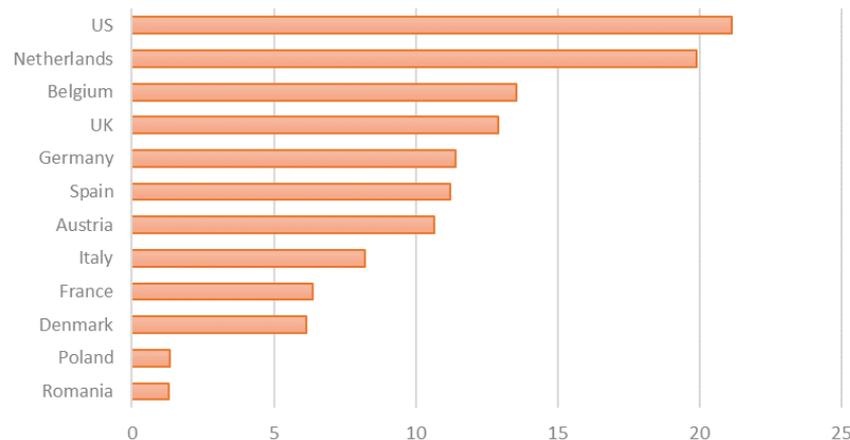
US Plant Based food market by category (and growth)



The European Plant Based Food Market



Plant based food / capita (US\$)



Some of the challenges that need to be overcome

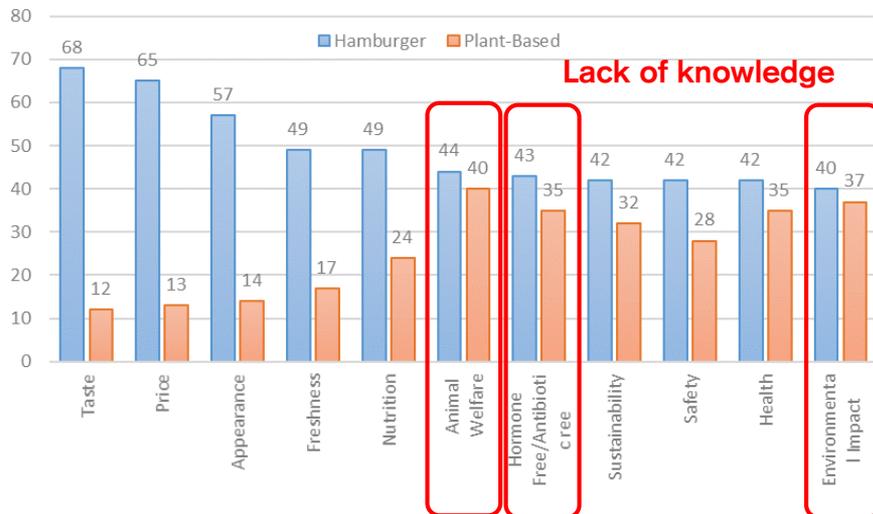
▪ We see a number of key challenges that need to be addressed

- Alternative protein is too expensive
- Taste may not meet consumer requirements
- Plant-based protein is seen as too processed
- Consumers need to be educated on alternative proteins
- Regulatory approval is needed for cultivated

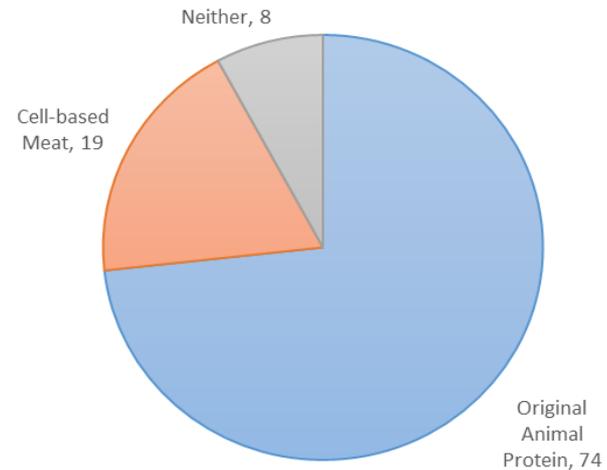
Closing the gap on price



What is "Better" of "Much better"?



