UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

Systems approaches: sustainable farming at the interface of land and food systems

Tim Benton

University of Leeds and Royal Institute of International Affairs, Chatham House

t.g.benton@leeds.ac.uk
tbenton@chathamhouse.org

@timgbenton

UNIVERSITY OF LEEDS

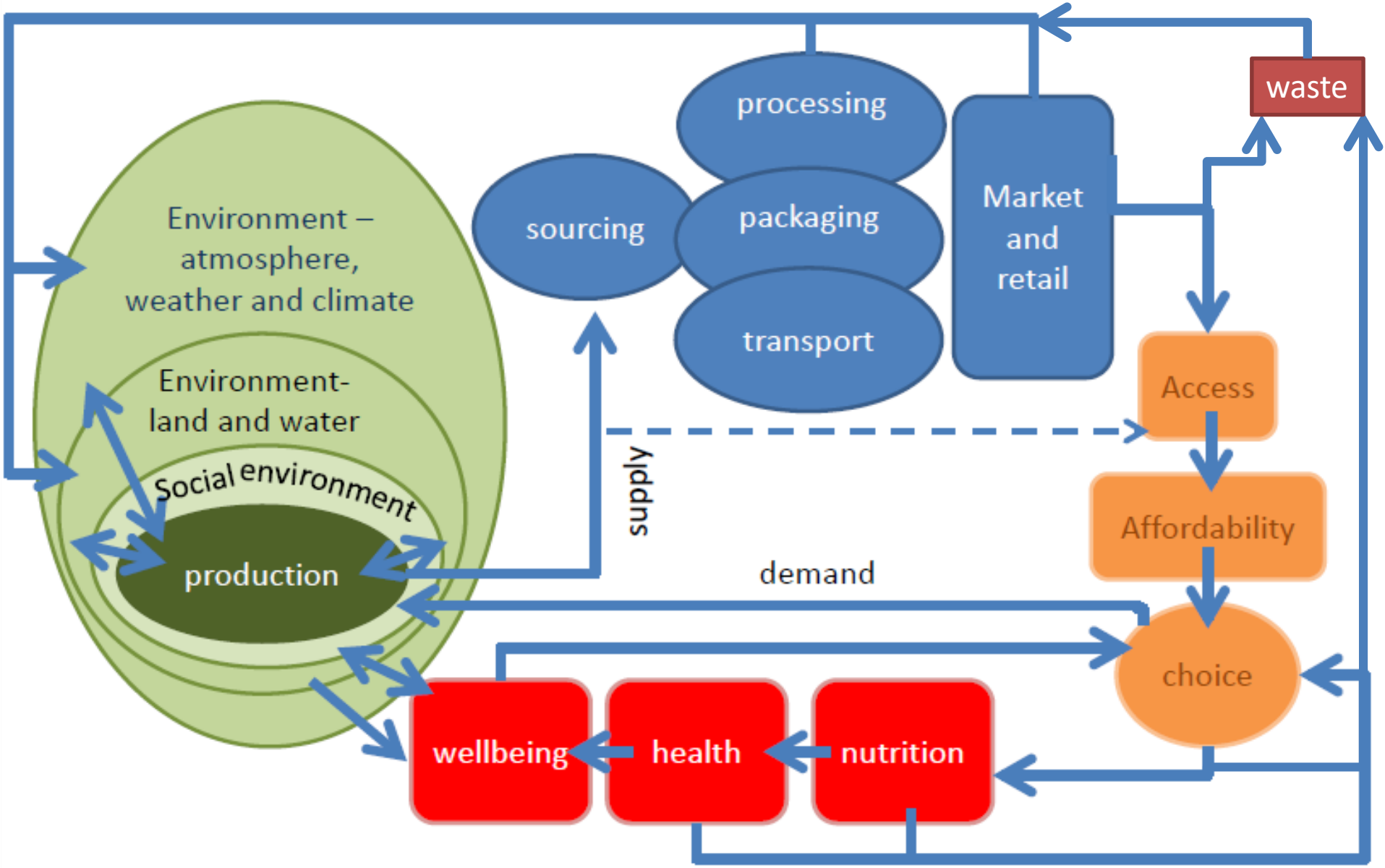
CHATHAM HOUSE
The Royal Institute of International Affairs

