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Present and Future



In 2016 total number of **undernourished** people estimated **815 million**



Increase in **overweight** and obese people

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Food utilization concerning levels of **waste**



Natural resources are under pressure.



Massive environmental "**footprint**" of the food production and distribution sectors



Global population has reached 7.8 billion people and will reach 10 billion by 2050



Challenges of the current Food System







What is sustainability?





- In 1987, the United Nations Brundtland Commission defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."
- → 2015: Sustainable development goals (SDGs)



Sustainable Food Systems





Food and Agriculture Organization of the United Nations

"Is a food system that **delivers food security** and **nutrition** for all in such a way that the **economic**, **social** and **environmental** bases to **generate food security** and **nutrition** for **future generations** are **not compromised**"

In sustainable food system development, **sustainability is examined holistically**. In order to be sustainable, the development of the food system needs to **generate positive value along three dimensions** simultaneously: **economic, social** and **environmental**



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Greenhouse Gas emissions, global warming and the food system



- Livestock is by far the biggest contributor to dietary GHG emissions
- \rightarrow Shifts needed in consumer

behaviour change



Eating habits





Environmental dimension





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Diet related GHG emissions in Ireland





Diet related GHG emissions in Ireland





The EAT-Lancet Commission

Can we feed a future population of 10 billion people a healthy diet within planetary boundaries?

- Practical considerations make **defining a global healthy diet challenging**
- → different nutritional needs of people because of age, sex, disease status, and physical activity levels, and needs of vulnerable populations
- The Commission quantitively describes a universal healthy reference diet, based on an increase in consumption of healthy foods, and a decrease in consumption of unhealthy foods that would provide <u>major health benefits</u>, and also increase the likelihood of <u>attainment of the Sustainable</u> <u>Development Goals</u>



37 world-leading scientists across the globe



EAT-Lancet recommended reference diet





- Half a plate of vegetables and fruits
- The other half:
 - Primarily whole grains
 - Plant protein sources
 - Unsaturated plant oils
 - Optional: modest amounts of animal sources of proteins

EAT-Lancet recommended reference diet























- Largely plant-based
- Modest amounts of fish, meat and dairy foods

\rightarrow Flexitarian diet



EAT-Lancet recommended reference diet





Increase consumption of plant-based foods





Insufficient intake of minerals (calcium, zinc, iodine and selenium) and Vitamin D

True cost accounting



The True Cost Of Food Is Three Times What Americans Pay For it

National annual U.S. food expenditure and its estimated true cost as of 2021*



* True cost includes hidden factors such as health, environmental and economic impact of the U.S. food system. Source: The Rockefeller Foundation







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Let's take a walk through the supermarket





Fresh produce



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The EPA estimated that food waste in Ireland in 2019 amounted to 1 million tonnes, not including waste from primary production. This estimate suggests that after accounting for food waste, Irish fruit and vegetable supply per person would be below the recommended intake of 400g/person/day (WHO/FAO).

https://www.ucd.ie/foodandhealth/t4media/UCD%20Institute%2 0Sustainability%20Report.pdf



Plant-based proteins: Market and interest



Global plant protein market valued for US\$ 10.5646 Bn in 2017, growing at a CAGR of 6.6% from 2018 to 2026.

(https://www.credenceresearch.com/report/plant-protein-market)

Reason behind increased interest in plant proteins

For consumer perspective

- Growing interest in sustainable and environmentally friendly sources
- Increased traction to plant-based and healthy diet
- Rising incidences of allergenicity

From producers' perspective

- Addressing consumer demand
- Finding a unique and competitive place in the market
- Valorizing by-products



Barilla

ProteinPLUS





Plant based drinks



Reasons

- Medical reasons
- Lifestyle choice



Global market for dairy alternative drinks

- 7.37 billion US\$ in 2016
- Reaching 16.3 billion US\$ in 2018



Commercially available plant-based milks



Screening of different commercial plant-based milk substitutes



- Composition Visual appearance
 - Physicochemical properties
 - Glycaemic properties

Commercial plant-based drinks: Nutritious?





Milk versus plant-based alternative



€1.15 per litre

Ingredients: Cows milk



	Per 100 g
Energy	47 kcal
Protein	3.5 g
Fat	1.5 g
Carbohydrates	4.9 g
of which sugar	4.9 g
of which dietary fibre	0.0 g
Salt	0.2 g

• Economic impact

- Environmental impact
- Social (nutrition) impact



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€2.59 per litre

Ingredients: Soya Base (Water, Hulled Soya Beans (8%)), Sugar, Acidity Regulators (Potassium Phosphates), Calcium (Calcium Carbonate), Flavouring, Sea Salt, Stabiliser (Gellan Gum), Potassium Iodide, Vitamins (B2, B12, D2)

	Per 100 g	
Energy	39 kcal	
Protein	3 g	
Fat	1.8 g	
Carbohydrates	3 g	
of which sugar	2.5	
of which dietary fibre	0.5	
Salt	0.08	

Sugar and blood sugar levels





High blood sugar – health implications





Time/Hours



Commercial plant-based drinks: Sustainable?