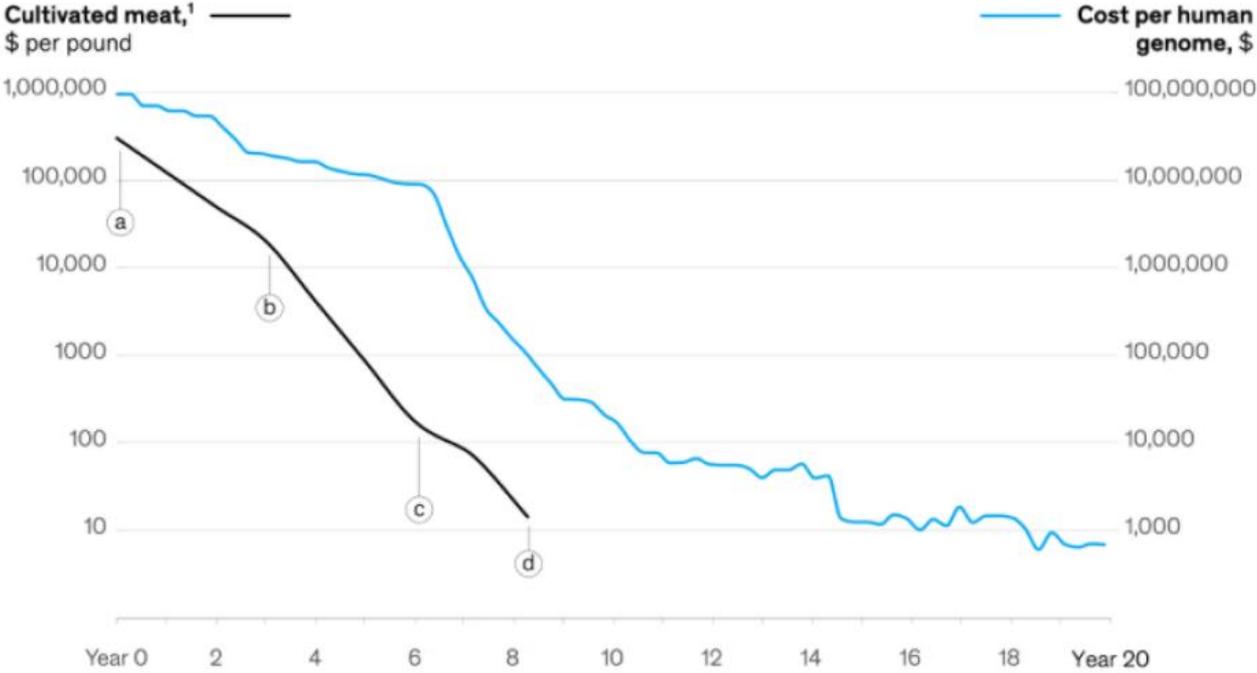
Perception is key: all else being equal consumers prefer animal protein over a cell-based option (for now?)



The signs, however, are promising

Cost is coming down rapidly

Comparative cost of changing technologies (logarithmic scale)