POINT 1: SYSTEMS VIEW CHANGES THE FRAME AND THUS THE GOAL FOR AGRICULTURE

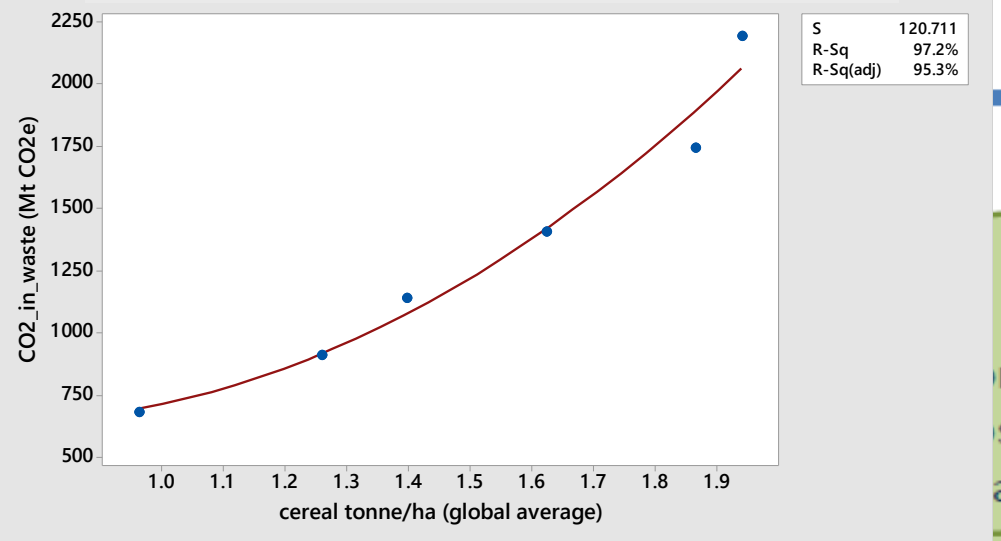
UNIVERSITY OF LEEDS

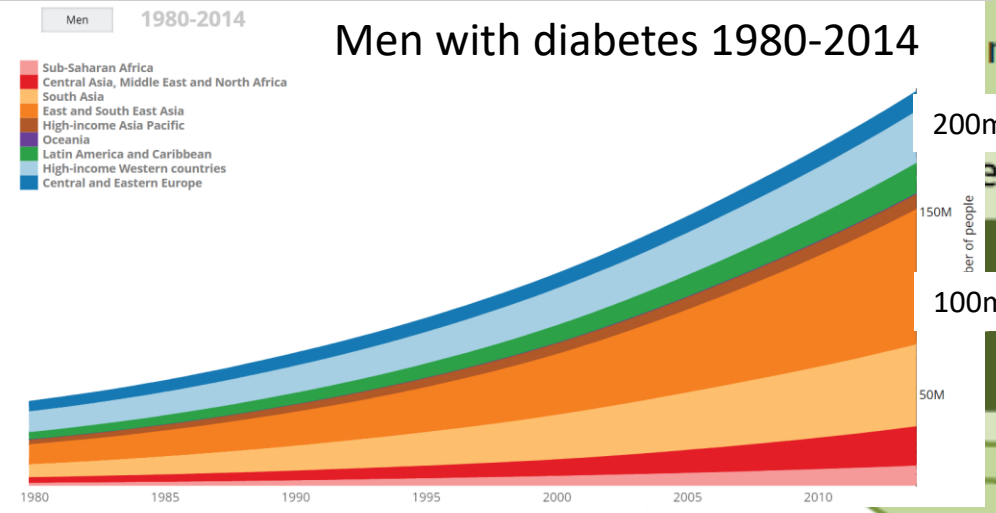
CHATHAM HOUSE
The Royal Institute of International Affairs

