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The future of food: scenario analyses



Tim Benton

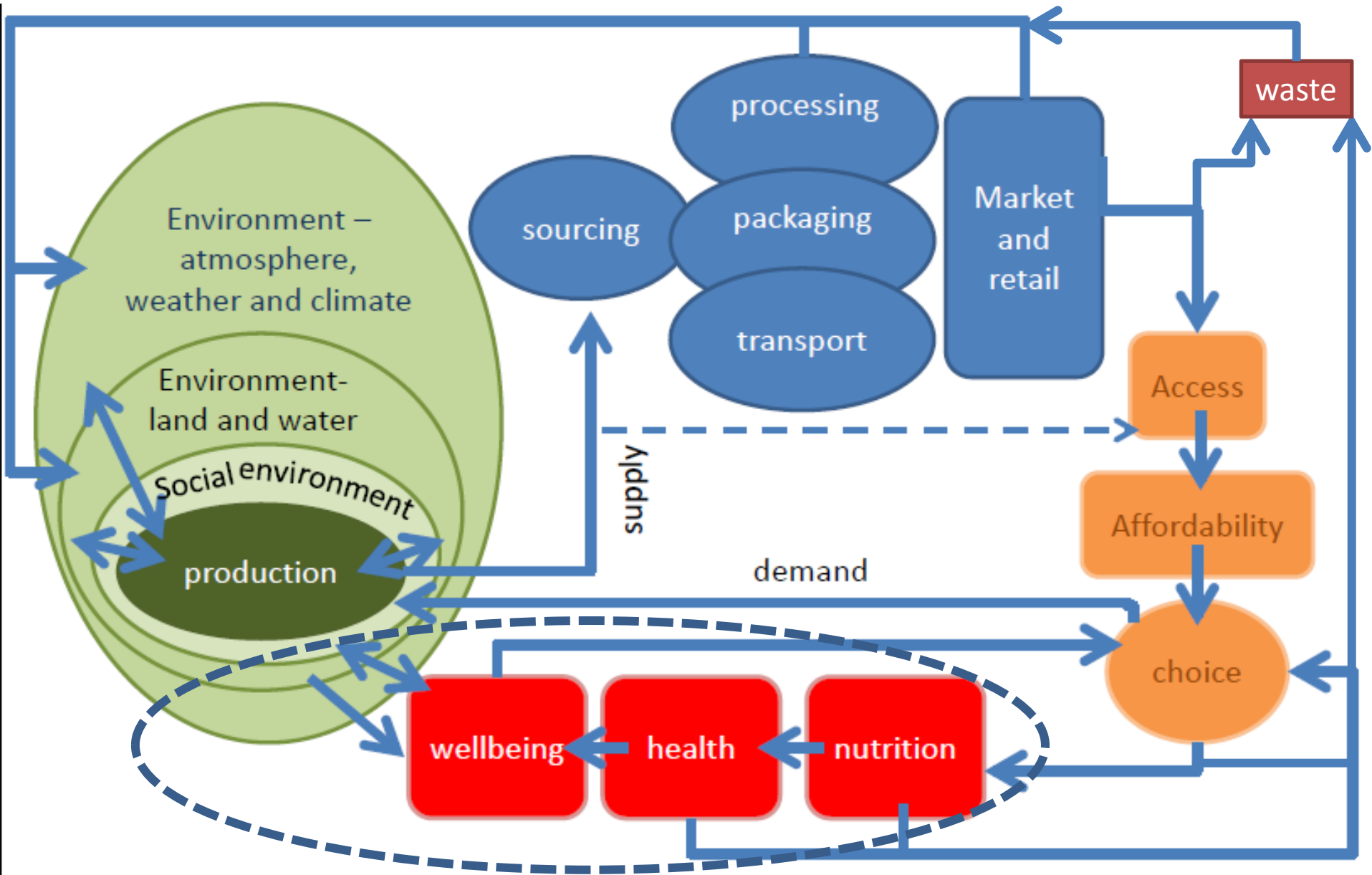
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The food system: feedbacks, loops and connections