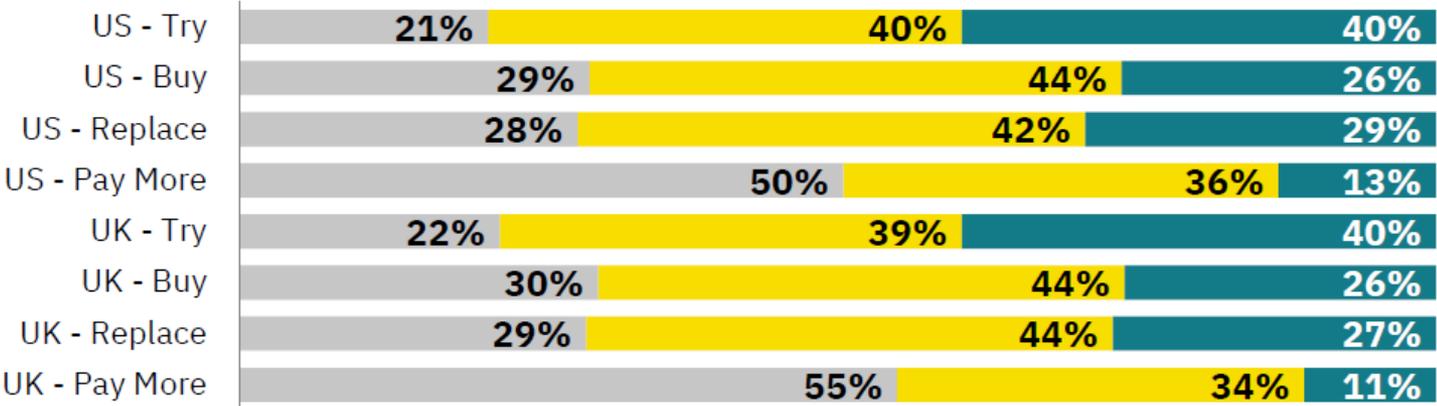


- a** 2013: Dutch scientist developed and produced first cultivated meat at ~\$300,000 a burger²
- b** 2016: Memphis Meats produced a "cultivated meatball" for ~\$20,000/lb
- c** 2019: Future Meat Technologies reduced production costs of chicken to \$150/lb and beef to \$200/lb
- d** 2021: Future Meat Technologies announced it produced a 4 oz chicken breast at \$4 (with mixed plant protein)

The signs, however, are promising

Consumers might be willing to try cultivated meat

Likelihood of adopting cultivated meat, by country and segment



Not at all likely
 Somewhat or moderately likely
 Very or extremely likely

Start-ups dominate the alternative protein supply chain

List of companies in the alternative food sector

Cell Culture Products

- Aleph Farms
- Artemys Foods
- Avant Meats
- Biotech Foods
- BiofoodSystems
- BlueNalu
- Cell Farm Food Tech
- Clearmeat
- Cubiq foods
- Finless Foods
- Fork & Goode
- Future Meat Technologies
- Gourmey
- Higher Steaks
- Hoxton Farms
- Innocent Meat
- Integriculture
- Eat Just
- Lab Farm Foods
- Meatable
- Meat Tech 3D
- Memphis meat
- Mirai Foods
- Mission Barns
- Mosa Meat
- Mzansi Meats
- New Age Meats
- Peace of Meat
- Shiok Meats
- Supermeat
- Vow
- Wildtype

Plant - based companies

- Alpha Foods
- Alchemy foodtech
- The better meat co
- Beyond Meat
- Perdue/Chicken plus
- Climax foods
- Daring foods
- Impossible foods
- Good Catch
- Green Monday
- The Meatless Farm
- Monde Nissin / Quorn
- New Wave Foods
- No Evil Foods
- Novameat
- Noquo
- Notco
- Oatly
- Parabel
- Rebl
- Rebellious Foods
- Rebel Kitchen
- Redefine meat
- Simulate
- This
- Veestro
- Zhenmeat

Bioreactors/ 3D cell culture support

- Applikon Biotechnology
- Atlast Food
- Biocellion
- Biomimetic solutions
- Celltainer Biotech
- Cellularrevolution
- Cellular Agriculture
- Corning life sciences
- Incuvers
- Kerafast
- Kuhner shaker
- Matrix meats
- Merck Millipore
- Ospin
- Sartorius
- Sunp biotech
- Thermo Fisher Scientific
- Vivex bio