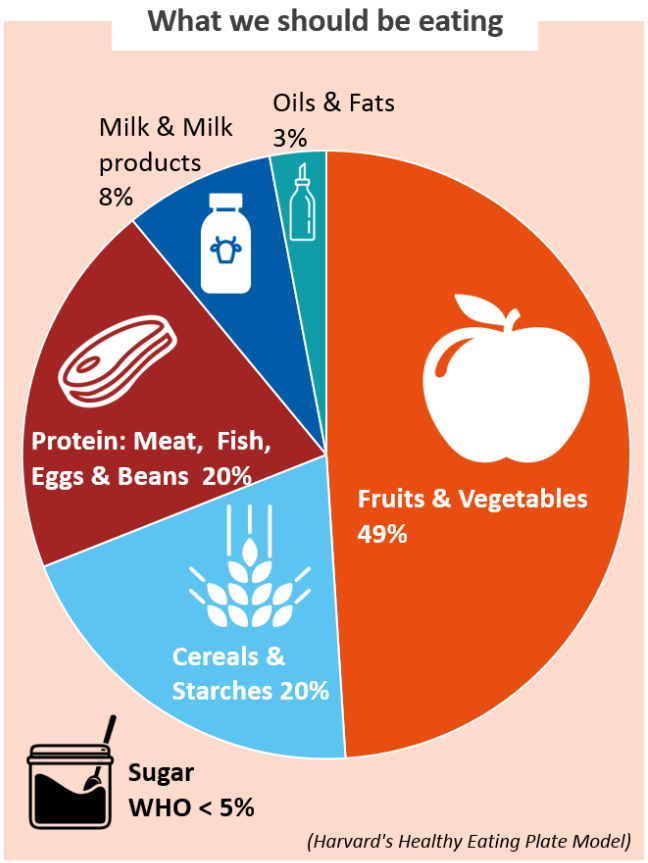
The food system

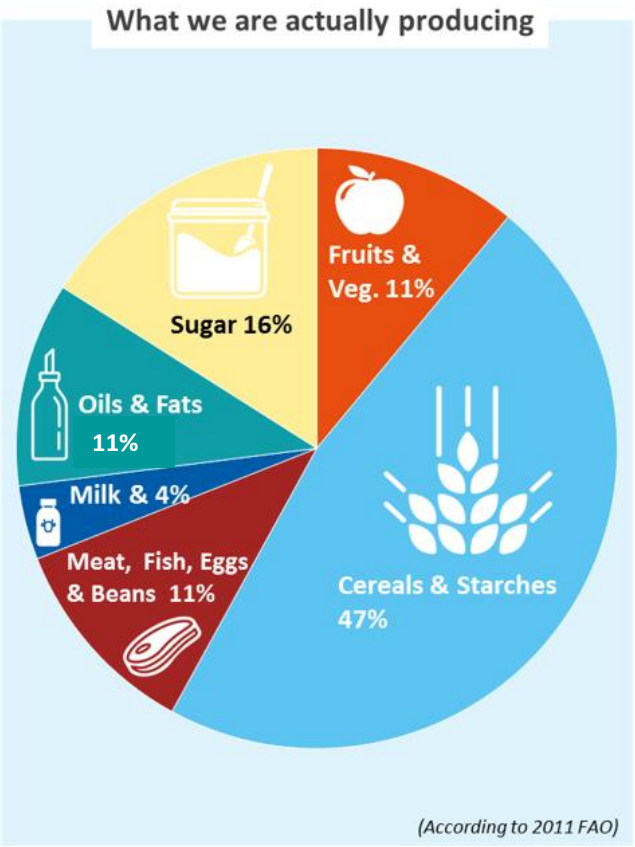


As yields increase, waste increases faster

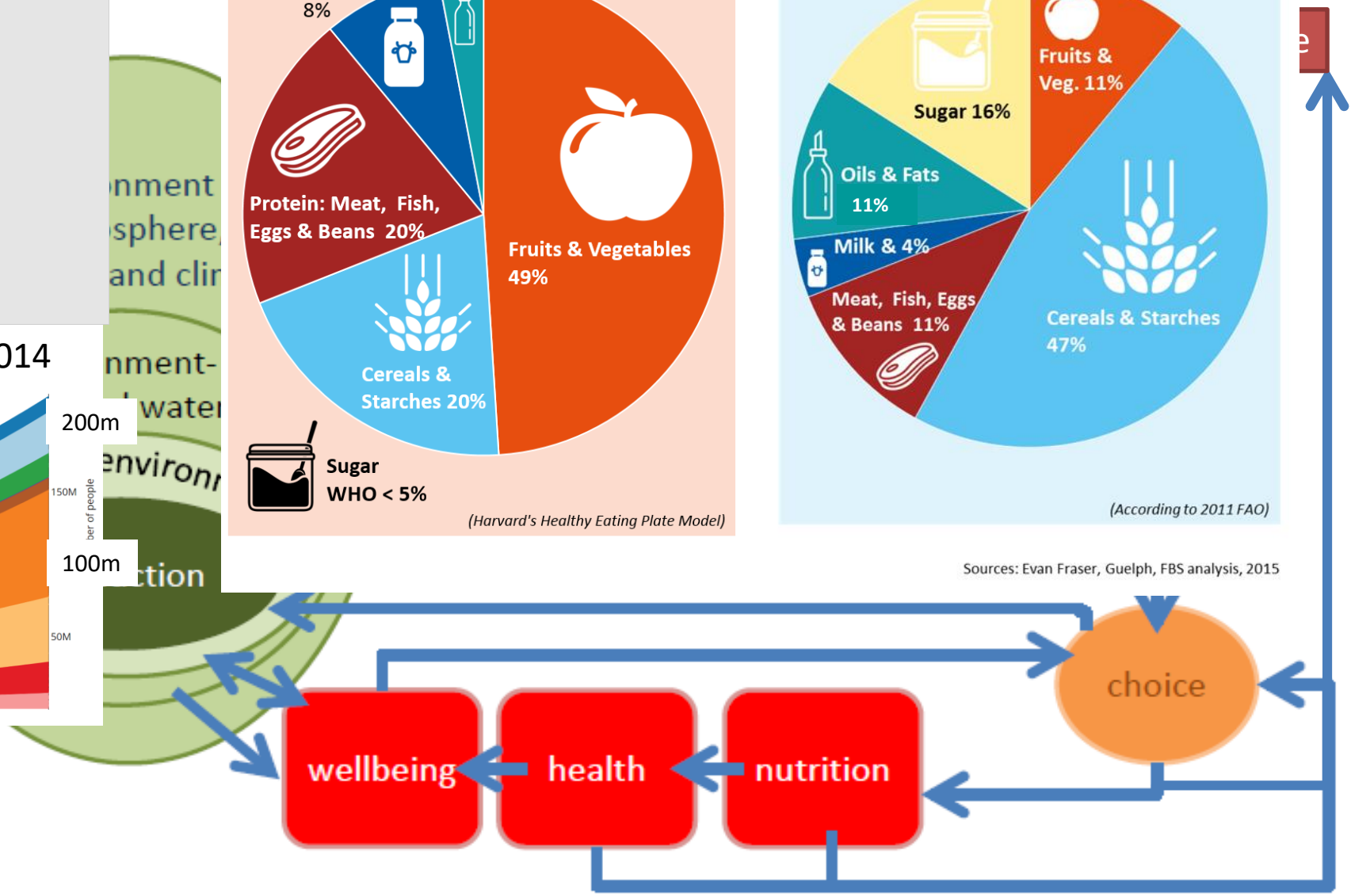








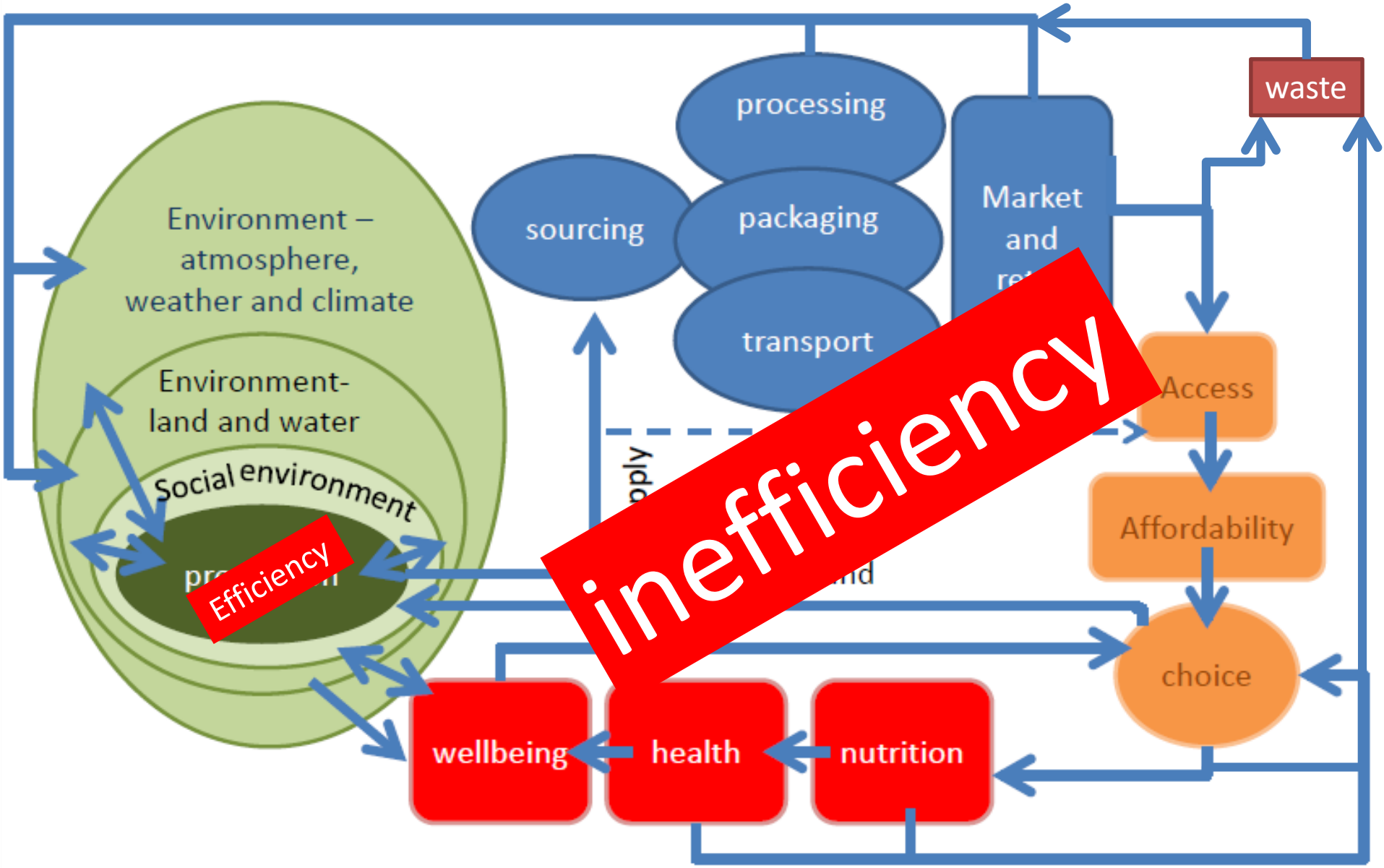
Sources: Evan Fraser, Guelph, FBS analysis, 2015



UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

The food system



By concentrating only on agricultural outputs and their efficiency we have created a food system that is highly inefficient

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

Conclusion 1

- A systems' view suggests we should focus on delivering efficiency from the food system:
  - *healthy people fed sustainably per unit input*
- And develop business models that support this (using relevant policy levers)

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

"Buy land, they're not making it anymore" (Mark Twain)

POINT 2: DEMAND FOR THE OUTPUTS FROM THE LAND SYSTEM IS GROWING

The land system: global demand for land

category	Today
Total habitable land	10.4 Bha
Crop	1.5 Bha
Grazing	3.3 Bha
Forest managed	300 Mha
Forest natural	3.7 Bha
Scrub+semi-natural land	1.2 Bha
Urban	~360 MHa

Scale: Spain is 506 Mha

- 120 Mha of **urban** expansion by 2030
- Consumes 46 Mha of highly productive cropland
- Sea-level rise: land lost + 13.1 m people in US displaced by 2100 (Hauer, 2017)