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DRIVERS FOR CHANGE



International governance game changers: 2015



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 **SUSTAINABLE DEVELOPMENT GOALS**



PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Agriculture and food frames sustainable development: food is far more than feeding people

	<ul style="list-style-type: none"> • Secure access to land • Agricultural development
	<ul style="list-style-type: none"> • Food production • Calories and nutrients
	<ul style="list-style-type: none"> • Diets underpin health • Agricultural pollution, AMR, zoonosis
	<ul style="list-style-type: none"> • Women agricultural labourers • Women's access to land
	<ul style="list-style-type: none"> • 70% freshwater used for agriculture • Agricultural pollution of water
	<ul style="list-style-type: none"> • Land for bioenergy, solar, wind • Water (silt-free) for hydro
	<ul style="list-style-type: none"> • >1 billion jobs in agriculture • Agricultural development

	<ul style="list-style-type: none"> • Infrastructure drives land-use change • Bioeconomy and biomaterials
	<ul style="list-style-type: none"> • Land for urbanisation • Urbanisation and dietary demand • Air quality and agricultural pollution
	<ul style="list-style-type: none"> • Dietary choices – what is grown? • Over-consumption, food waste
	<ul style="list-style-type: none"> • Agriculture and land-use ~30% GHGs • Paris agreement: need to transform from source to sink
	<ul style="list-style-type: none"> • Pollution from agricultural run-off • Crop feed for aquaculture
	<ul style="list-style-type: none"> • Habitat destruction/degradation • Species loss, ecosystem services





International governance game changers: 2015

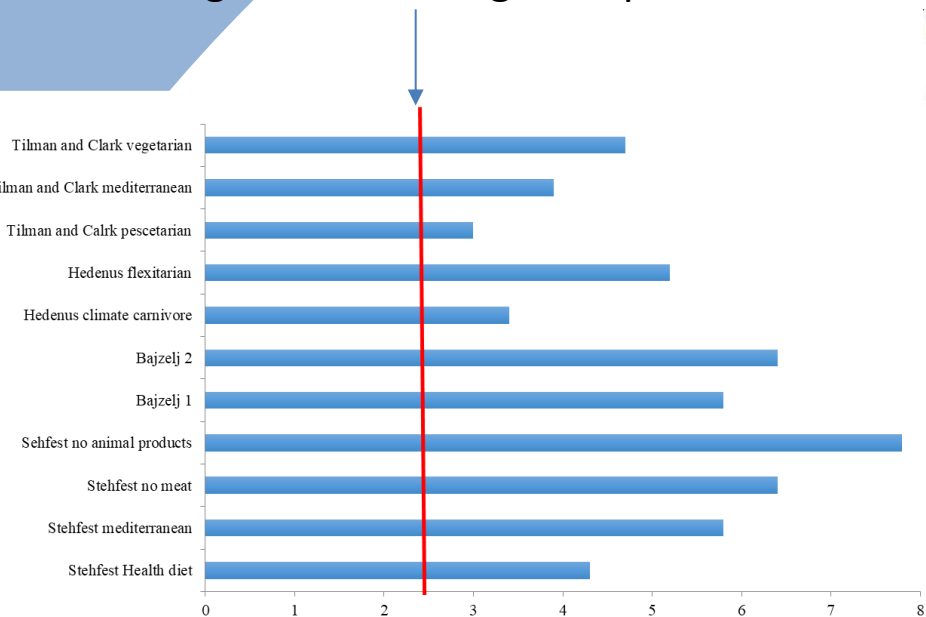


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Agricultural mitigation potential

