

Megatrends impacting Australian agriculture over the coming twenty years

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CSIRO AGRICULTURE AND FOOD

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Research & Development Corporation





Drakensberg Bushman Rock Art

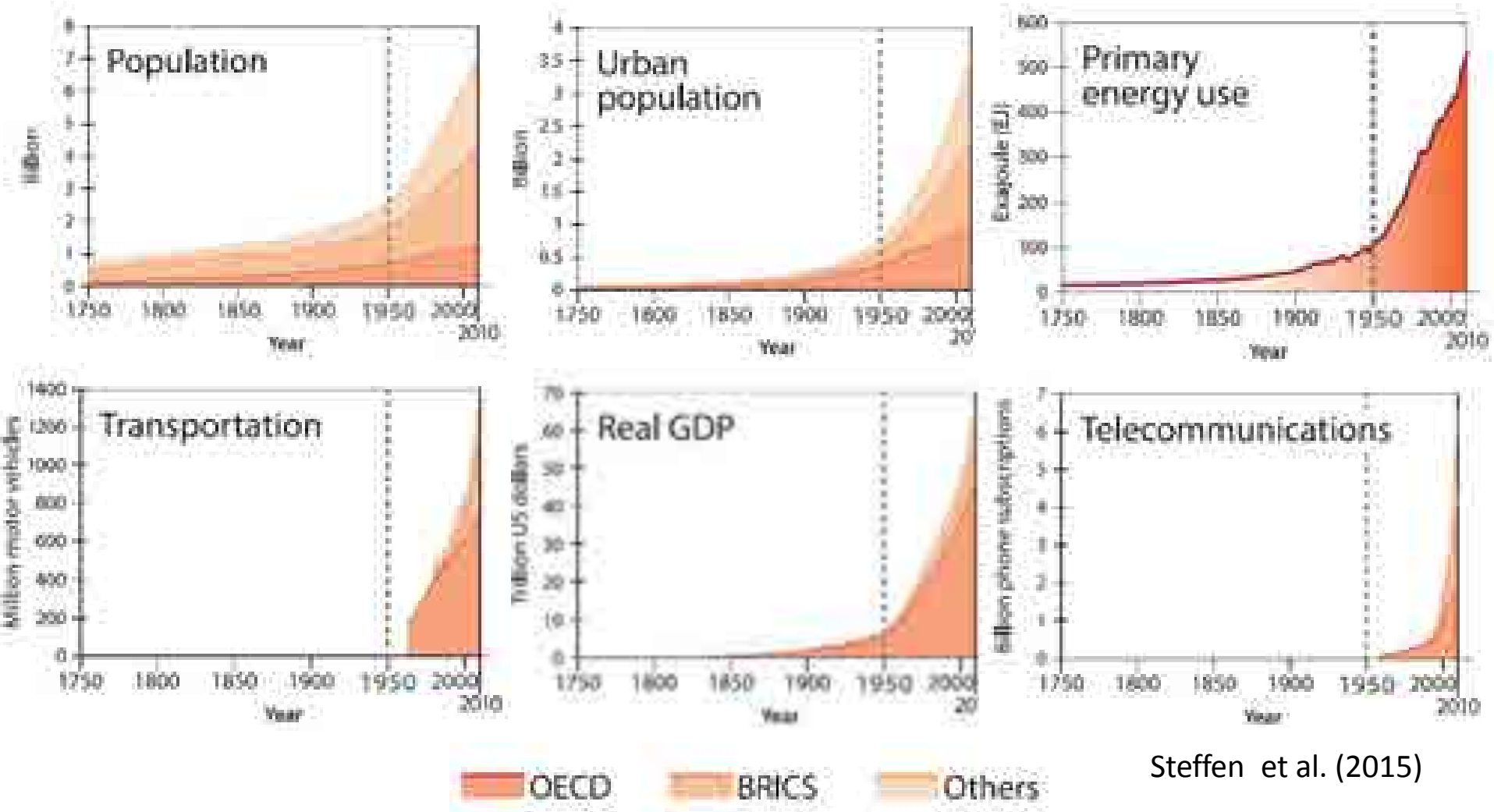


The Corn Harvest, Bruegel the Elder



New Holland CR10.90

The great acceleration...

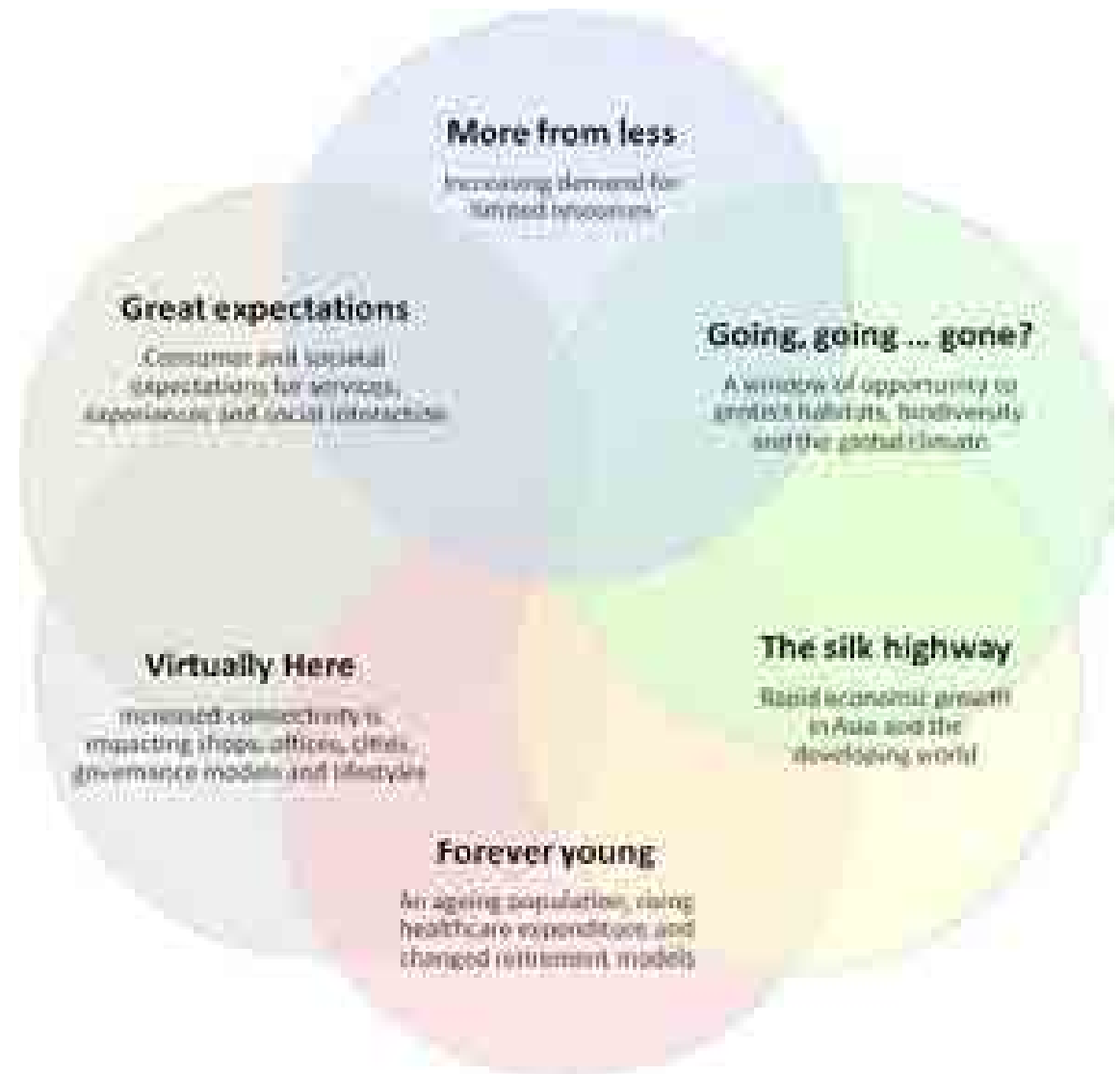


Steffen et al. (2015)