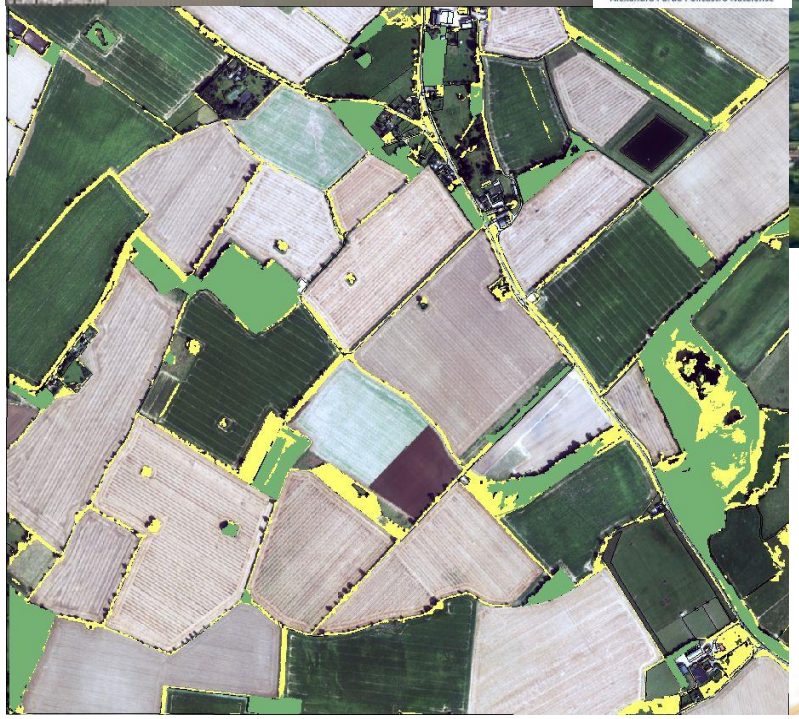
- 60-100% more **food** by 2050?
- Expansion typically on lower productivity lands
- 100 - 1,000 Mha more land by 2050 depending on assumptions

- 500 EJ per year of bioenergy by 2050?
- **Renewables** typically 10 to 3,000 times more land intensive

- 115 Mha of new land for **biomaterials/bioeconomy** by 2050

- 300-700 Mha of new land by 2100 for Bioenergy with **carbon capture & storage** (BECCS)
- Afforestation and reforestation would require 970 Mha

What does land do?



"Sustainability" is about maintaining ecosystem services at a global and local scale appropriate to place, societal needs and ethical values.

It is absolute and efficiency is not a proxy for it

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

Conclusion 2

- Demand for the products from land (ecosystem services broadly) exceed our ability to supply sustainably

  Need to address demand side to free up land

- And develop business models that more decouple profit from productivity (using relevant policy levers)

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

POINT 3: SYSTEMS ANALYSES DEFINE THE TRANSFORMATIVE AGENDA

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

Virtuous circle

"Business as usual"

- Continued focus on productivity ("sustainable intensification") as prime driver of agriculture
- More, cheaper, food; more waste and ill health
- Drives more climate change; greater impacts on yields
- Creates greater need for land for climate mitigation
- Intensifies competition for land, water, energy, inputs
- Less biodiversity, more uniformity, erosion of soils and natural capital
- Less resilience to perturbations (locally or through global markets)

"Business unusual"

- Greater focus on addressing the demand side: move towards 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 more diversified agriculture; allowing more circular ag (e.g. mixed farms)
- More multi-functional landscapes (fewer monocultural landscapes)
- Efficient food system makes space for BECCS
- More rural employment
- More resilient landscapes and food systems

Vicious circle

Why systems approaches?

The world is a complex, interconnected, finite, ecological-social-psychological-economic system . We treat it as if it were not, as if it were divisible, separable, simple, and infinite. Our persistent, intractable global problems arise directly from this mismatch.

Dana Meadows, 1982
http://donellameadows.org/wp-content/userfiles/Whole-Earth-Models-and-Systems.pdf

The more complex the world becomes, the more difficult it is to complete something without the cooperation with others

AG Fleming

- Necessary for action-oriented research ("grand challenges", "impact-led")
- They identify the conceptual framework (including assumptions, feedbacks, trade-offs, uncertainties, and potential for unintended consequences)
  - They can recognise hierarchies of systems as boundary conditions (e.g a farming system within the food system)
- They are necessary to identify the "leverage points for intervention"
  - Where might change have the biggest impact?
  - Which points are most locked-in? "Theory of change"
  - What is the R&I and social/political research agenda?
    - Does it require research programmes?
    - Do not require all research to be "systems"
- They provide the grounds for social discourse about "public interest"
  - How will intervention X lead to positive outcomes, and for whom?