Impact on environment

- 76% less farmland required
- iiii 190 million more people could be fed
- **8%** of feed protein is converted into consumed protein





Meat, seafood and alternatives





















Plant-based meat alternatives



	Beef burger	Beyond Burger		
Calories (kcal/100g)	264	252.0		
Protein (g/100g)	19.0	17.0		
Carbohydrate (g/100g)	1.7	3.5		
Sugars (g/100g)	0.7	0.0		
Fat (g/100g)	20.0	19.0		
Saturates (g/100g)	8.7	5.6		
Fibre (g/100g)	<0.5	1.3		
Sodium (g/100g)	0.63	0.75		

Main protein source in meat alternatives



Plant-based meat alternatives



GEN 1 PRODUCTS OFTEN HAVE TERRIBLE INGREDIENT LISTS

For 20 years consumers have been telling the food industry that they want products that are 'clean label', or have short ingredient lists. Most plant-based brands fail this test.

Beyond meat plant-based burger

24 ingredients



Ingredients: Water, pea protein*, expeller-pressed canola oil, refined coconut oil, rice protein, natural flavors, dried yeast, cocoa butter, methylcellulose, and less than 1% of potato starch, salt, potassium chloride, beet juice color, apple extract, pomegranate concentrate, sunflower lecithin, vinegar, lemon juice concentrate, vitamins and minerals (zinc sulfate, niacinamide [vitamin B3], pyridoxine hydrochloride [vitamin B6], cyanocobalamin [vitamin B12], calcium pantothenate). Impossible plant-based burger



Ingredients: Water, Soy Protein Concentrate, Coconut Oil, Sunflower Oil, Natural Flavors, 2% Or Less Of: Potato Protein, Methylcellulose, Yeast Extract, Cultured Dextrose, Food Starch Modified, Soy Leghemoglobin, Salt, Mixed Tocopherols (Antioxidant), Soy Protein Isolate Vitamins and Minerals: Zinc Gluconate, Thiamine Hydrochloride (Vitamin B1), Niacin, Pyridoxine Hydrochloride (Vitamin B6), Riboflavin (Vitamin B2), Vitamin B12. Contains: Soy

Beef burger



Ingredients: 100% beef.

Development of meat alternatives





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Nutritional value



• Generation of fibre-like food structure

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- Generation of volatile aroma compounds
- Reduction of valuable thermolabile components such as vitamins or amino acids
- Protein digestibility?





Human digestive tract





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Why do we aim for high protein digestibility?





Diet shift towards more plant-based foods – the protein question





Plant-based cheese alternatives



Global Vegan Cheese Market, by Product 2020-2027





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Plant-based cheese alternatives





Starch



Fat

Price: €15 /kg			Price: €12 /kg			
	Amount per 100g			Amount per 100g		00
MATURE	Energy	303 cal	VS	Energy	416 cal	CATURDEN
Black	Fat	24g	1000	Fat	34.9g	CITY
1) alien	Saturates	22g		Saturates	21.7g	MATURE
Vioceje	Carbohydrates	20g		Carbohydrates	0.1g	Annald, and a set of an art. An only beginning
	Sugars	0.2g		Sugars	0.1g	and any many
	Protein	1.3g		Protein	25.4g	
	Salt	2.2g		Salt	1.8g	
	Calcium	Og		Calcium	739mg	
	Vitamin B12	2.5mcg				

INGREDIENTS

Water, Coconut Oil (24%), Modified Starch, Starch, Sea Salt, Sunflower kernel, Mature Cheddar flavour, Acidity Regulator: Lactic Acid, Olive Extract, Colour: B-Carotene, Vitamin B12.

INGREDIENTS

Cultured pasteurized milk, salt, enzymes.

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Commercial plant-based products: Sustainable?



Affordability







Average price for milk: 0.90 Euro per litre Average price of plant based alternative: 2.00 Euro per litre Average price for beef burger: 1.00 Euro per patty

Average price of plant based alternative: 3.00 Euro per patty

Average price for cheese: 1.25 Euro per 100 g

Average price of plant based alternative: 2.25 Euro per 100 g

\rightarrow Plant-based options are more expensive

Conclusion and outlook



- A plant-based diet reduced GHGe
- A diet shift can come with challenges
 - Consider the three dimensions of Sustainability:
 environment, economy, society

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 Do we have to decide between plant-based and animal products?



Feeding cows a few ounces of seaweed daily could sharply reduce their contribution to climate change





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Thank you for listening