Megatrends



Manufacturing
Mining
Sports
The future of work



Megatrends for Australian agriculture

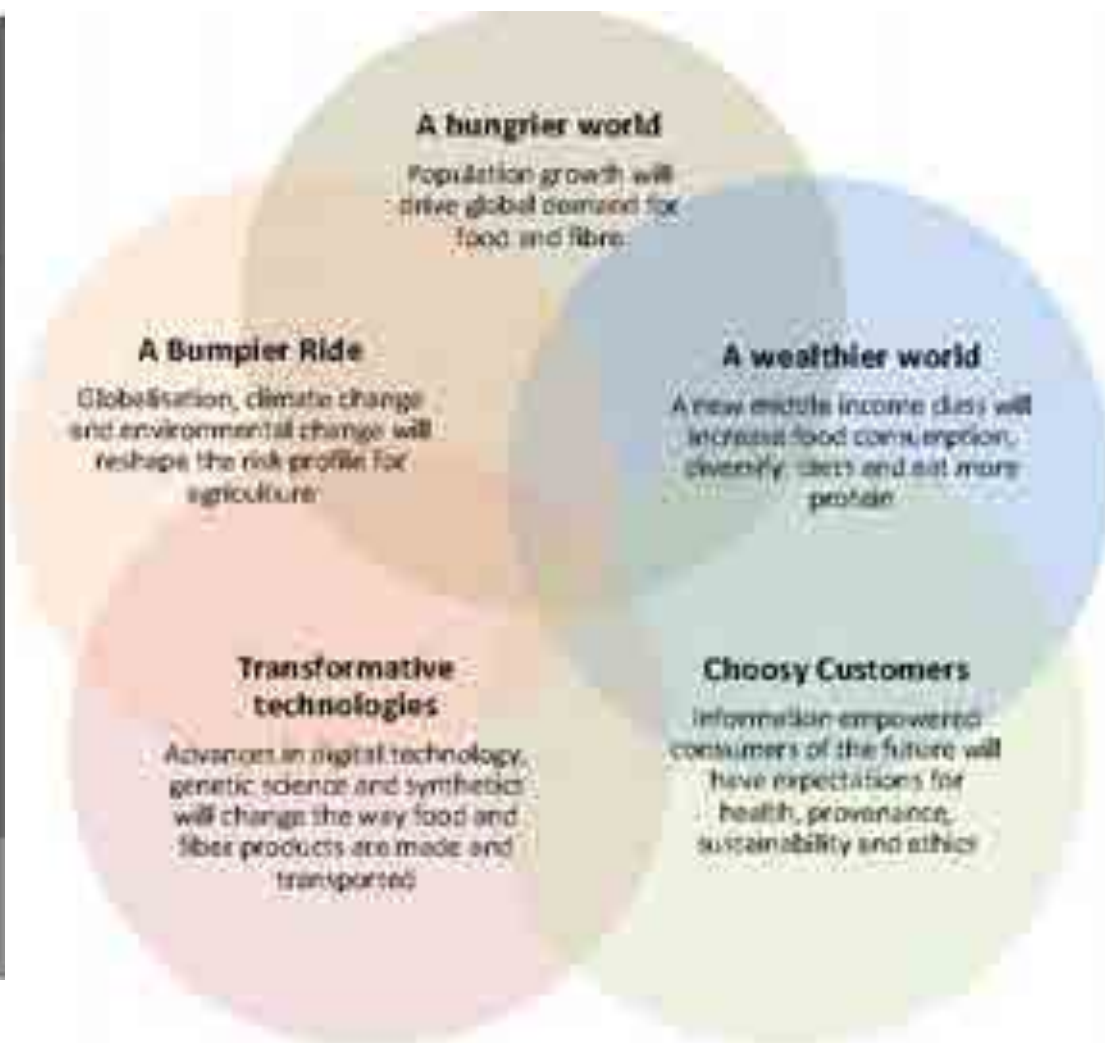
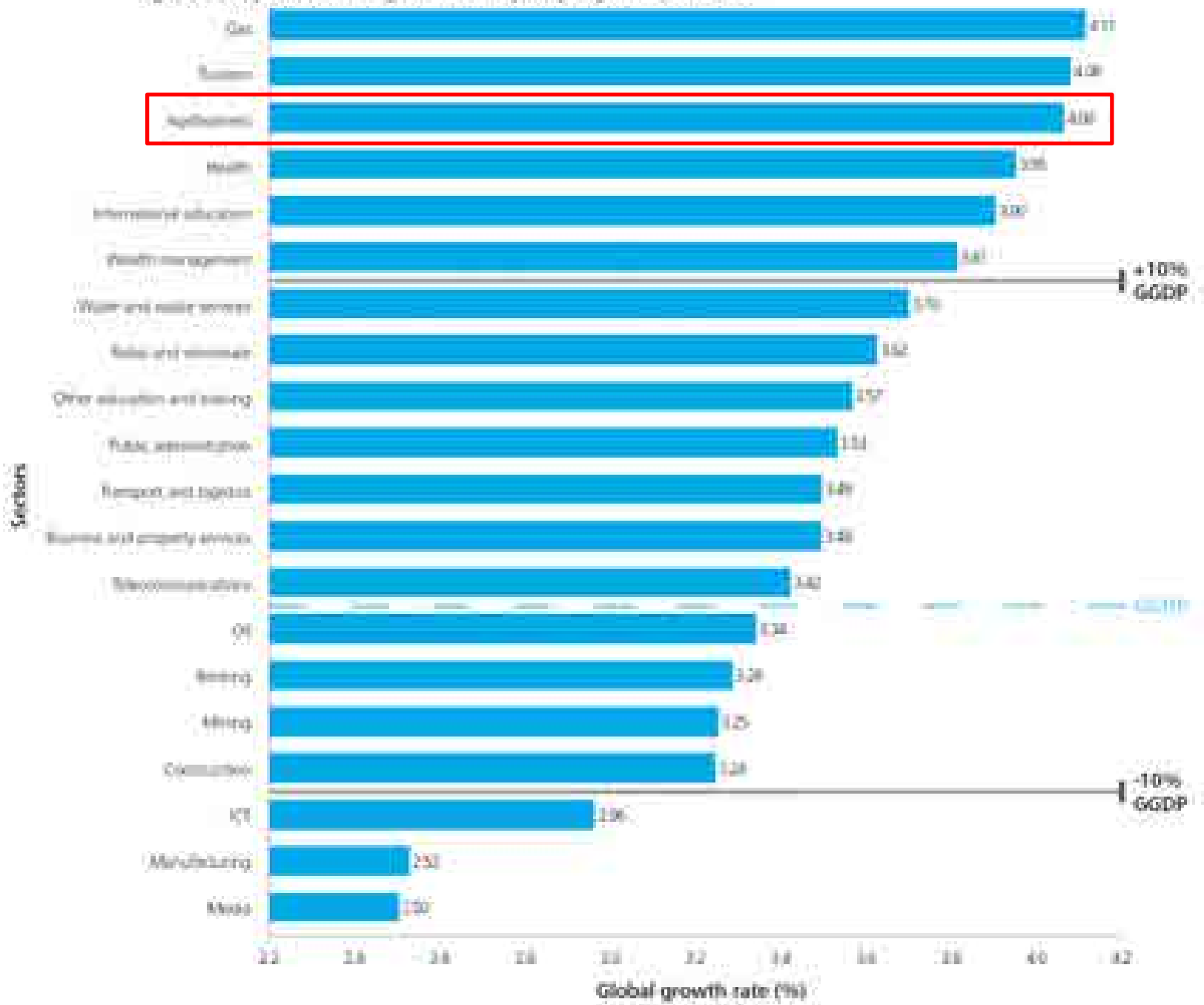
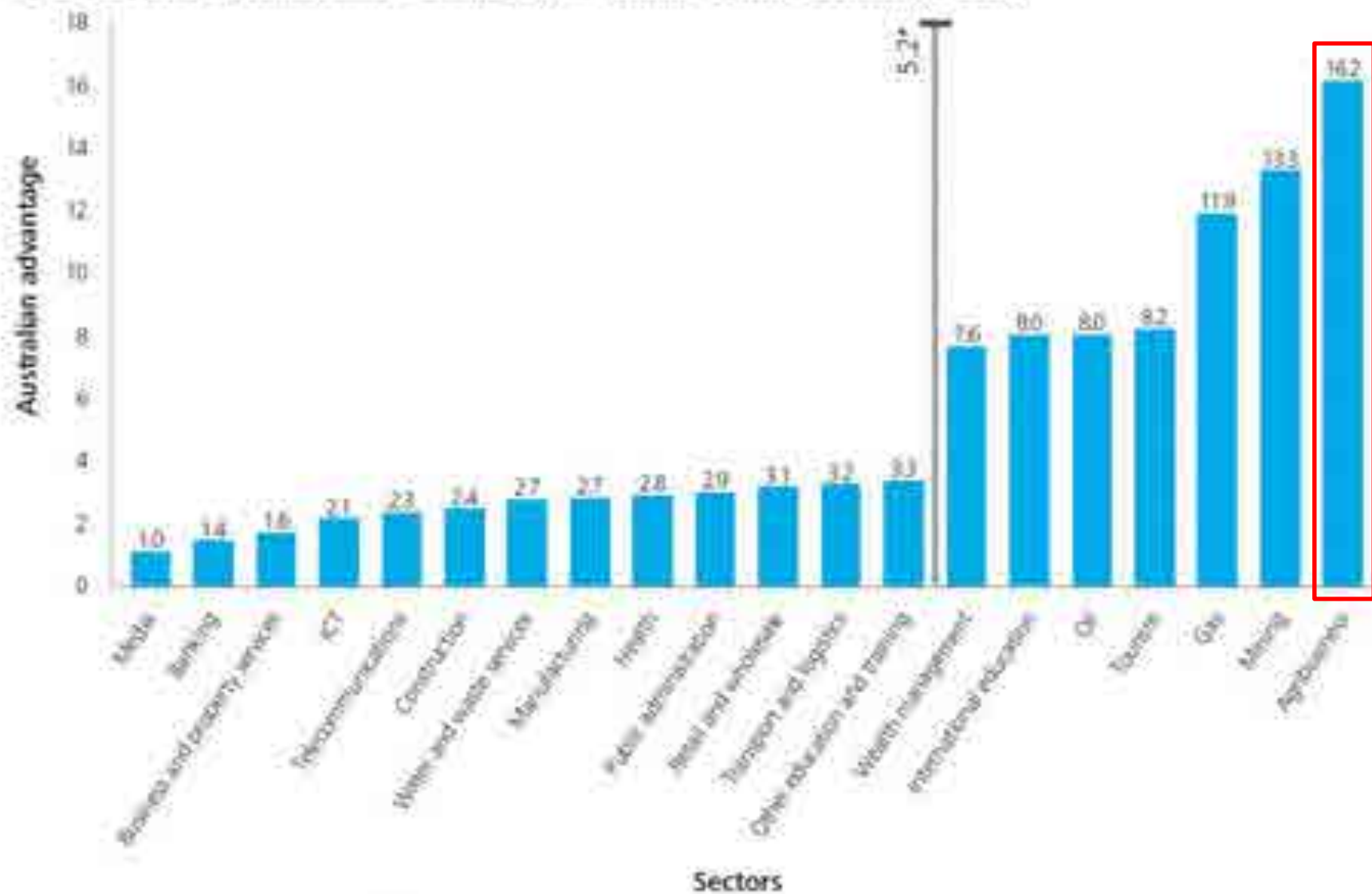


Figure 6: Projected annual global industry output growth, 2013-33



Source: Deloitte Access Economics

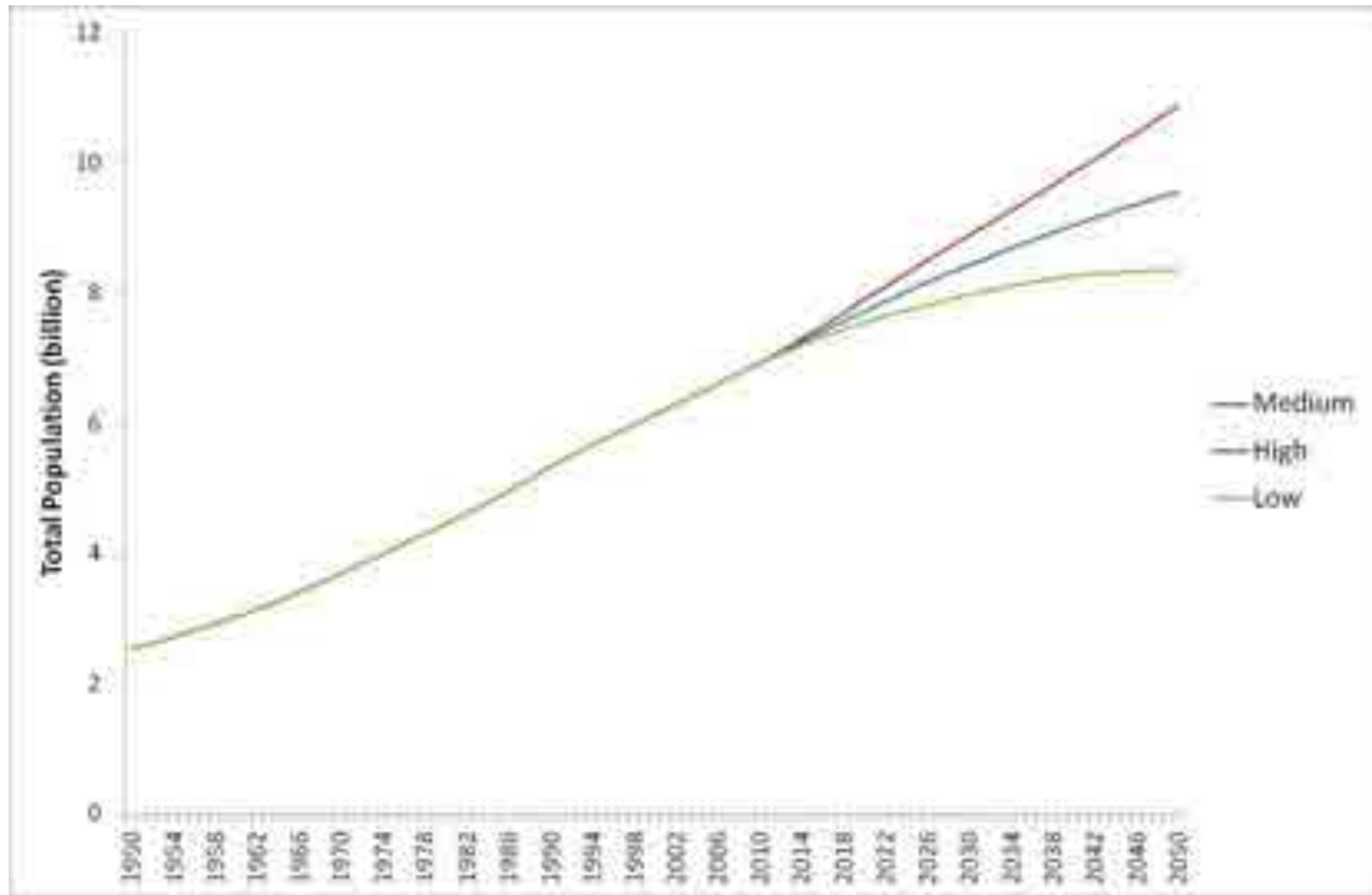
Figure 8: Areas of comparative advantage for Australia (relative advantage score)