Ingredients

- Afineur
- Arzeda
- Bioscienz
- Clara Foods
- Geltor
- Motif Foodworks
- Puris
- Ripple food
- The Protein Brewery

Cell Cultured Pet Food

- Bond Pet Foods
- Because Animals
- Hownd
- Wild Earth

Biofabrics

- Ananas Anam
- Bolt Threads
- Ecovative design
- Furoid
- Galy
- Modern Meadow
- Mycoworks
- Spiber
- Vitrolabs

Air Fermentation Protein

- Air Protein
- Deep Branch Biotech
- Novonutrients
- Solar Foods

Fermentation Dairy

- Better Dairy
- Biomilq
- Califia Farms
- Legendary foods
- New culture
- Perfect day
- Turtletree labs

Cell Culture Growth Media

- Back of the yards algae sciences
- Biftek
- Cultured Blood
- Future Fields
- Heuros
- Luyef Biotechnologies
- Multus Media
- Scinora

Traditional companies are also transitioning towards alternative food solutions

Europe		
Company	Startup	Area of Investment
Bayer	Guardian Agriculture	Crop Protection systems
Bayer	Ukko	Biotechnology
Bayer	Unfold	Vertical farming
Bayer	Rantizo	Drones
BASF	Equinom	Seed and legumes/Alternative Plant protein
BASF	Hummingbird Technologies	AI/Data Analytics for agriculture
BASF	Ecorobotix	Robotic solutions for agriculture
Bell Food group	Mosa Meat	Cultured Meat
Danone	Laird Superfood	Plant based/non-dairy products
Danone	Phenix	Food Waste management
Danone	Nature's Fynd	Microbe based meat alternatives
Danone	Agricool	Urban farming
Danone	Forager project	Organic, Plant based non dairy and grain free alternatives
DSM	Meatable	Cultivated/Cell-based meat
DSM	Chinova Bioworks	Natural fibre for food preservation
Kerry group	Pevesa Biotech	Plant protein
Marks & Spencer	Cogz	Food waste and Supply chain management
Marks & Spencer	3FBio/Enough	Microbe based meat alternatives/Myco-protein
Nestle	Velle	Dairy-free products
Nestle	XO	Beverage packaging/Resealable beverage cans
Orkla	Bower	Recycling solutions for packaging
Orkla	Farmforce	Agritech, sustainable sourcing
PHW Gruppe	ReDefine Meat	3Dprint of animal-free meat
PHW Gruppe	Enterra Feed	insect-based animal feed
Tesco	Buttermilk	Plant based/non-dairy products
Tesco	THIS™	Plant-based meat alternative
Unilever	3FBio/Enough	Microbe based meat alternatives/Myco-protein
Unilever	Algenuity	Plant based protein (microalgae)
Unilever	The Vegetarian Butcher	Plant based meat alternative