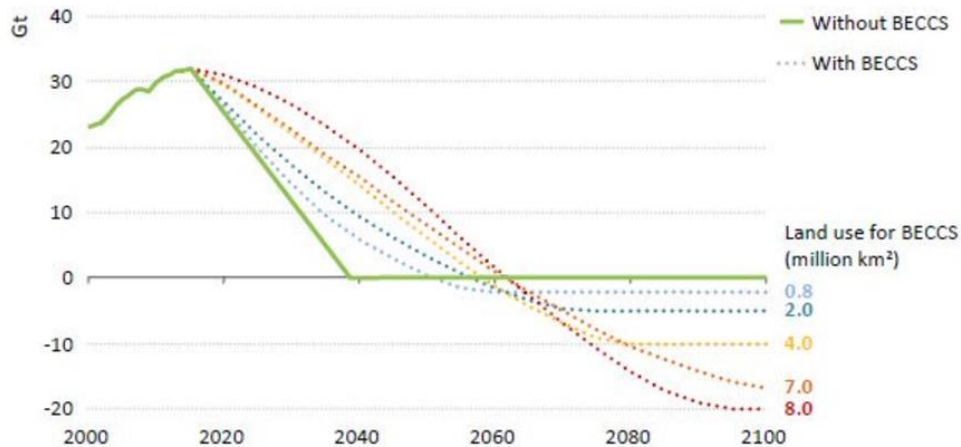


Gt carbon mitigation potential (Herrero et al 2016)



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Figure 8.16 ▶ Energy sector CO₂ emission pathways consistent with a 1.5 °C temperature rise



CO₂ emissions need to fall to zero between 2040 and 2060 to stay below 1.5 °C

IEA/OECD WEO 2016



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Scenario: a set of plausible assumptions about the way the world works in future

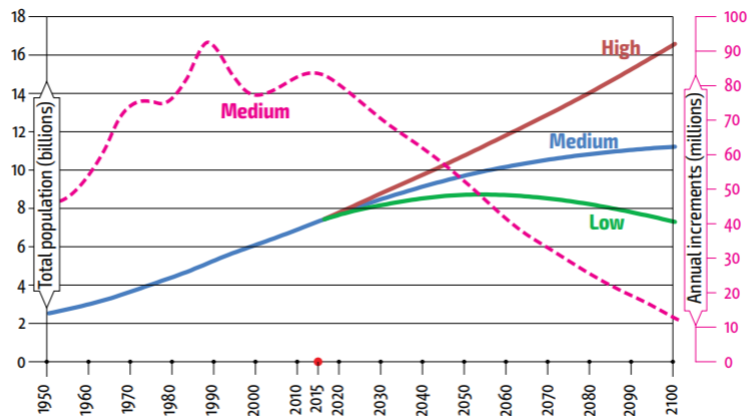
Projection: given a set of assumptions this is how a variable will develop

Prediction: this is how the world would look

SCENARIOS FOR THE FUTURE

Strategizing under uncertainty

Figure 1.1 Global population growth to 2100, by variant



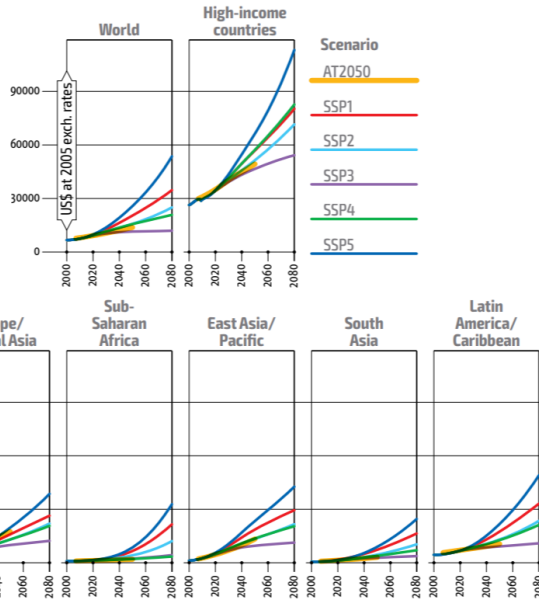
Note: Annual increments are 5-year averages.
Source: UN, 2015.