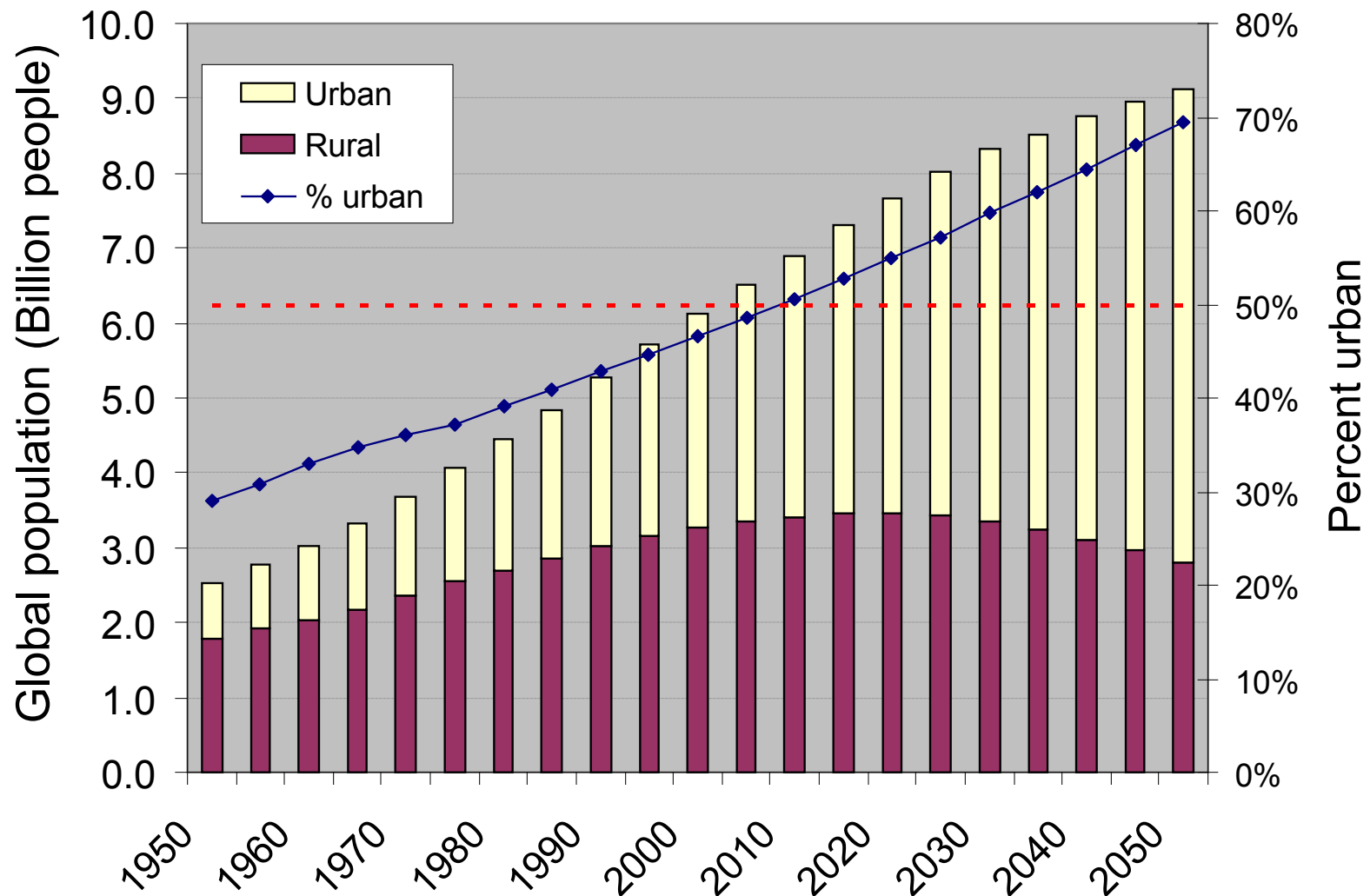


Source: Deloitte Access Economics.

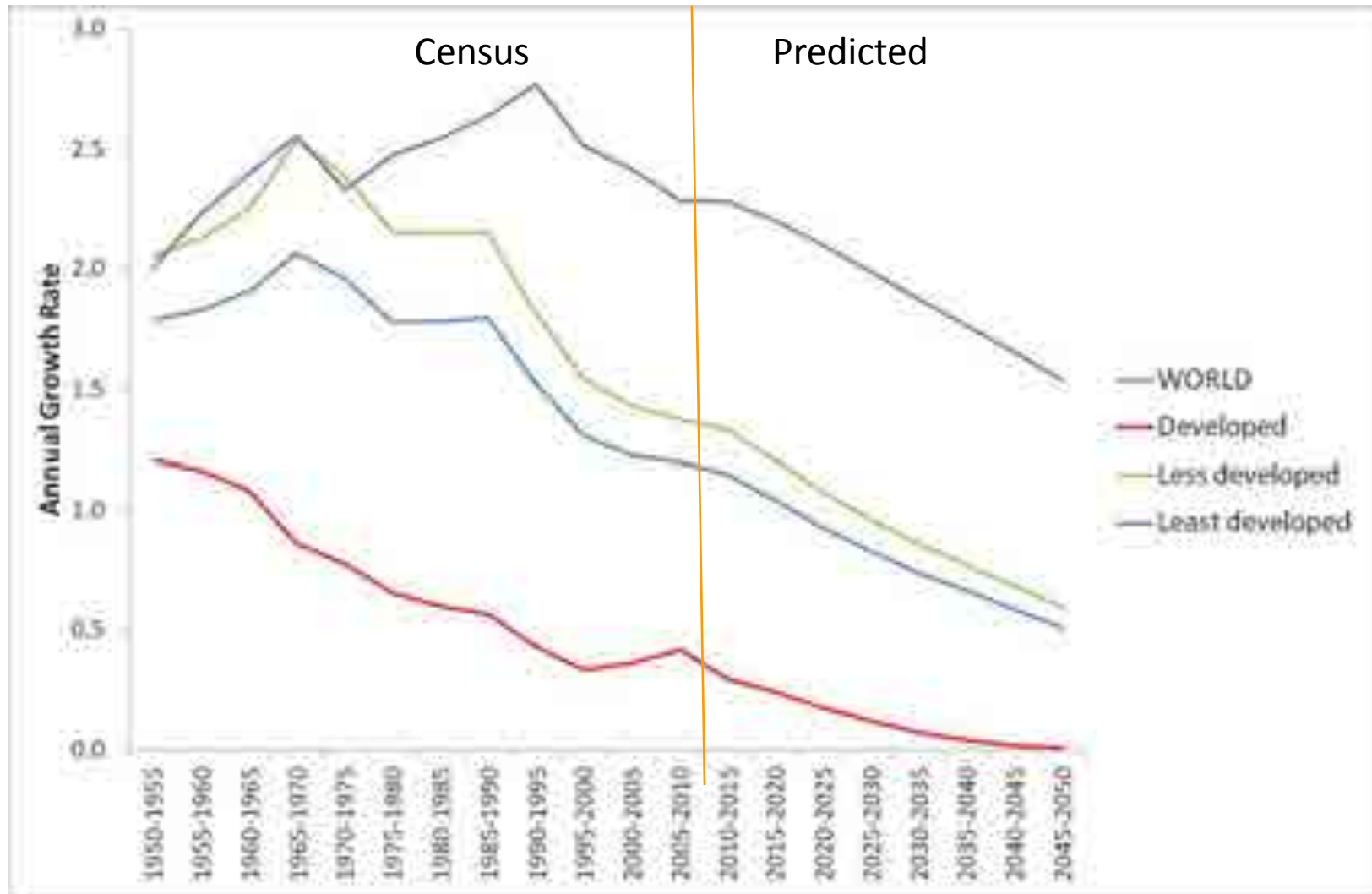
A Hungrier World

Total Global Population 1950-2050





Annual Population Growth Rates - Medium



Source: United Nations, Department of Economic and Social Affairs, Population Division (2013). World Population Prospects: The 2012 Revision, DVD Edition.

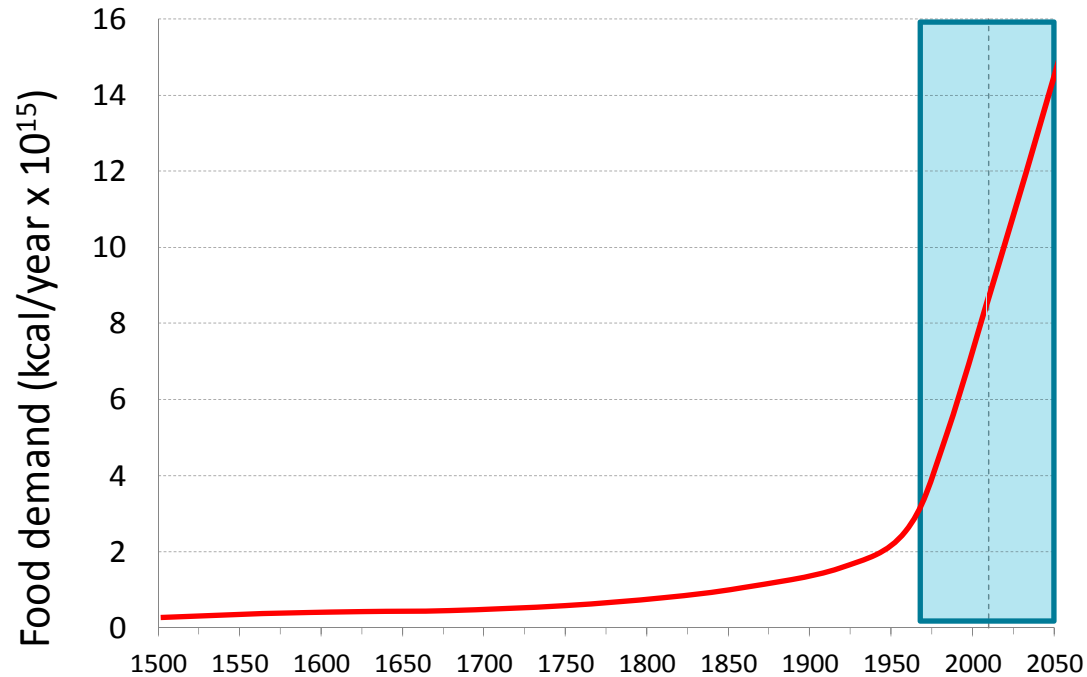
“Green Revolution” 1961-2000

- Yields more than doubled (x 2.3)
- Food production rose 146%
- Population rose 98%