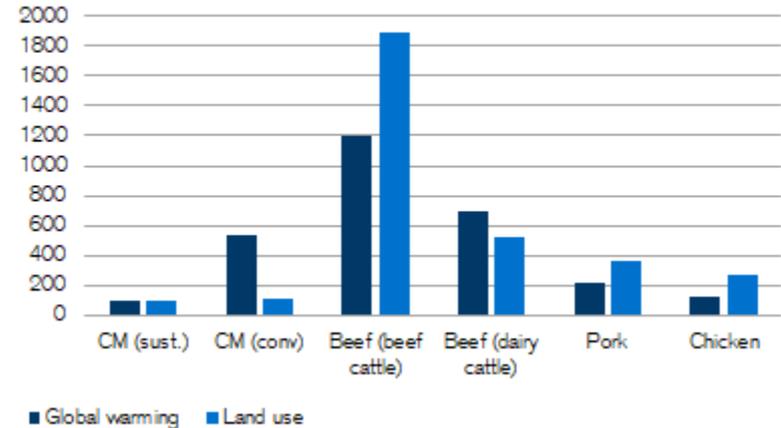
USA		
Company	Startup	Area of Investment
Campbell's	Spoler Alert	Foodwaste Technology
Campbell's	Mori	Food Coating
Cargill	Memphis Meats	Cell based Meat
Cargill	Aleph farms	Cultivated Meat
Cargill	PURIS	Pea Protein
Ecolab	Ecoplant	Supply chain management
General Mills	Good Catch	Plant based seafood alternative
General Mills	GoodBelly	Probiotics
General Mills	Rhythm Superfoods	Health snacks
General Mills	Urban remedy	Plant based/gluten-free/non-dairy products
John Deere	Nori	Carbon credits
John Deere	Nvision Ag	Agricultural data modeling and analytics
John Deere	FaunaPhotonics	Real-time pest detection and control
John Deere	Taranis	Precision Agriculture
Krogers	Replate	Food donation
Krogers	Mobius	Food waste
Krogers	JourneyFoods.io	Food science and supply chain
Tyson Foods	Future Meat Technologies	Cell based Meat
Tyson Foods	NewWaveFoods	Cultivated Shrimp
Walmart	Ninjacart	Fresh produce supply chain
Asia		
Company	Startup	Area of Investment
CP group	Consentio	B2B food marketplace/Food supply chain management
CP group	New Wave Foods	Plant based seafood alternative
CP group	Telesense	Sensor
Marico	Avanjial	Irrigation systems
Marico	Vasumitra	Organic fertilizers, crop protection
Thai Union	Alchemy Foodtech	Food technology for diabetes management
Thai Union	HydroNeo	Aquaculture technology
Thai Union	BlueNalu	Cell-base seafood
Latin America		
Company	Startup	Area of Investment
JBS	Vivera	Plant based meat
BRF	Aleph Farms	Cell based protein

Alternative protein has strong growth potential

- **Key attractions**
 - Superior environmental footprint
 - No killing of animals needed or waste production
 - Antibiotics no longer used as part of animal feed.
- **We see strong growth potential.**
 - Over 400 companies are involved in alternative proteins. The report lists over 100 of these. We also show how traditional food companies transition towards sustainable food.
 - A 25% share for alternative meat in 2050 would suggest turnover of US\$555bn.

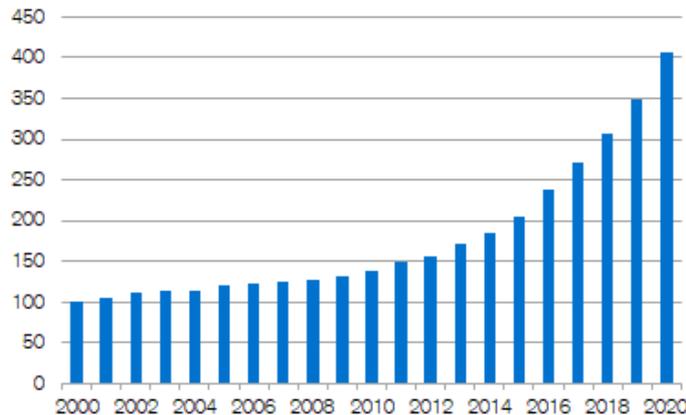
Cultivated meat has a superior environmental footprint to regular meat

Impact of animal-based protein products relative to cultivated meat when the latter is produced using renewable energy