Assumptions are key

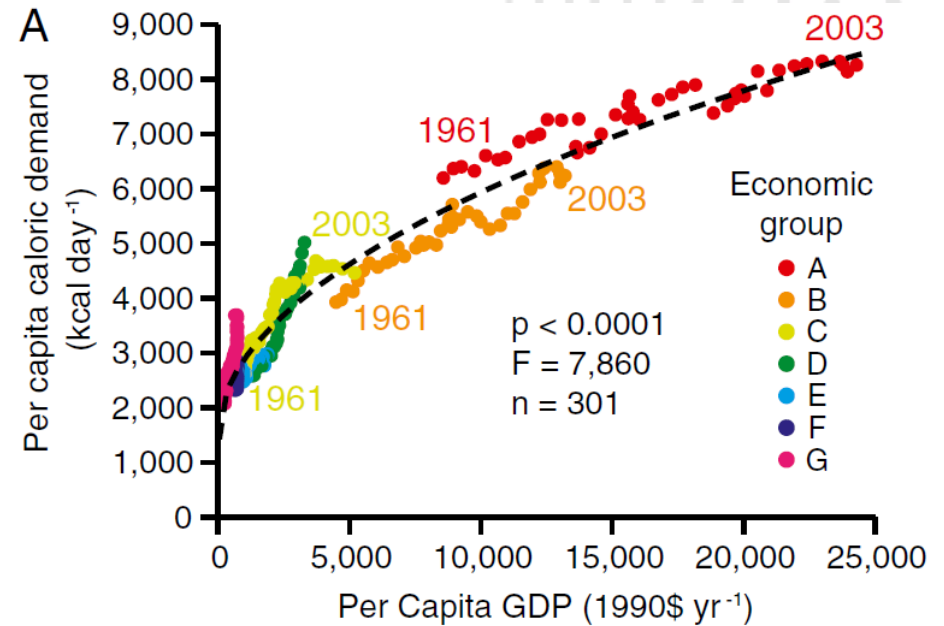
OBESITY IS NOW A GLOBAL EPIDEMIC!



Figure 2.2 Projections of per capita GDP growth, by region



Note: Regional groups do not include high-income countries.
Source: FAO Global Perspectives Studies, based on IIASA, 2016; Alexandratos and Bruinsma, 2012.



Tilman et al., 2011 (PNAS)

$$\text{Demand} = \text{people} \times (\text{per-capita demand} \times \text{income})$$



Assume or...Assu me



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Projections are not forecasts,
and not "FACTS"

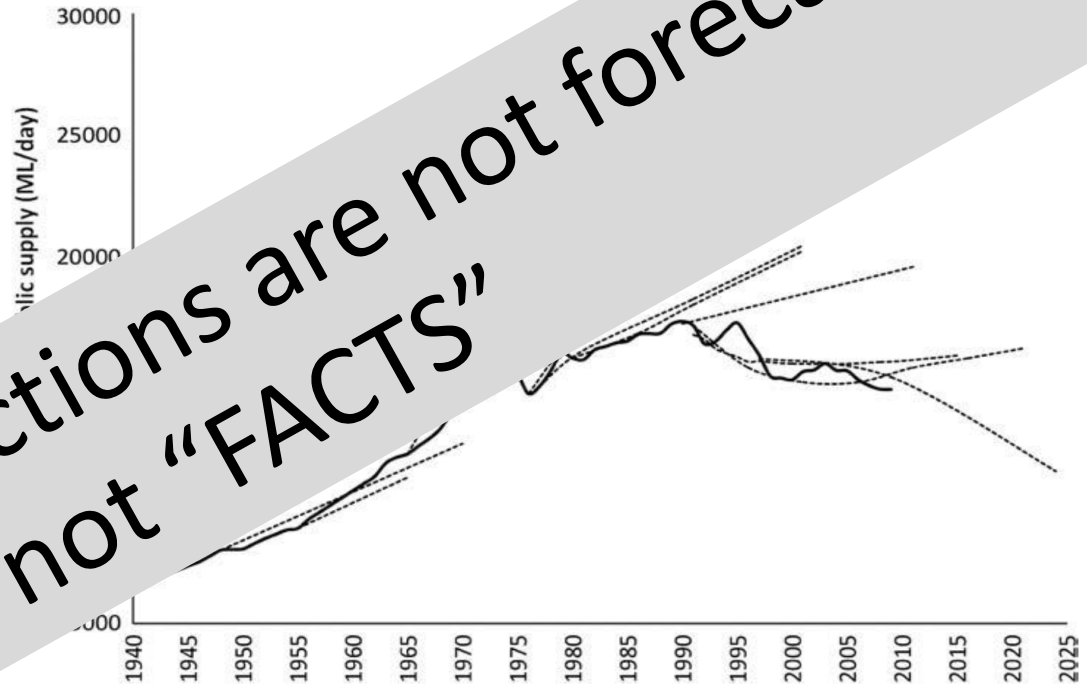


Fig 2.28. Water demand forecasts for England and Wales, 1949-2009 (dotted lines) and actual demand realised (solid line). Source: Gareth Walker. 2013