- Arable land in use rose only 8%
- Inputs rose much faster
 - x 7 N fertiliser
 - x 3 P fertiliser
 - x 2 irrigation water
- Local and global consequences



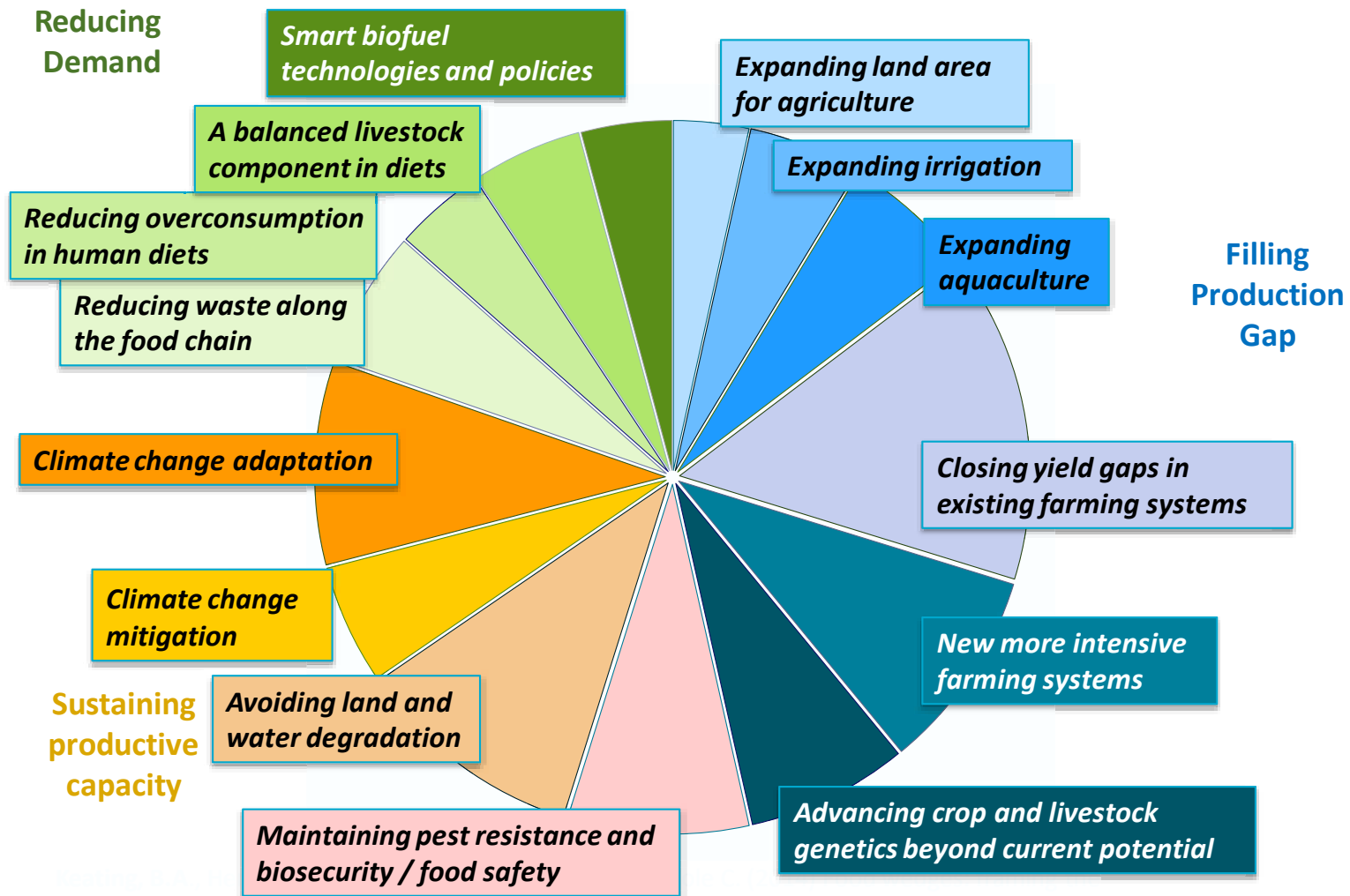
The current challenge



Scale:

- 1970 – 2010 : 129% increase or $5 \text{ Kcal/year} \times 10^{15}$
- 2010 – 2050 : 71% increase or $6 \text{ Kcal/year} \times 10^{15}$

Wedges of global food security “rainbow” pie....



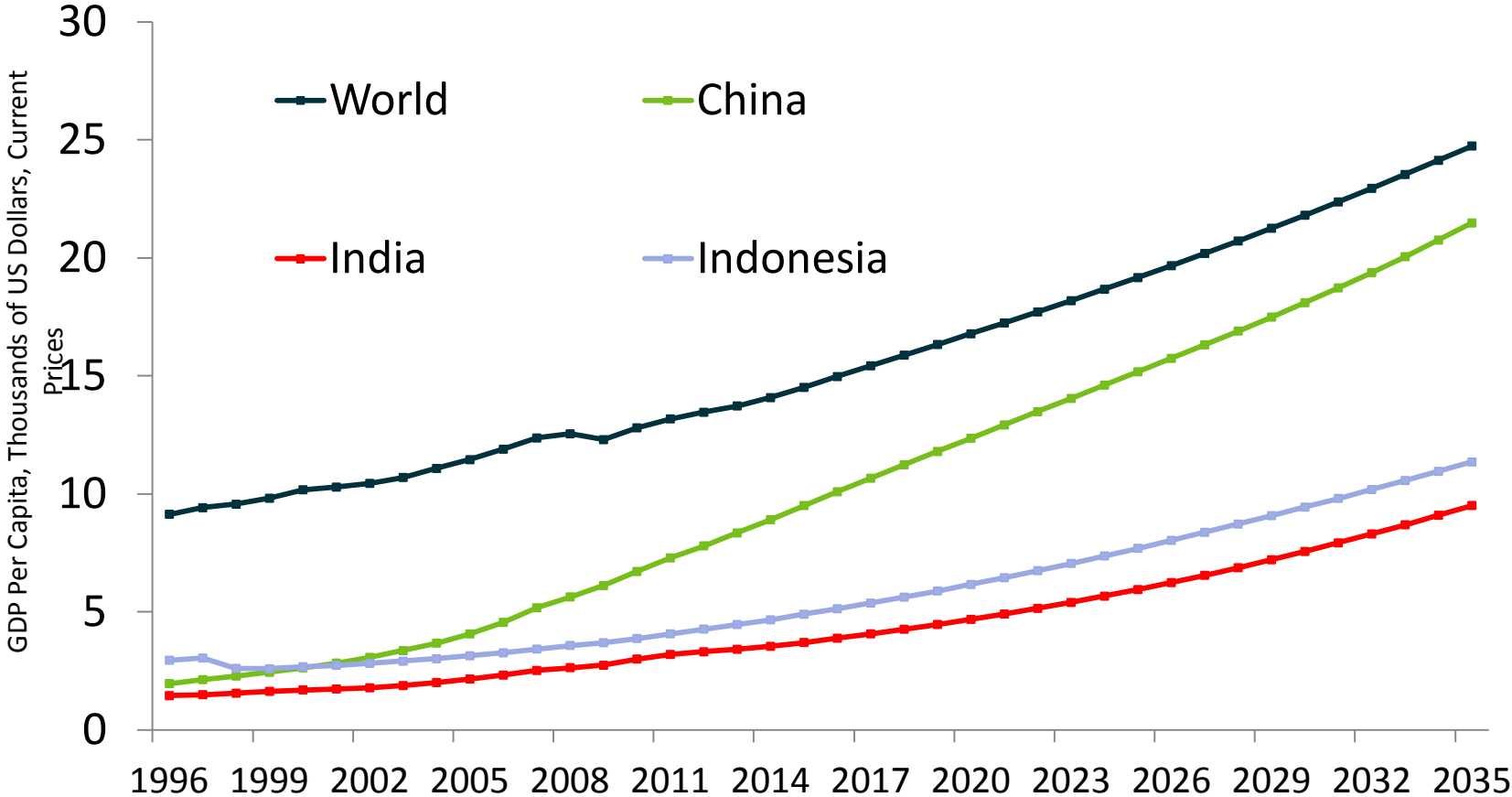
Structural enablers to get food to where it is needed

- Ability to trade - stability
- Access to capital
- Global investment in agricultural R&D