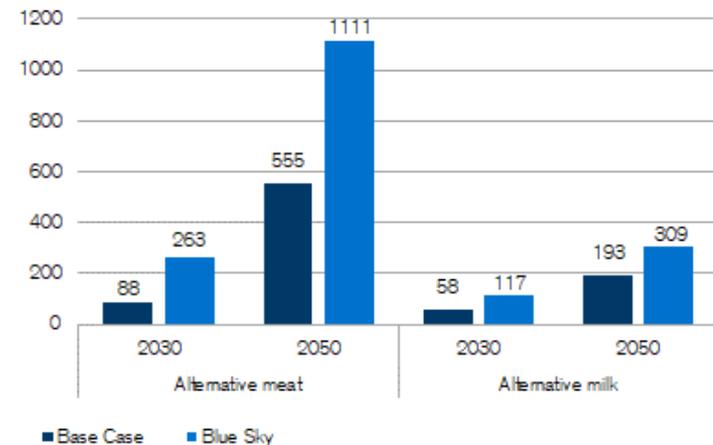
Popularity of alternative protein is accelerating

Number of alternative protein companies by year



The market opportunity for alternative meat is substantial

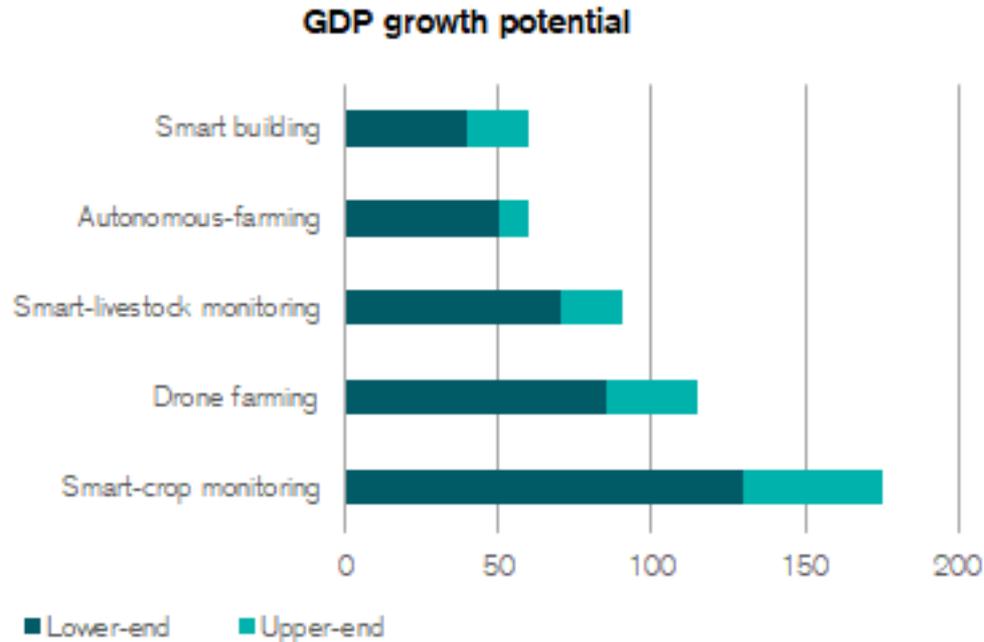
Potential size of alternative meat and milk market globally (USD bn)



Solution 3: Smart-agriculture

- **New technologies are needed.** Considering that total food demand is likely to increase by more than 50% during the next few decades. Traditional farming might not be able to meet these requirements.
- **Smart-Ag is a key growth area.**
 - *Vertical farming*
 - *Precision agriculture*
- **The economic impact of adopting technologies to enhance agricultural productivity can be substantial**

Total value impact of smart-ag solutions (US\$bn)

