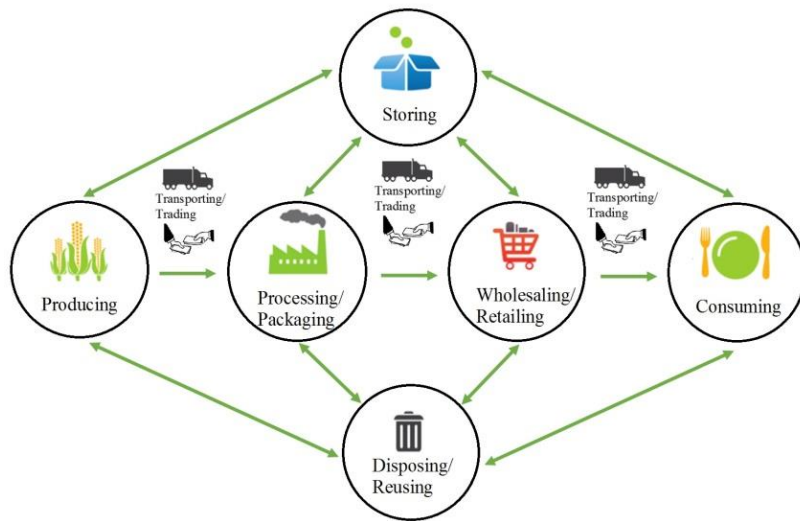# 'Agricultural Innovation Systems'

in the context of the Food Systems and SDGs

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An 'Agricultural Innovation Systems' (AIS) perspective can simultaneously address multiple SDGs …


… by embracing not only the science suppliers but the totality of interactions between actors involved in innovation
(World Bank, 2008)

So how does AIS mesh with a Food Systems perspective?

Food systems are 'complex adaptive systems'
Interactions among many actors and their activities, influenced by a wide range of environmental, social, political, economic and technological factors.
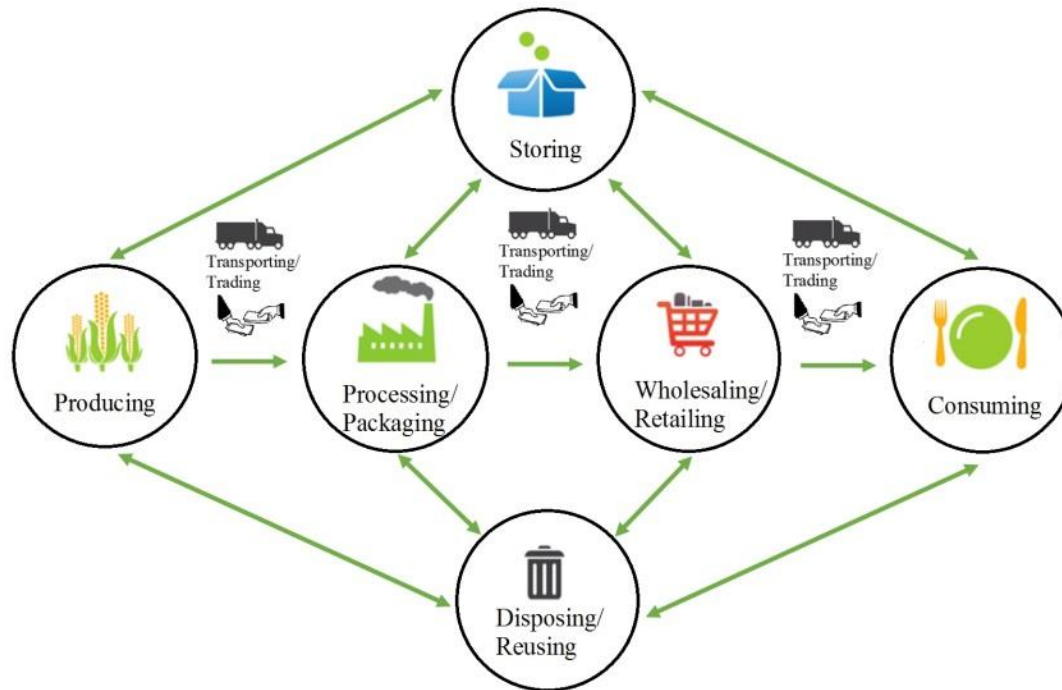
AIS recognises interactions among key food system *Activities* and their *Actors*

We know the overall food security 'situation'

| Insufficient cals Insufficient nutrs *currently ~ 1 billion*	Sufficient cals Insufficient nutrs *currently ~ 2 billion*	Sufficient cals Sufficient nutrs *currently ~ 3 billion*	Excess cals (incl. some with insufficient nutrs) *currently >2.5 billion*