A Wealthier World

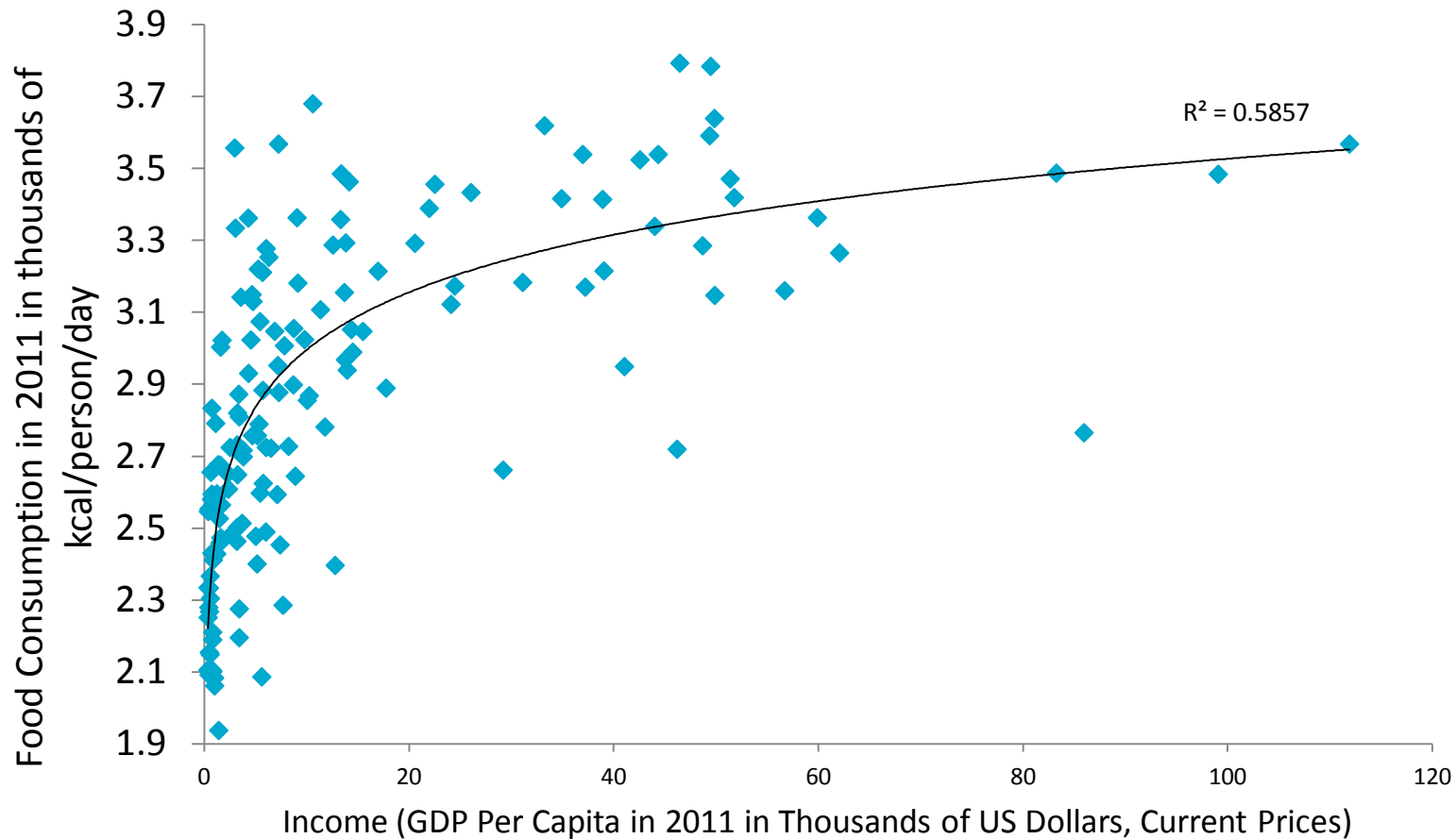
A Wealthier World

Income Growth



A Wealthier World

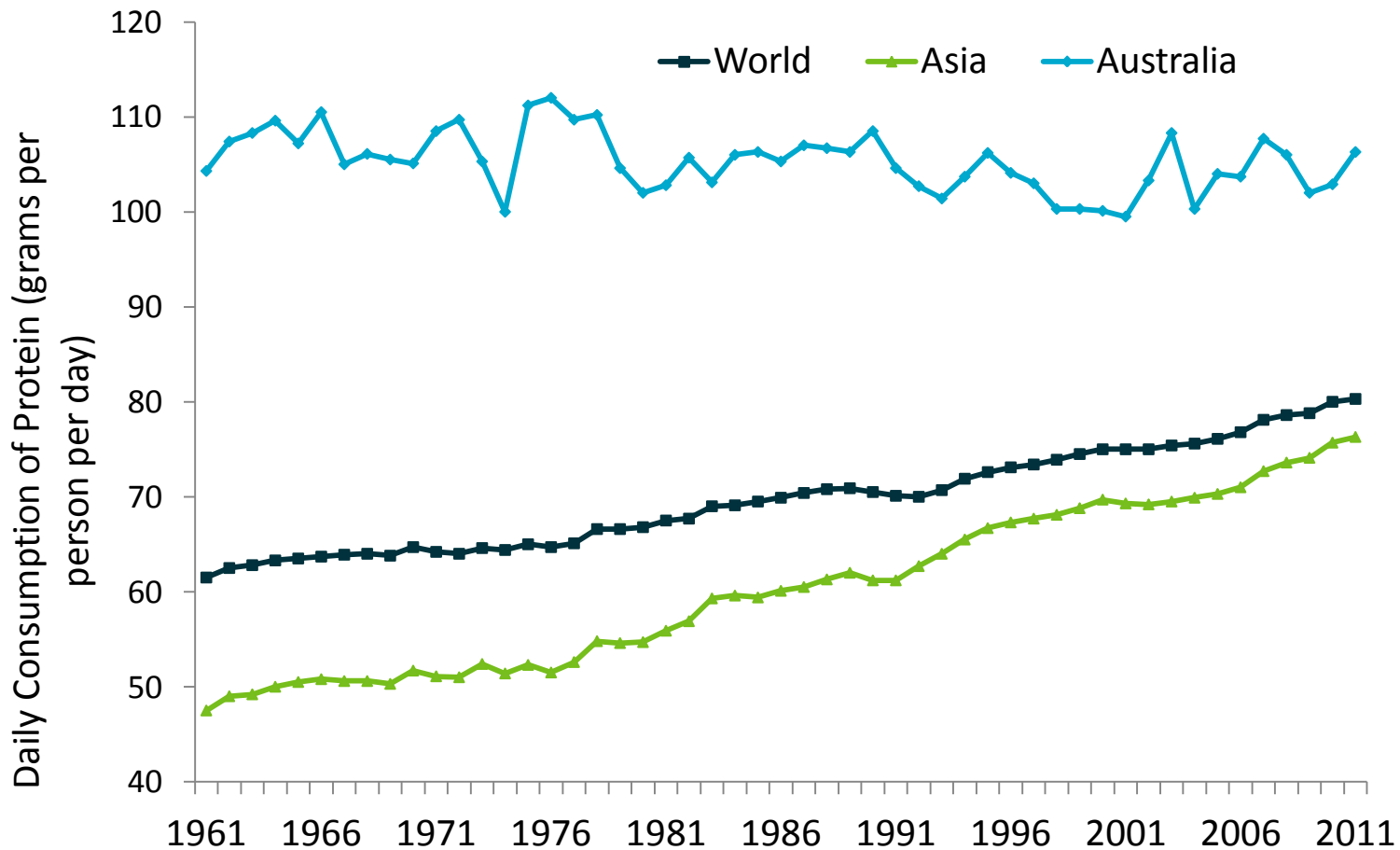
Income Growth <-> Food Consumption



Source: Food and Agriculture Organization and World Bank.

A Wealthier World

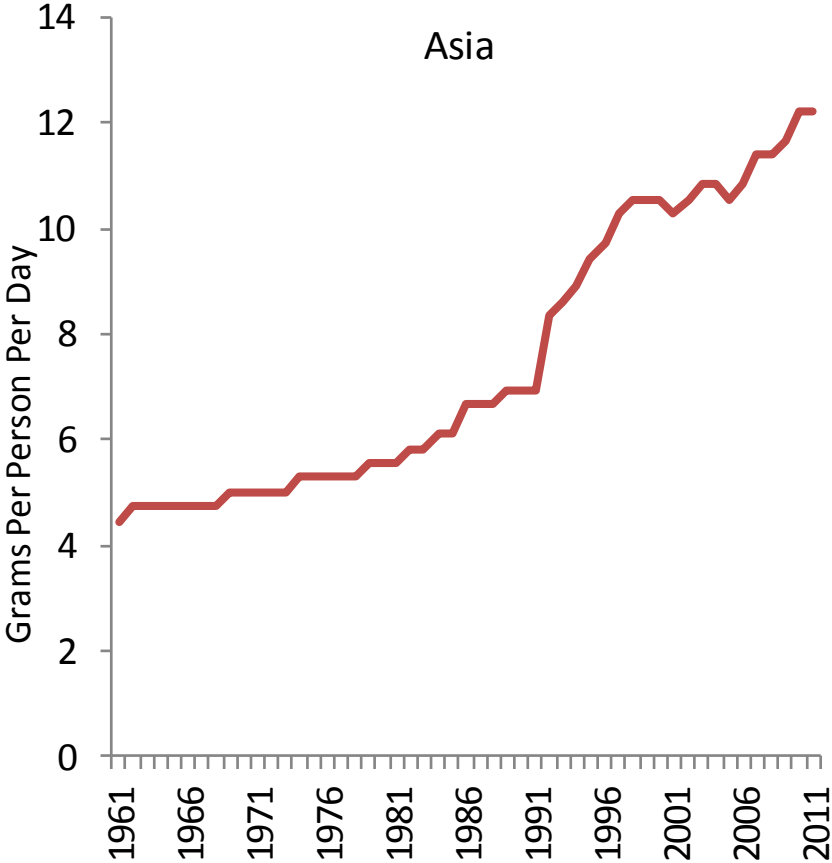
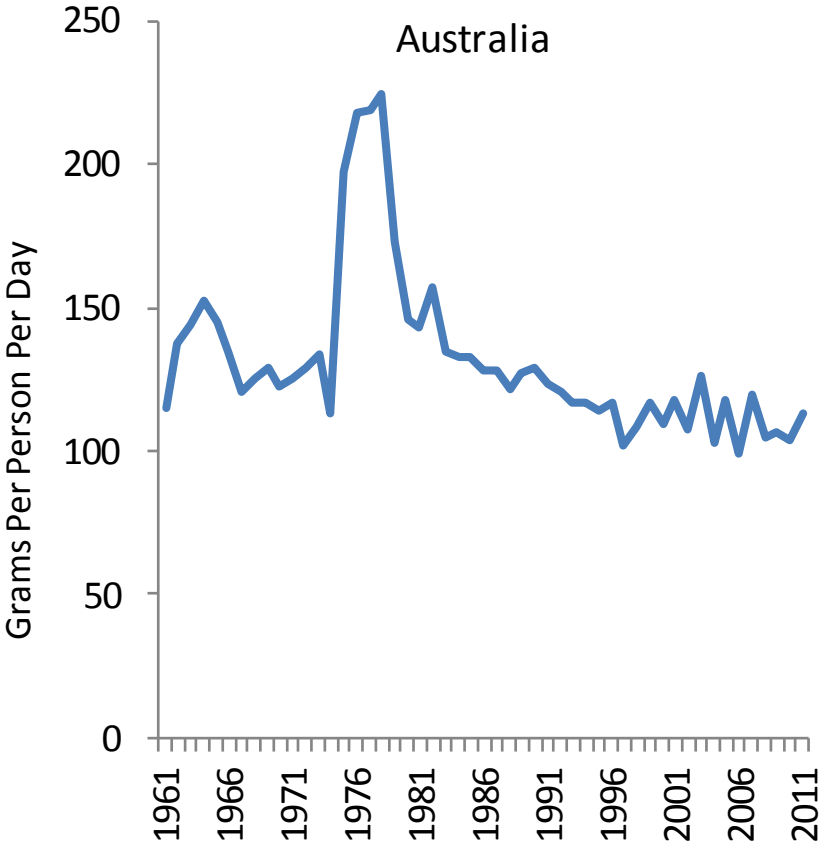
Growth in Protein Consumption