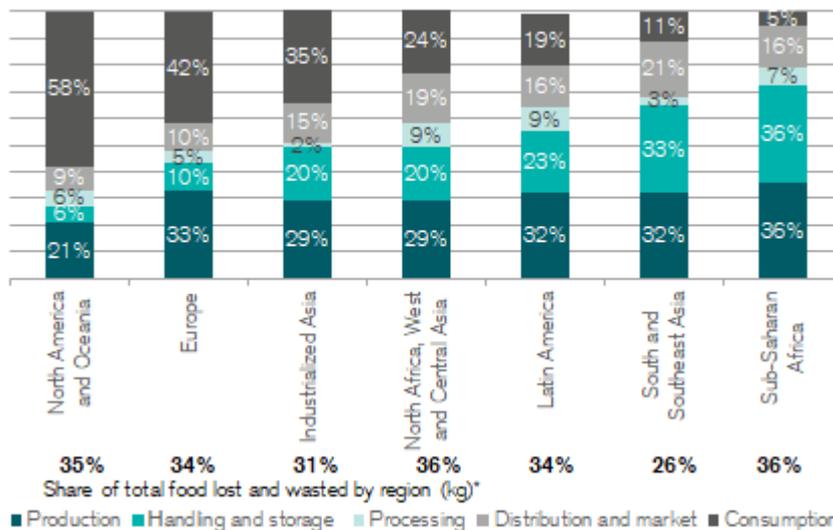


Solution 4: Address food loss and waste

- **Food loss and waste is a substantial issue.**
- **The economic implications are significant.** In 2019, more than US\$400bn worth of food was wasted. The FAO estimates that the total economic, environmental and social cost of food waste is around US\$2.6trn.
- **Solutions.**
 - Smart, plant-based, packaging
 - Cooling technologies
 - Treatment of produce
 - Circular Economy

More than 30% of food is either lost or wasted globally

Food loss and waste as a percentage of food supply
Share of tonnage per region (2007)



Cutting food loss and waste would reduce emissions substantially

Emissions associated with food loss and waste relative to major emitting countries

If food loss and waste were a country, it would be the third-largest greenhouse gas emitter in the world



Note: Figures reflect all six anthropogenic GHG emissions, including those from land use, land-use change, and forestry (LULUCF). Country data are for 2012, while the food loss and waste data are for 2011 (the most recent data available). To avoid double counting, the food loss and waste emissions figure should not be added to the country figures.

Thank You!

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Companies Mentioned (Price as of 08-Oct-2021)

BASF (BASFD.DE, €63.68)
BRF S.A. (BRFS3.SA, R\$26.33)
Bayer (BAYGN.DE, €47.75)
Bell (BELL.S, \$F294.5)
Beyond Meat (BYND.OQ, \$100.58)
C.P. ALL PCL (CPALL.BK, BRS.5)
Campbell Soup Company (CPB.N, \$42.21)
Cargill (CARG.CM, \$LR236.0)
Charoen Pokphand Foods Public (CPF.BK, B25.5)
Danone (DANO.PA, €56.89)
Deere & Co. (DE.N, \$343.17)
Ecotab (ECL.N, \$215.06)
General Mills (GIS.N, \$61.46)
JBS (JBSS3.SA, R\$37.39)
Kerry Group (KYGa.I, €116.35)
Koninklijke DSM NV (DSMN.AS, €173.95)
Marico Ltd (MRCO.BO, R\$563.7)
Marks & Spencer (MKS.L, 774.3p)
Monde Nissin (MONDE.PS, P18.44)
Nestle (NESN.S, \$F112.46)
Oatly Group AB (OTLY.OQ, \$14.6)
Orkla (ORKL.N, Nkr76.16)
Sartorius (SARTG.DE, €575.0)
Tesco (TSCO.L, 275.6p)
Thai Union Group (TU.BK, B20.8)
The Kroger Co. (KR.N, \$39.47)
Thermo Fisher (TMO.N, \$563.92)
Tyson Foods (TSON.N, \$78.57)
Unilever (ULVR.L, 3866.5p)
Walmart Inc. (WMT.N, \$139.66)

Disclosure Appendix

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Outperform (O) : The stock's total return is expected to outperform the relevant benchmark* over the next 12 months.

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Underweight : The analyst's expectation for the sector's fundamentals and/or valuation is cautious over the next 12 months.

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Rating	Versus universe (%)	Of which banking clients (%)
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Underperform/Sell*	10%	(20% banking clients)
Restricted	2%	

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