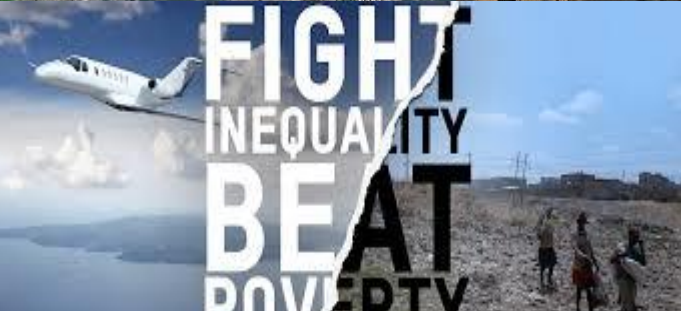
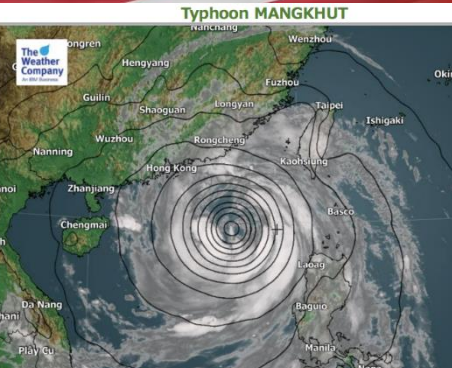
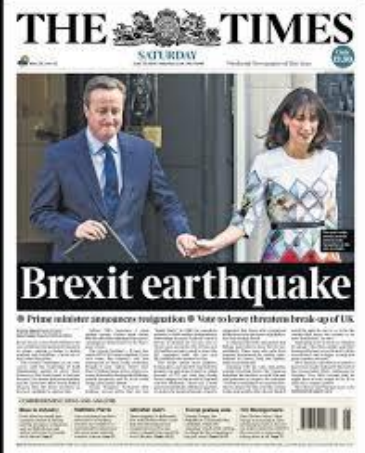
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