Source: United Nations Food and Agriculture Organization FAOSTAT

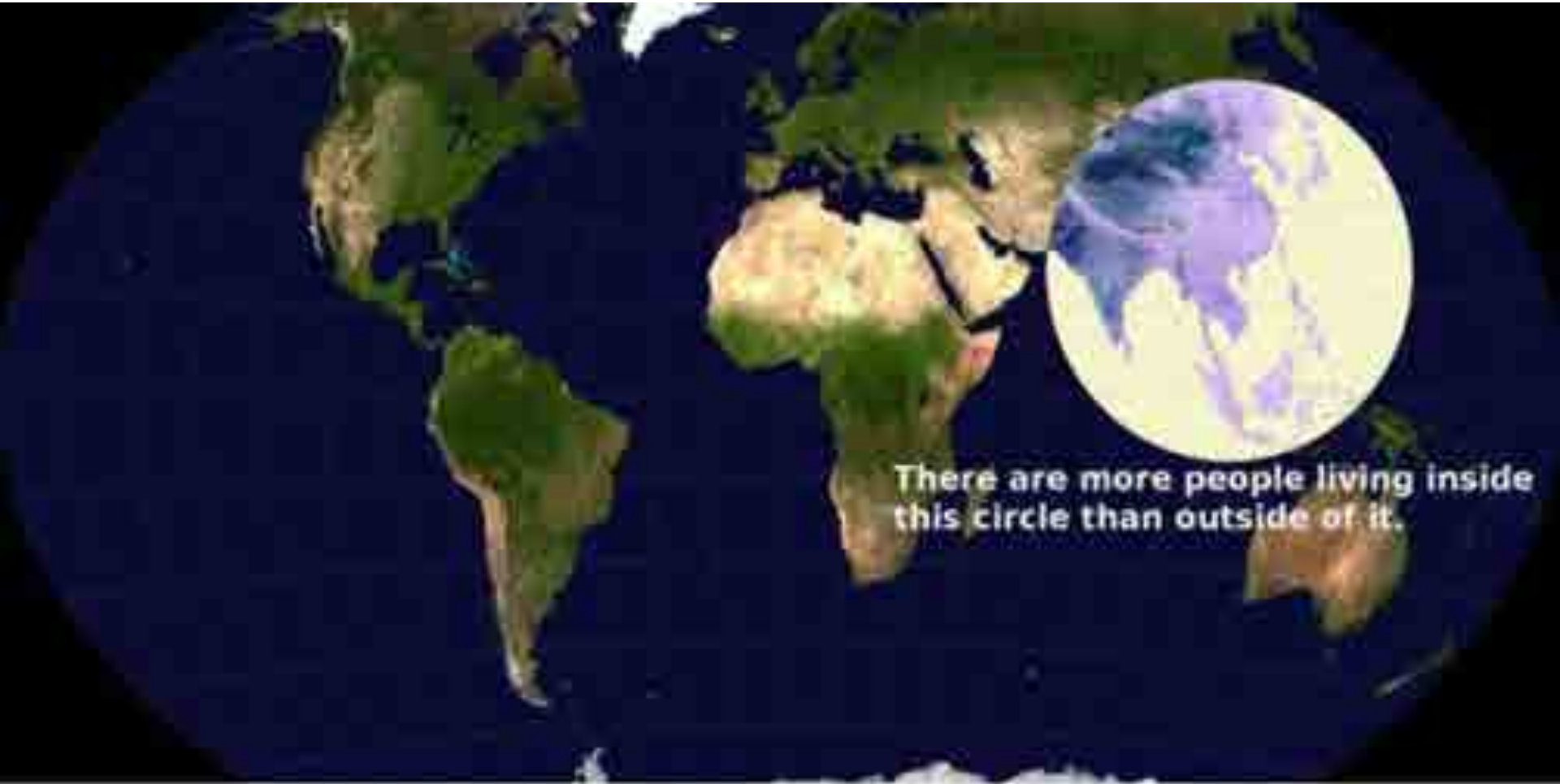
A Wealthier World

Beef Consumption



A Wealthier World

The Asian Century



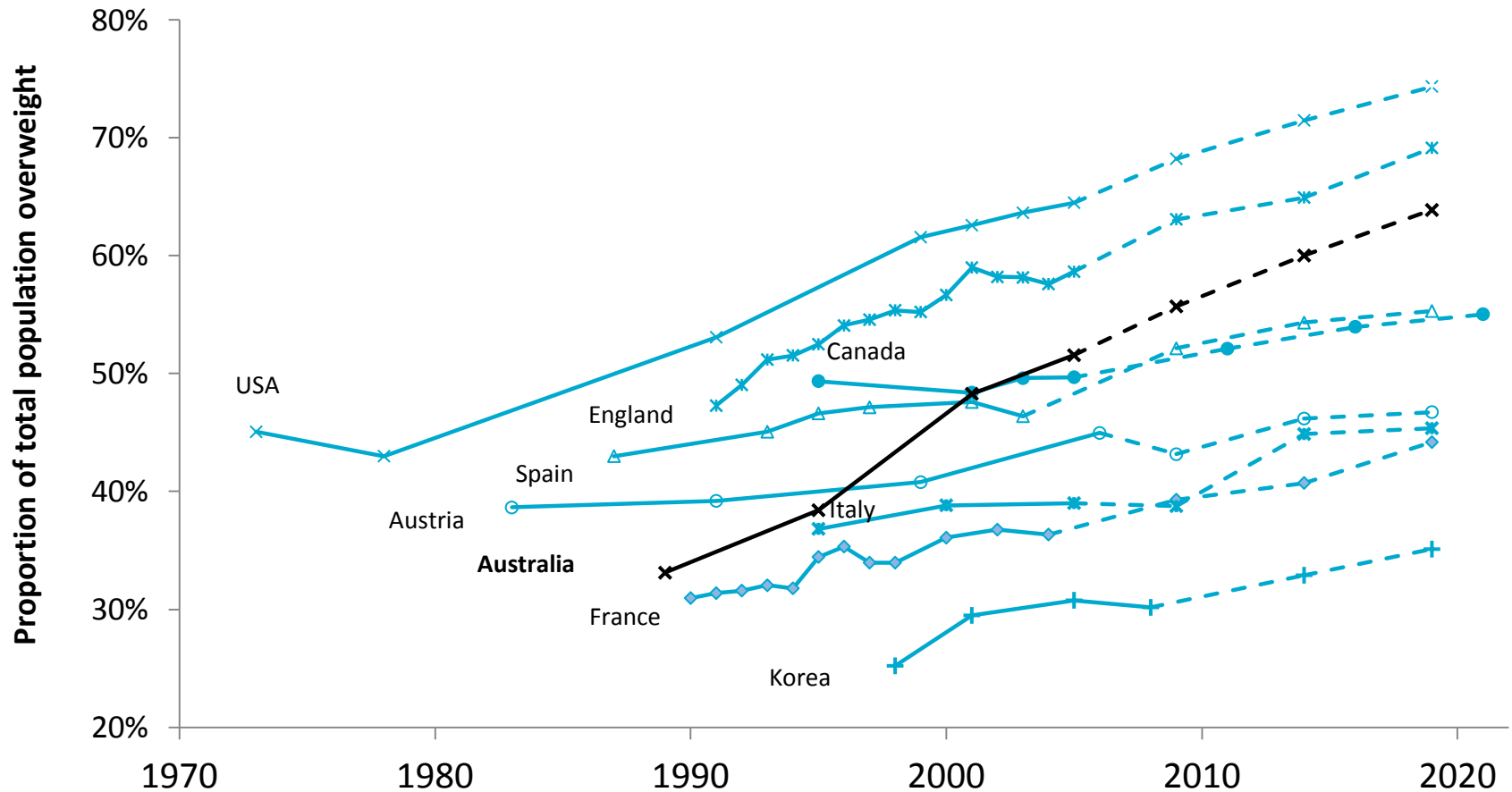
Credit – Valerie Pieris <http://i.imgur.com/CK6aONG.jpg>

Choosy Customers

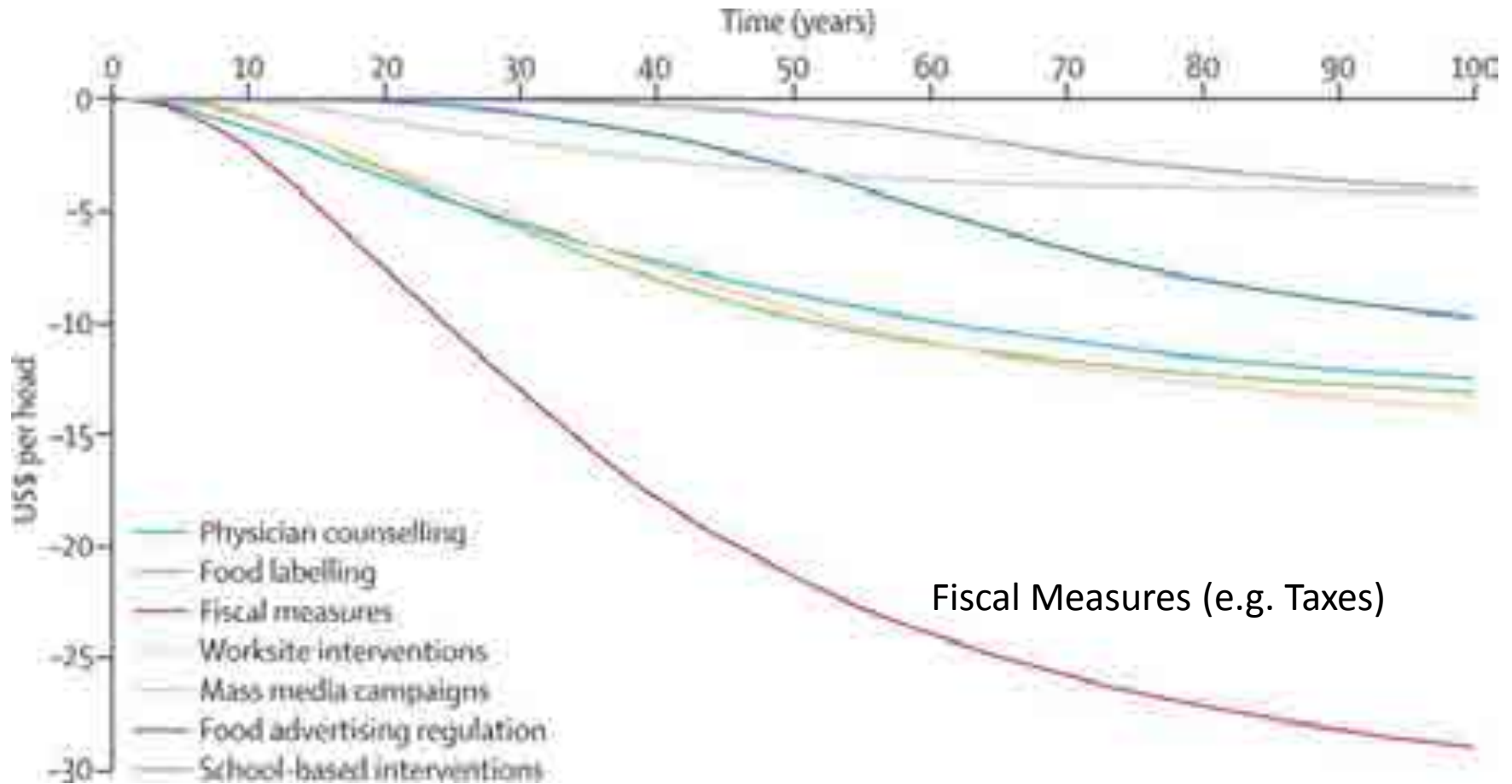
- Health
- Function
- Ethics
- Provenance



Rising Rates of Overweight/Obese



Improving information on benefit cost ratios of dietary change



Fiscal Measures (e.g. Taxes)

Growing Functional Foods

Global market estimated at US\$90.5 billion in 2013.

Largest markets Europe and Japan (90 percent of total sales)

United States market up 21 % year-on-year



Ethics and Provenance

- Live export cattle – humane slaughter in destination country
- Cage-free eggs
- Coles’ “sow stall-free pork”
- Where did my Maggie Beer’s ice cream really come from?
- Nana’s frozen berries – expectations of safety
- Rising popularity of Farmers’ markets

Impact of online and social media

Transformative Technologies

- **Biological science**
- **Digital science**
- **Materials science**





**Super
high oleic
oil
safflower**



**Omega-3
oil canola**



**Biomass
oil**



**Gluten
free
barley**



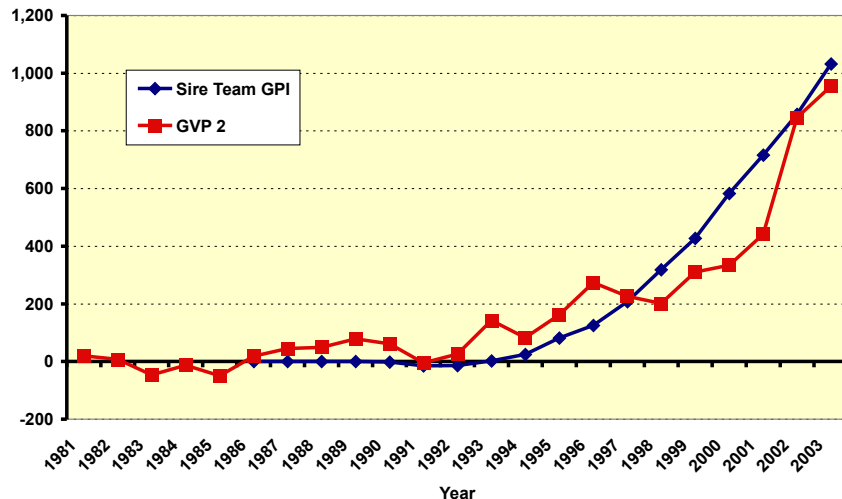
Gartner's Hype Cycle



Creation of a new \$3billion industry: The Australian lamb industry

R&D on genetics, feeding and meat processing coupled with a coordinated industry plan transformed sheep meat from a \$300m p.a. industry in 1990 to over \$3billion p.a. now.