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

Thank you!

t.g.benton@leeds.ac.uk

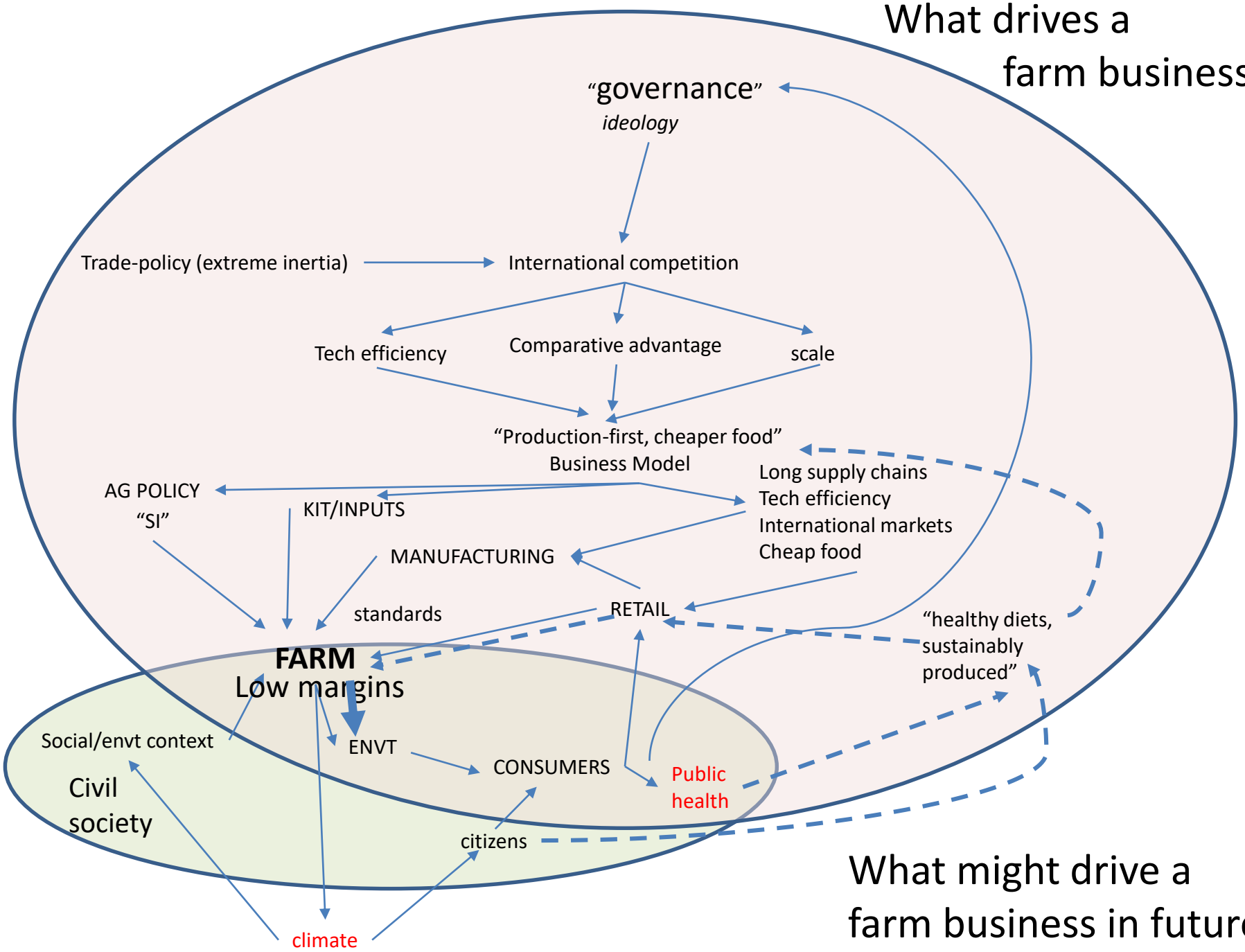
@timgbenton

UNIVERSITY OF LEEDS

CHATHAM HOUSE
The Royal Institute of International Affairs

How can externalised costs be internalised to change the business models via providing farmers a real price for sustainably produced healthy food?

What drives a farm business?



What might drive a farm business in future?