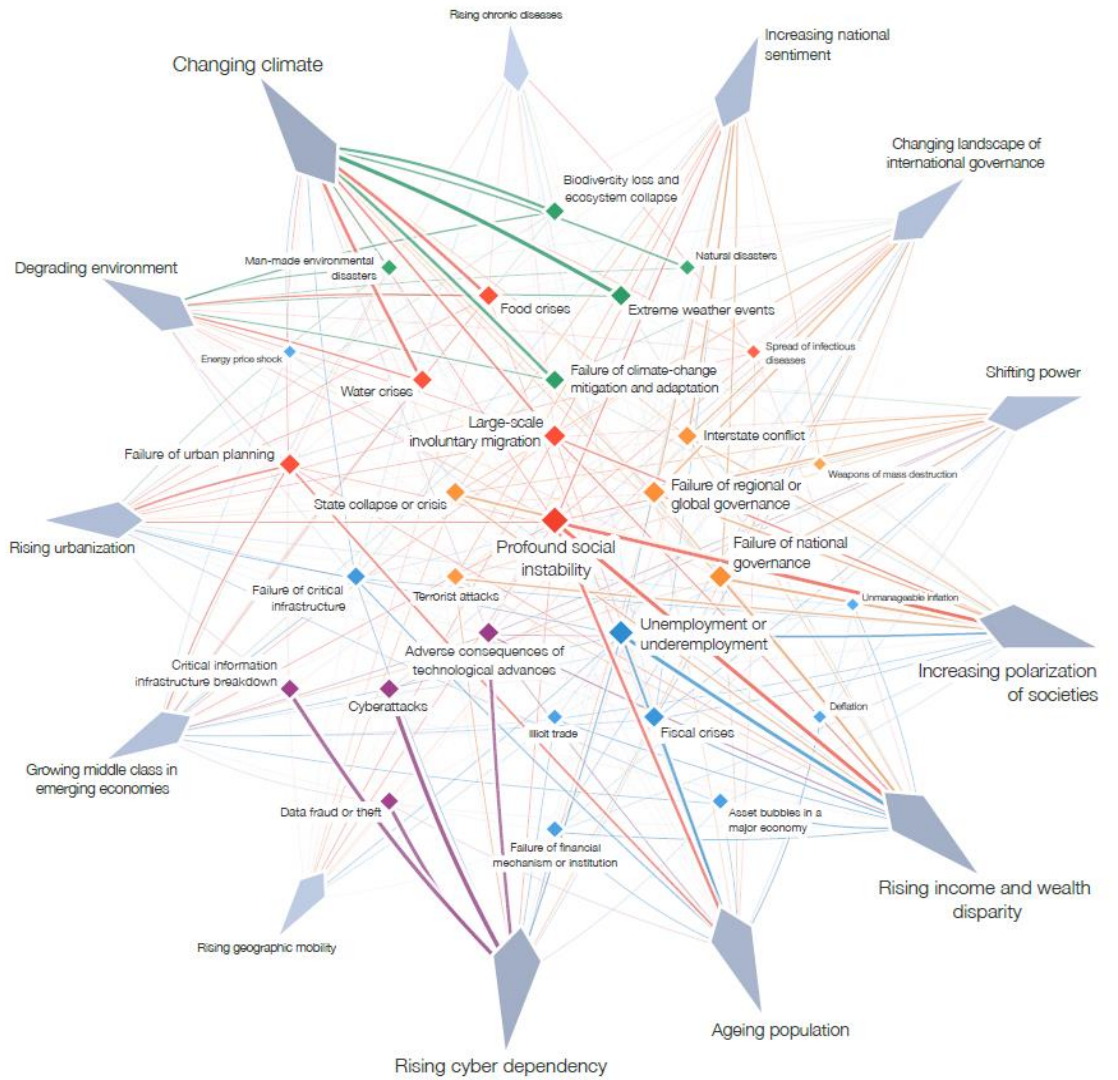
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THE FUTURE IS UNLIKELY TO BE AN EXTRAPOLATION OF THE PAST