Genetic trend for performance index (GPI) and gross value of production (GVP) of the lamb industry.



Genetic improvement plus altered management produced larger cuts demanded by high value markets



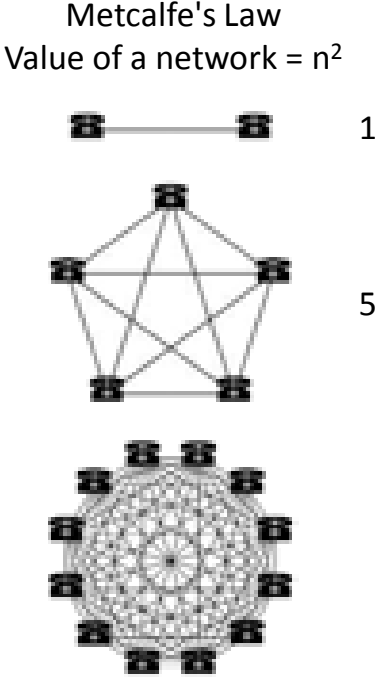
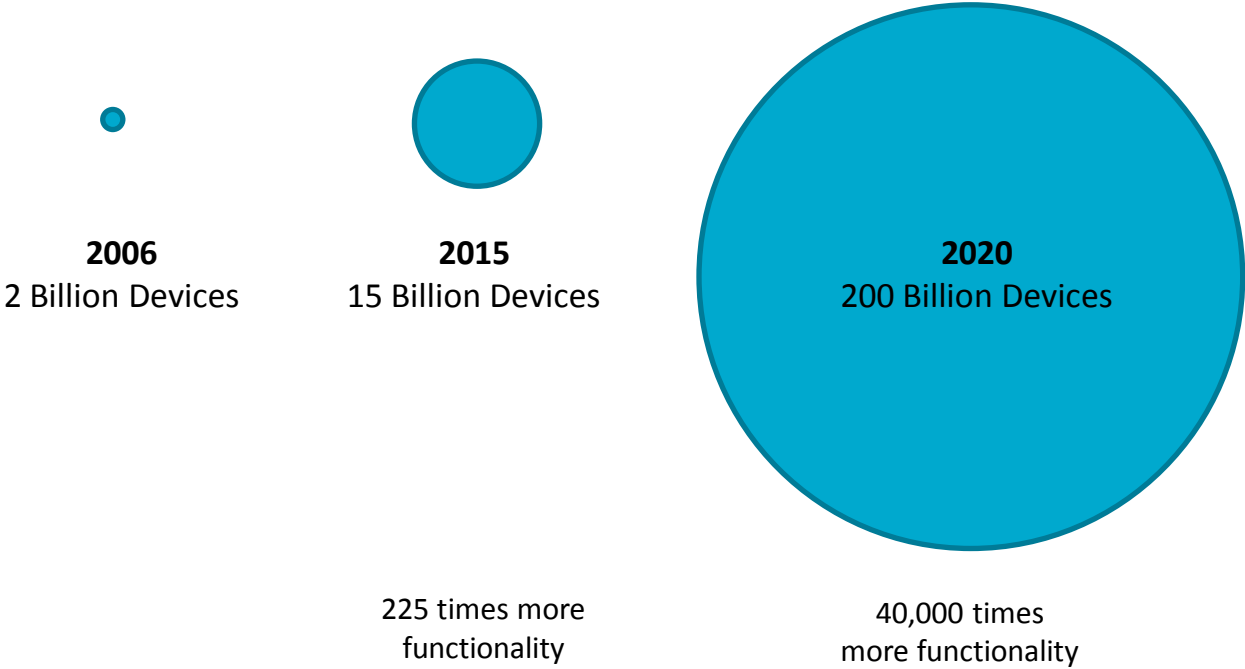
1950's

1990

2006

2012

The Internet of Things

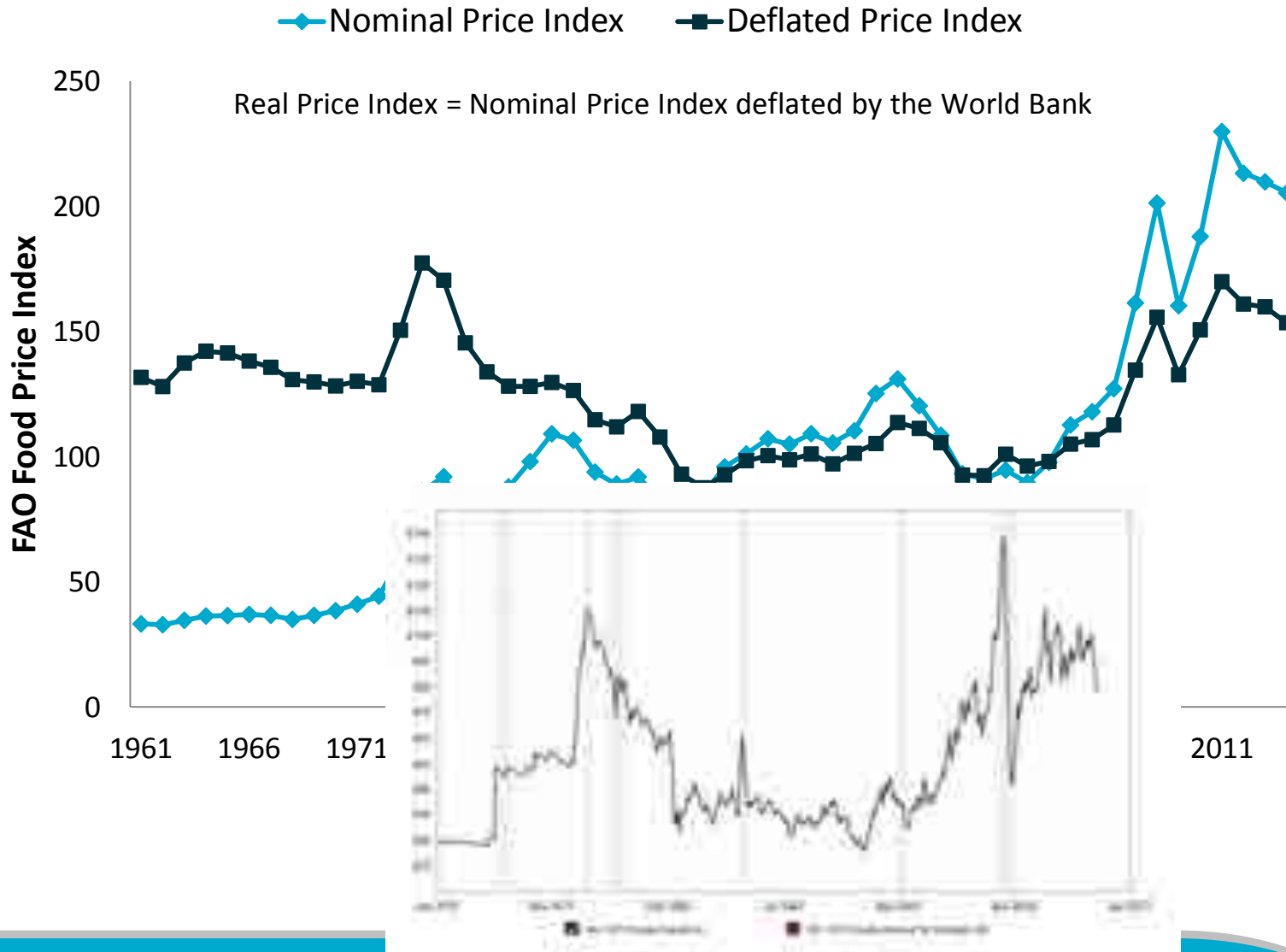


Data source: Intel Corporation. A Guide to the Internet of Things, www.intel.com

A Bumpier Ride

- Climate Change and Extreme Weather
- Globalisation of Supply Chains
- Food Price Shocks
- Technology / Biosecurity Breakdown

Food Price Patterns and Oil Price



Global environmental consequences

Greenhouse emissions from land clearing and agriculture must be reduced without impacting food security