Under nutrition:
- Poor nutrition: 171M stunted children
- Vit-A deficiency: up to 500k children blinded/yr
- Fe deficiency: 46k DALYs lost/yr
- Zn deficiency: 433k deaths 0-5yrs/yr

Over nutrition:
- Overweight or obese adults: 2.5M globally
- Obese children: 19% of Yr 6 in UK
- Diabetes sufferers: 382M globally
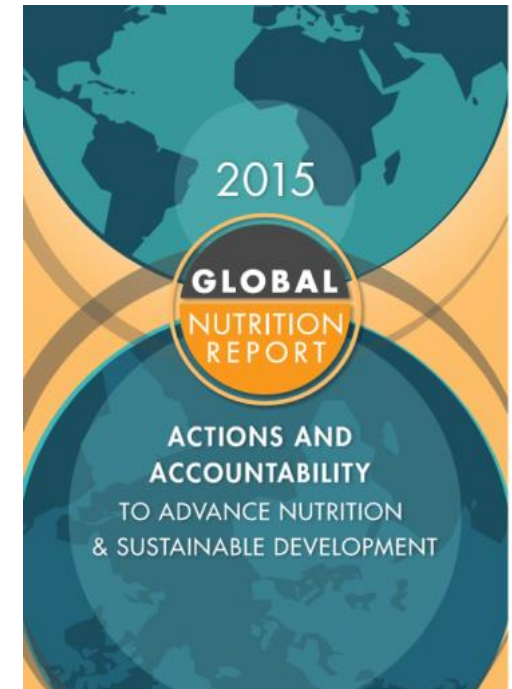
Different, overlapping forms of malnutrition is the 'new normal'
(IFPRI, 2015)

Reminder: Food security...

... exists when all people, at all times, have physical, economic and social access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

"enough for a particular purpose; as much as you need"
... OED

"unless trends are curbed, half the global adult population will be overweight in 15 years time"
(McKinsey, November 2014)

We also know that current technologies will continue to significantly impact natural resources
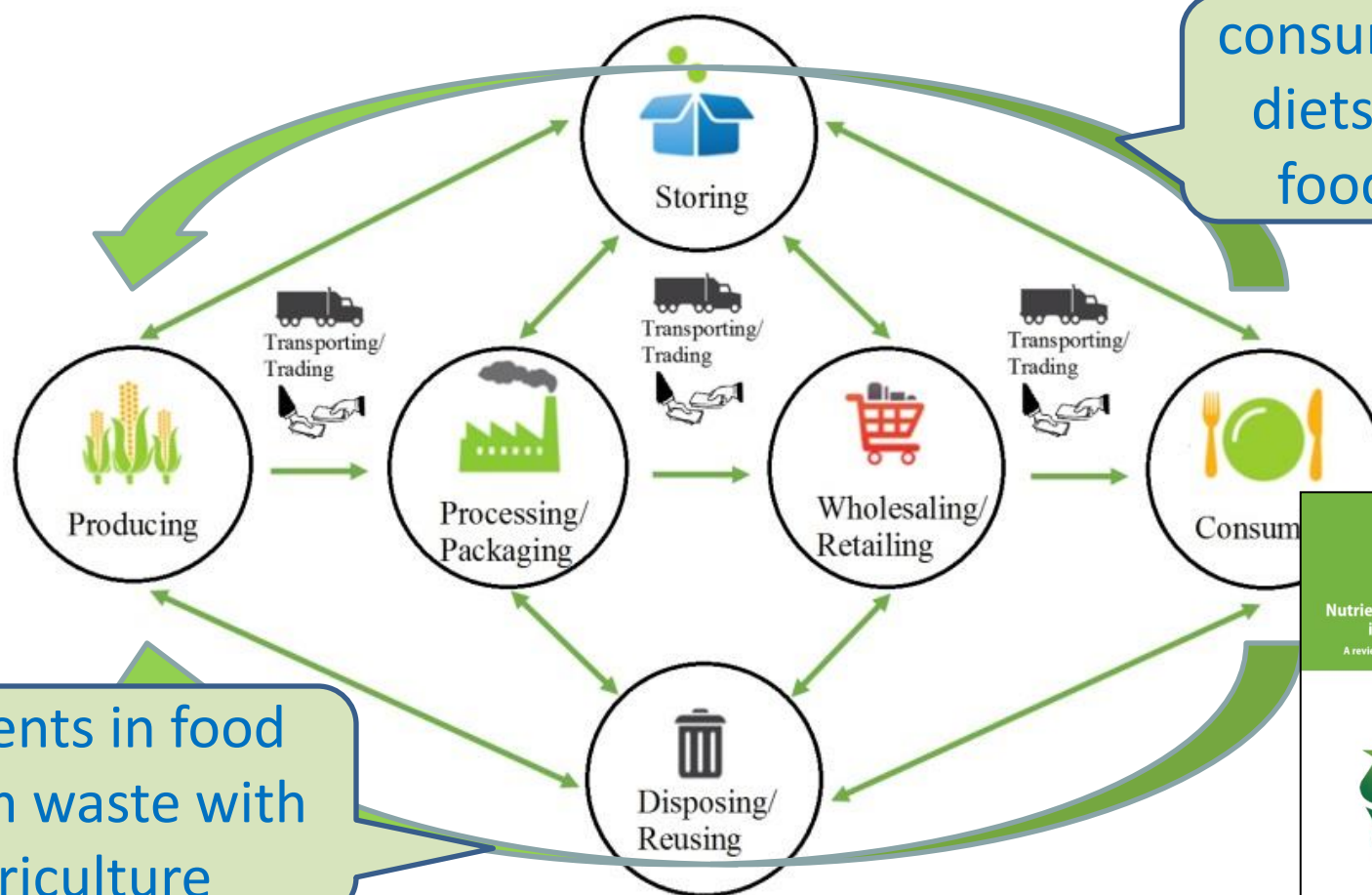
Agriculture has already led to:

- Soil 33% degraded
- Fresh water 20% aquifers overexploited
- Biodiversity 60% of loss

- Minerals >80% losses farm-to-fork

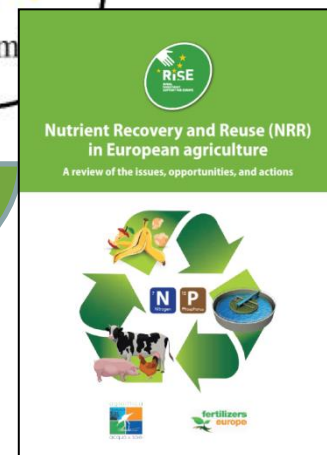And contribute 24% of total GHG emissions

Recoupling is needed

consumers with diets & other food issues

nutrients in food system waste with agriculture

Storing

Transporting/ Trading

Transporting/ Trading

Transporting/ Trading

Producing

Processing/ Packaging

Wholesaling/ Retailing

Consum...

Disposing/ Reusing

Nutrient Recovery and Reuse (NRR) in European agriculture
A review of the issues, opportunities, and actions

=> benefits agriculture, other food system enterprises, health and environment (*i.e.* helps towards multiple SDGs)

Can disrupting AIS offer some insights?
Towards Innovation 3.0

Innovation 1.0	Innovation 2.0	Innovation 3.0
Technology Transfer	**Interactive Inter-disciplinary Knowledge Processes**	**Adaptive Emergence in Complex Systems**

Innovation 3.0

✓ Based on the dynamics of complex social, economic and natural systems (cf. food systems: 'complex adaptive systems')

✓ Integrates and builds on Innovation 1.0 and 2.0

✓ Recognizes ethical dilemmas

✓ Combines technological and institutional innovation

✓ Deals explicitly with power and politics

Jim Woodhill, 2012

So how can Innovation 3.0 help address agriculture and other food system challenges?

✓ **Strengthening linkages** between established food system actors

✓ **Supporting new actors** and roles necessary to allow innovation systems to function effectively

✓ **Providing institutional space** for a diversity of innovation configurations and approaches to emerge

✓ **Stimulating institutional change** in public research and extension organisations (including the "rules of the game")

✓ **Building the capacity** for institutional and policy learning

But AIS are context- and case-specific
There is no single 'answer'

Case studies help identify innovation systems involving a range of agricultural and other food system actors, their activities and their incentives

An example:

Innovations to increase the proportion and variety of legume crops and hence plant proteins in diets

# Some key innovation bottlenecks in the protein system

1. Developing indigenous plants and new crop varieties as protein sources

2. Scaling adoption of new crops

3. Developing more efficient primary processing

4. Increasing the proportion of plant-based protein consumption

Based on *The Protein Challenge 2040*

Legumes are good for nutrition, good for environment
Per g of protein, legumes are very low CO_2 emitters