Despite our inherent bias towards believing the world is linear



Interacting risks and the metaphoric zoo of instability



Turbulent
Uncertain
Novel
Ambiguous



There are so many potential black swans, one is almost certain to appear

nds from WEF GRR18



Many emerging drivers of systemic change...



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- Move away from international rules-based cooperation
- Inequality as driver of social change
- Climate change and environmental degradation, and increasing climate shocks
- Increasing fragility of globally interconnected systems
- Need to adopt preventative health care as curative becoming too expensive...

“Business as usual” may not be an option for many reasons



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<https://www.foresight4food.net/>

THE FUTURES OF FOOD



Future food



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Free trade, global markets

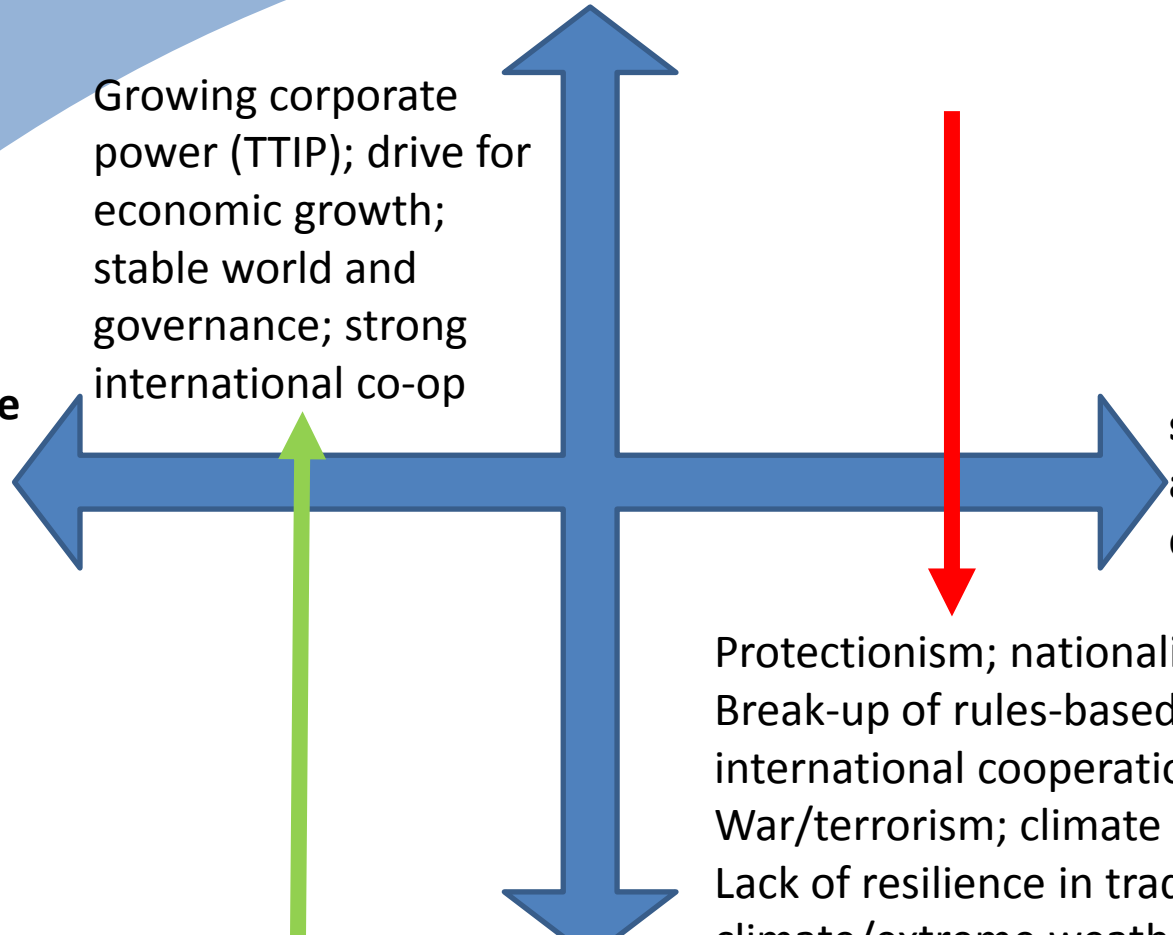
Growing corporate power (TTIP); drive for economic growth; stable world and governance; strong international co-op

Unsustainable and unhealthy diets

sustainable and healthy diets

Protectionism; nationalism
Break-up of rules-based international cooperation
War/terrorism; climate migrants
Lack of resilience in trade due to climate/extreme weather; demand from consumers for trustworthy provenance

Local or regional markets



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<https://www.weforum.org/whitepapers/shaping-the-future-of-global-food-systems-a-scenarios-analysis>



Alternative futures



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Free trade, global markets

Carbon tax; “polluter pays”; education; climate costs mount: Food becomes more expensive

Unsustainable and unhealthy diets

sustainable and healthy diets

Food tax; healthy eating incentive schemes; health insurance; public health education

Local or regional markets

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Moving towards sustainable and healthy: values matter



- Globalised food system incentivises externalisation of costs to health and environment
 - E.g. US air quality (Paulot et al 2014), obesity
 - Data becoming available to audit; global action-based agenda to transform (SDGs, FAO, WEF etc)
- Current food chains lack transparency, so consumer perceptions are not challenged
 - Trust in food currently depends on faith (“govt and industry put my interests first”) and blindness (“I can’t tell if they do or not”)!
- “cheap food” is not a public good if it is bad for health and environment
- Big data, social media, the emergence of “hyper-transparency”, innovations in food (alternative proteins) and new ways of selling may help shift through being “disruptive” innovation
- Events are likely to drive change in attitudes (potentially fast)