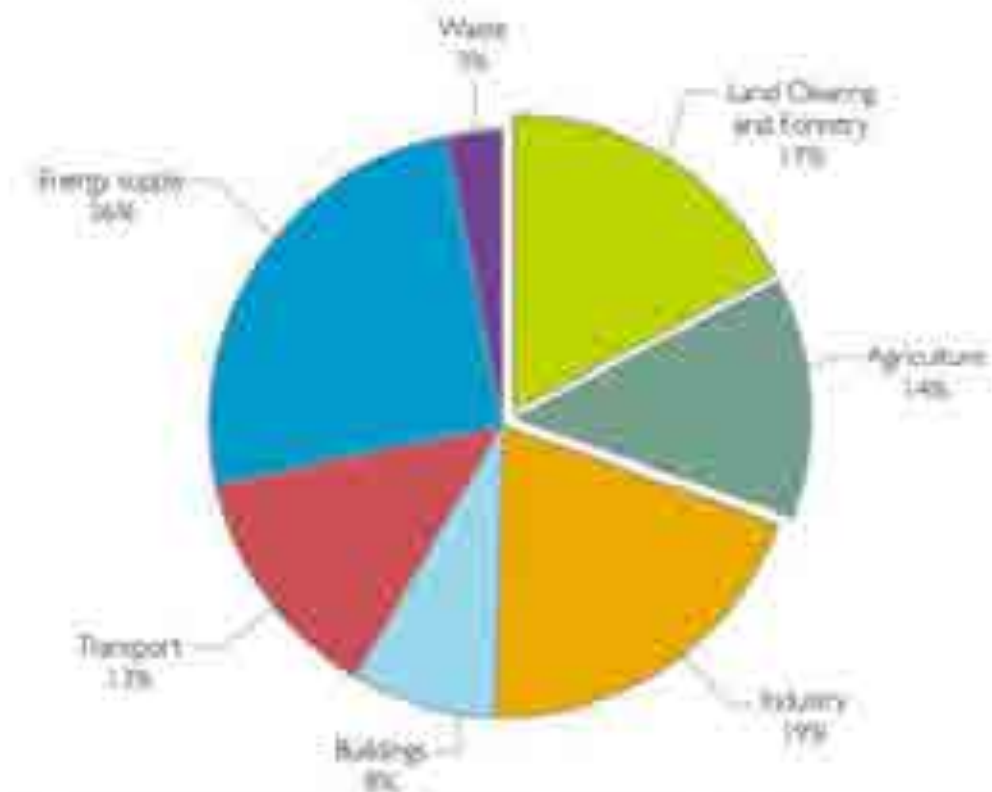
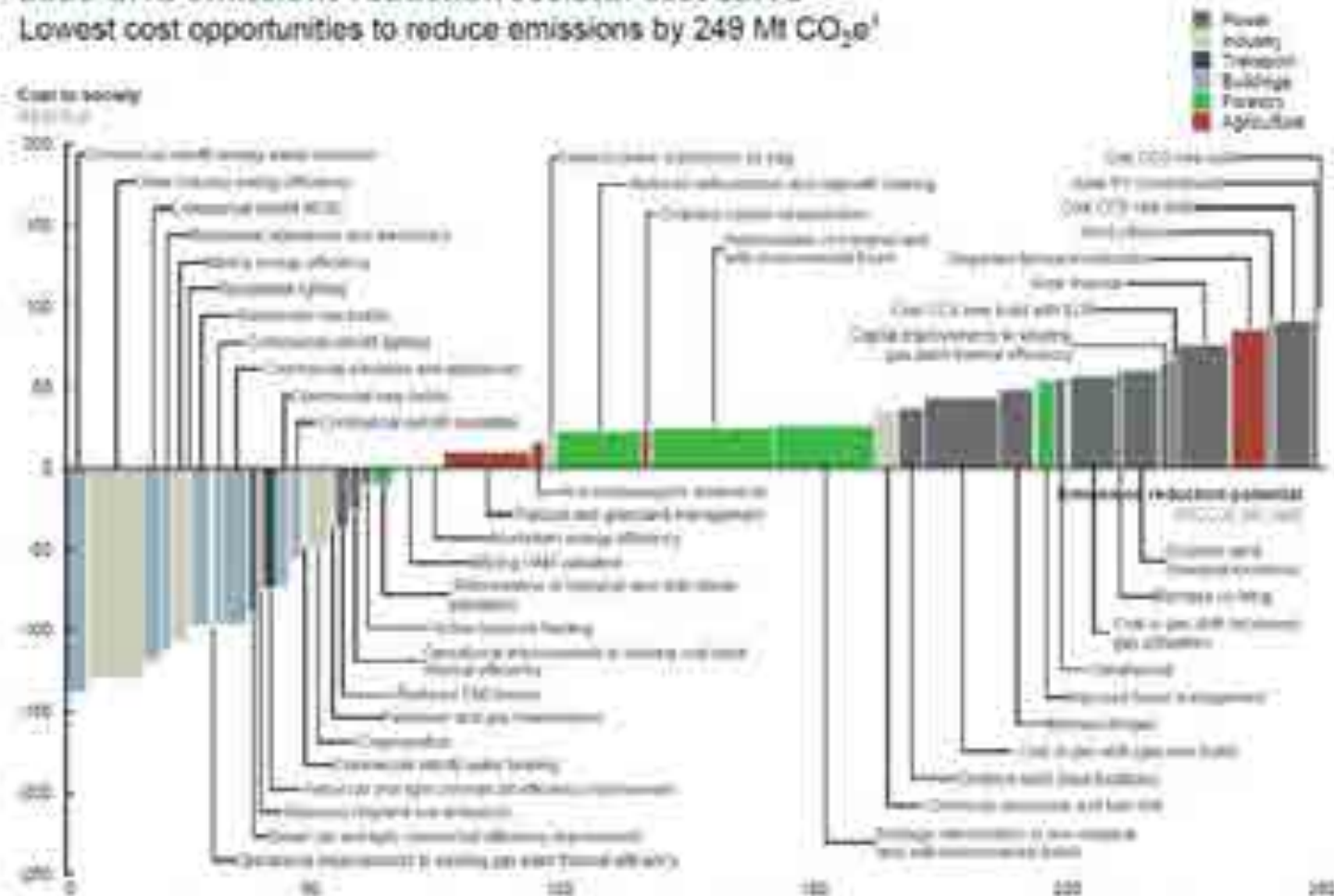


Figure 4.22 Global greenhouse gas emissions by sector in 2014 (GtCO₂e). (IPCC Assessment Report Working Group I, Second Working Paper, http://www.ipcc.ch/assessments/reports/working_group1.html)

Agriculture and GHG mitigation

2020 GHG emissions reduction societal cost curve

Lowest cost opportunities to reduce emissions by 249 Mt CO₂e¹



¹ The total abatement potential is assumed to be 249 Mt CO₂e in 2020, which is 20% of the 2000 emissions. Emissions reductions are shown as a percentage of the 2000 emissions. The chart shows the societal cost of abatement, not the marginal abatement cost. The chart is based on the CSIRO Emissions Projections (2007) and the CSIRO Emissions Projections (2007) and the CSIRO Emissions Projections (2007).

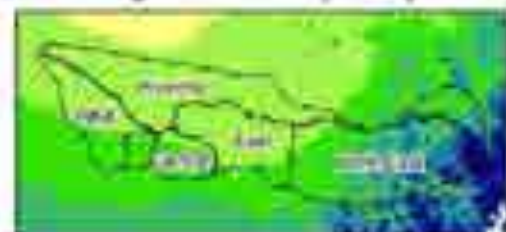
THI Impact on Milk Production CSIRO Mk 3.5 Model for 2050

Low Herd Susceptibility

Moderate Herd Susceptibility

High Herd Susceptibility

Base years
(1971 to 2000)



Mean THI Impact on Milk Production (t/ha/year)

100 150 200 225 250 300 325 350 400

A2
Scenario



A1T
Scenario



A1FI
Scenario



Difference between base years and climate change scenario (t/ha/year)

0 25 50 75 100 125 150 175 200 225

0 50 100 150 200 km

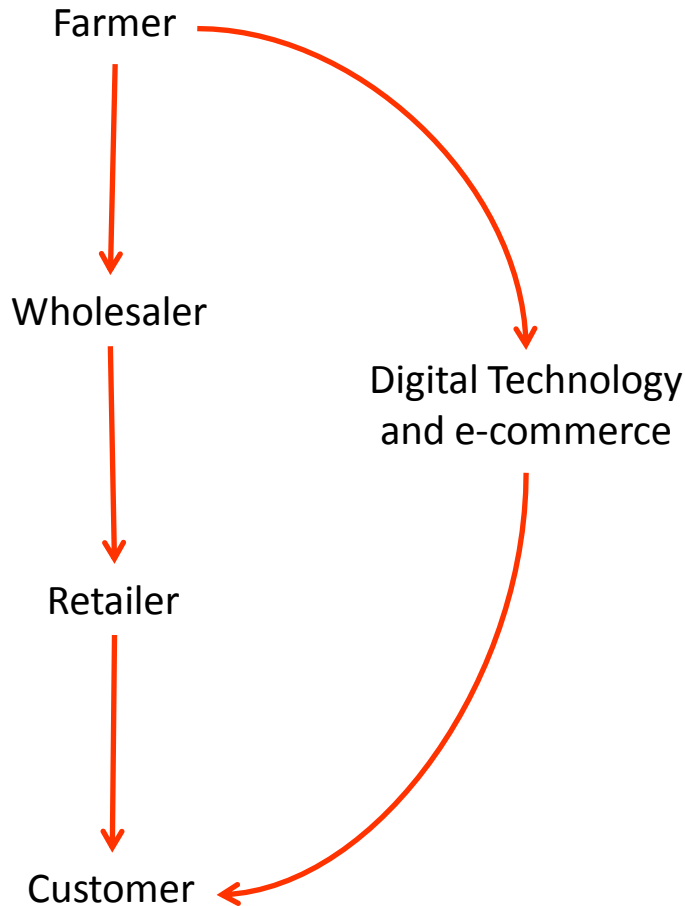


Understanding value chain climate risk exposure



New Business Models

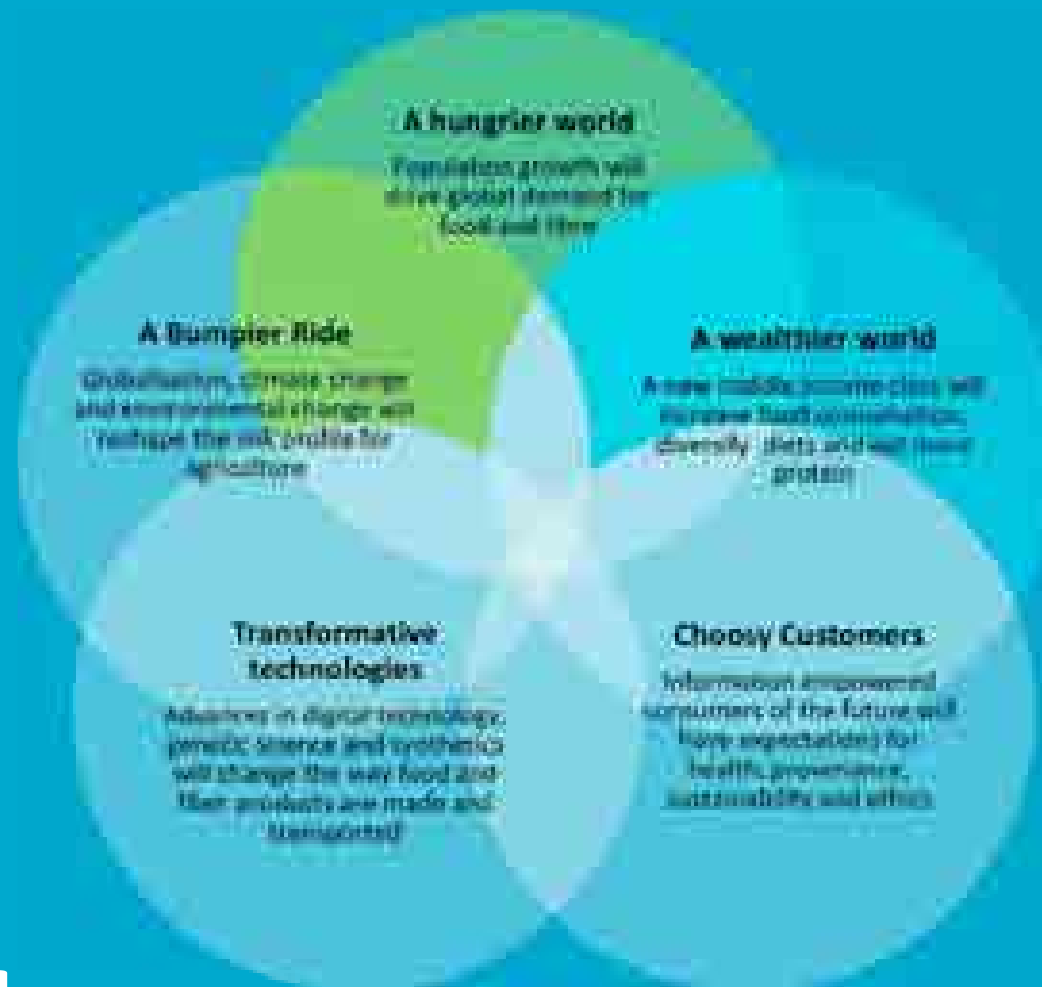
Technology enables supply Chain Disintermediation in Many new Ways – Consumers Making Decisions for Themselves



Mega shocks

- Biosecurity breakdowns – Panama disease, Nana's frozen berries
- Collision of societal values and farming - Live export ban
- Agro-terrorism – 1080 threats to baby formula
- Geo-political disruption of trade – exports to Russia
- Corruption of value in global supply chains – melamine in milk

How do we get smarter at both predicting and managing these risks?



Thank you