Legumes

Tilman, D and Clark, M, *Nature*, 2014
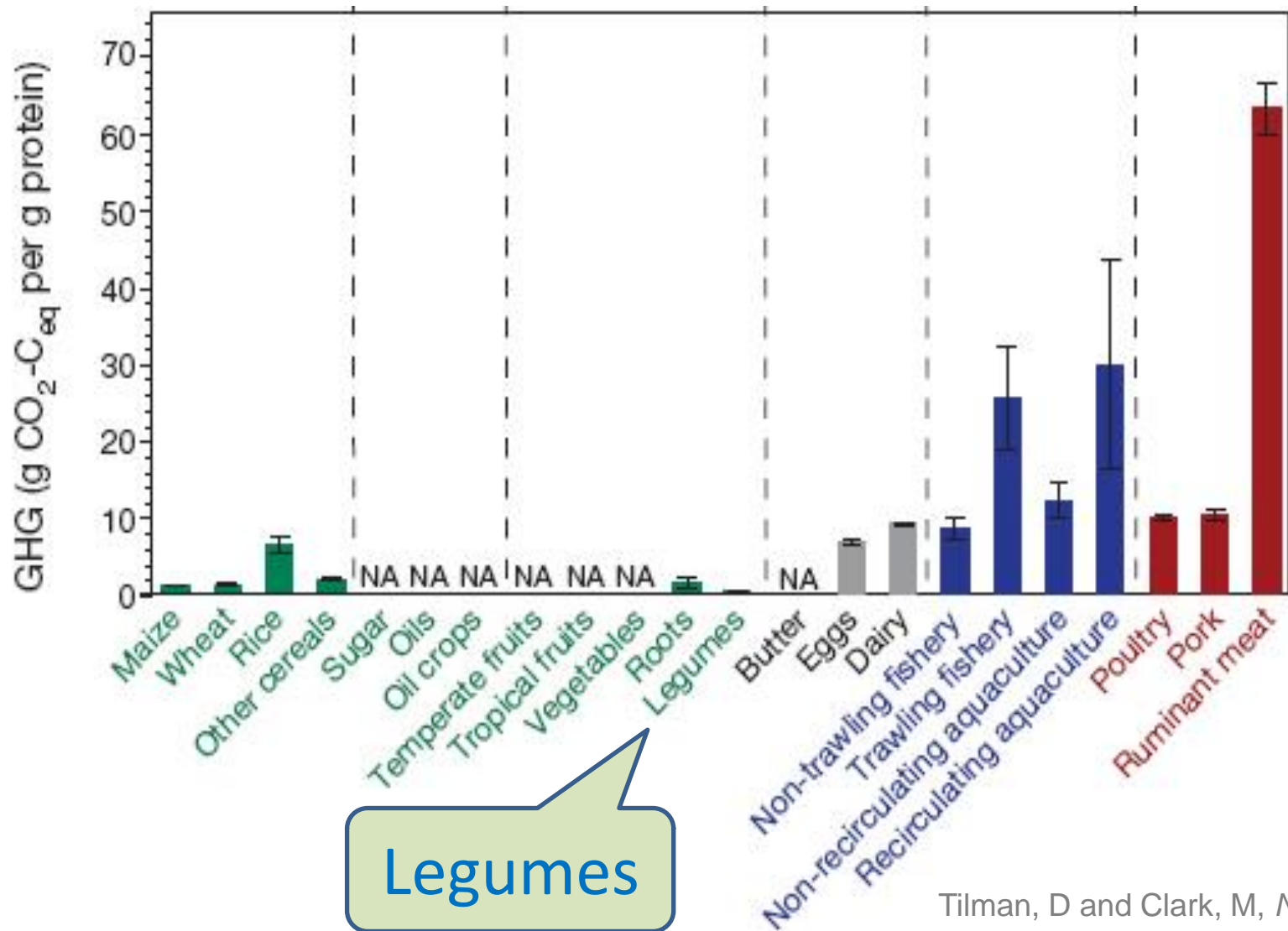
An AIS Perspective
based on multiple dialogues across multiple interfaces

Need for dialogue

Nutritionists, Anthropologists, Behavioural Psychologists
(=> innovative diets)

Final product processors
(=> innovative formulations)

Raw material proce
(=> innovative ingre...)

Agriculturalists
(=> innovative production systems)

Agro-biodiversity researchers
(=> innovative crops)

Plant breeders
(=> innovative plants)

Key questions:

Are the profiles of the novel plant products suitable for primary processing?

Are sustainable primary processing technologies available for novel plant products?

But enabling conditions need to be in place

1. **sustainable cultivation** of a wide variety of a protein-rich crops

2. **sustainable processing technologies** that deliver nutritious, safe, convenient, attractive and affordable ingredients

3. **value chains** based on shared value creation and risk, with viable business models

4. **consumer acceptance** recognising essential anthropological and other social customs

5. **shared vision and commitment** to bring about change

6. **regulation and policy** that supports and enables all of the above

forum for the future

The Protein Challenge 2040

Innovative research and implementation partnerships are needed

SDG Indicator 17.16

Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources

SDG Indicator 17.17

Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

Tripartite Research Collaborations across
State, Private sector and Academia can be very effective

A focus on food and nutrition security worldwide

So AIS perspectives can address multiple SDGs …

… but synergies among SDGs can be promoted most effectively when considered via a 'food systems' approach.