Blockchain



Foodchain

amazon-ification



Futures of food



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Free trade, global markets

Unchecked consumption

- *Growing ill-health*
- *More climate change*
- *More natural resources required*
- *MNC interests dominate politics*

Sustainable, high-tech world

- *Global innovations and tech platforms*
- *High efficiency*
- *App-driven personalised nutritious diets*
- *Consumers buy attributes*

Unsustainable and unhealthy diets

sustainable and healthy diets

Money talks most

- *Disconnected world with weak economic growth*
- *“post war economy”*
- *Unsustainable production to meet demands locally*
- *“spatial inequality”*

Local is lovely

- *Sustainable nutrition drives local industry*
- *“local food” SMES and artisanal food valued*
- *Holistic economies – low waste, high health and well being*
- *“spatial inequality”*

Local or regional markets



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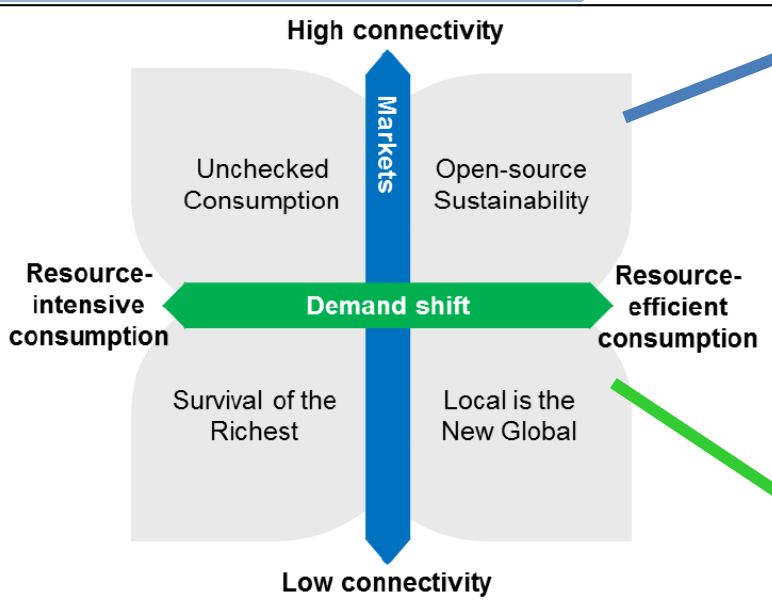
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Research and innovation agenda

Commodity crops, large scale
 Biotechnology and biofortification
 Ultra-processed foods
 Long supply chains
 Lots of robotics



More varied diets to provide nutrients
 More varied farming systems, smaller scale
 Less agricultural efficiency and more system efficiency
 Low waste
 Whole foods, cooked at home
 Short supply chains



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Conclusions

“Business unusual”

- Greater focus on system efficiency - healthy diets, sustainable (low waste) food systems
- Greater recognition of *values* associated with food, not just price, higher farm-gate prices
- Different diets driving better public health & diversified agriculture; more circular ag (e.g. mixed farms)
- More multi-functional landscapes (fewer monocultural landscapes), more rural employment
- Efficient food system makes space for BECCS and reduces climate drivers
- More resilient landscapes and food

- The world is changing fast
- Some change is reducing its resilience (or “lock in”)
- Systemic readjustments are possible
- Alternative futures are imaginable where our food systems deliver healthy food, sustainably
- But, such futures would imply a revolution in attitudes to food, price and social support
- Such a revolution could be endogenous or exogenous



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Thank you!

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- We have evolved food systems based on the notion that cheap food is a public good, and liberalised global markets to support international competition. Our current food system now leaves more people globally with an unhealthy weight rather than a healthy weight, with the economic costs associated with food-related ill-health, and creates a significant economic burden from environmental degradation, including being a major contributor to climate change. As such, the economic costs far exceed the economic benefits from the agricultural economy. Given the growing recognition, following the launch of the Sustainable Development Goals and the Paris Climate agreement, that the future of food systems cannot be 'business as usual', what might a food system that delivers healthy diets, sustainably, look like? Following reviews of some recent scenarios analyses, I will highlight some different potential futures, their costs and benefits and the barriers to transformation from the present day to potential better futures.