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Brief note on Food systems *and the role of livestock*

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International Center for Agricultural Research in the Dry Areas

A CGIAR Research Center

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Global food challenges remain to be



ensuring food security and nutrition for a growing population,



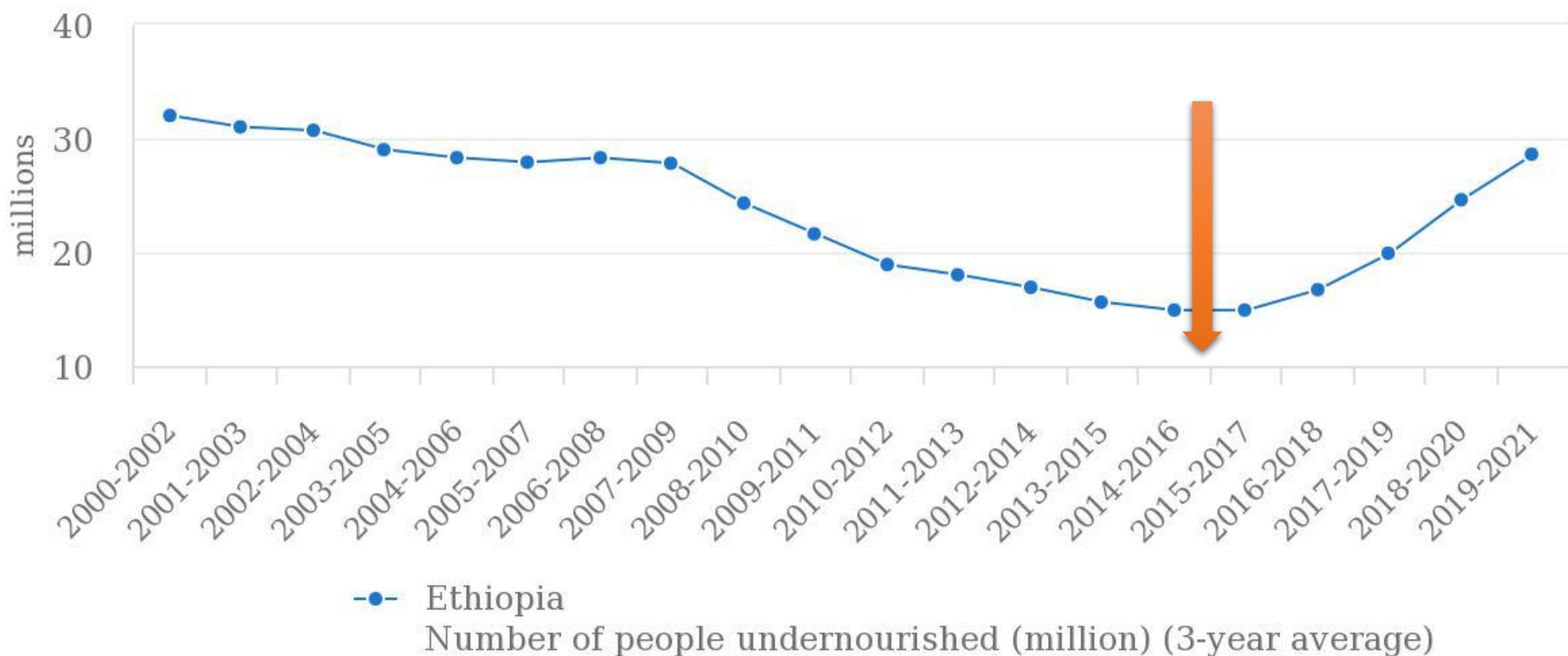
supporting the livelihoods of millions of farmers and others in the food chain, and



doing so in an environmentally sustainable way (OECD, 2022).

Undernourishment in Ethiopia

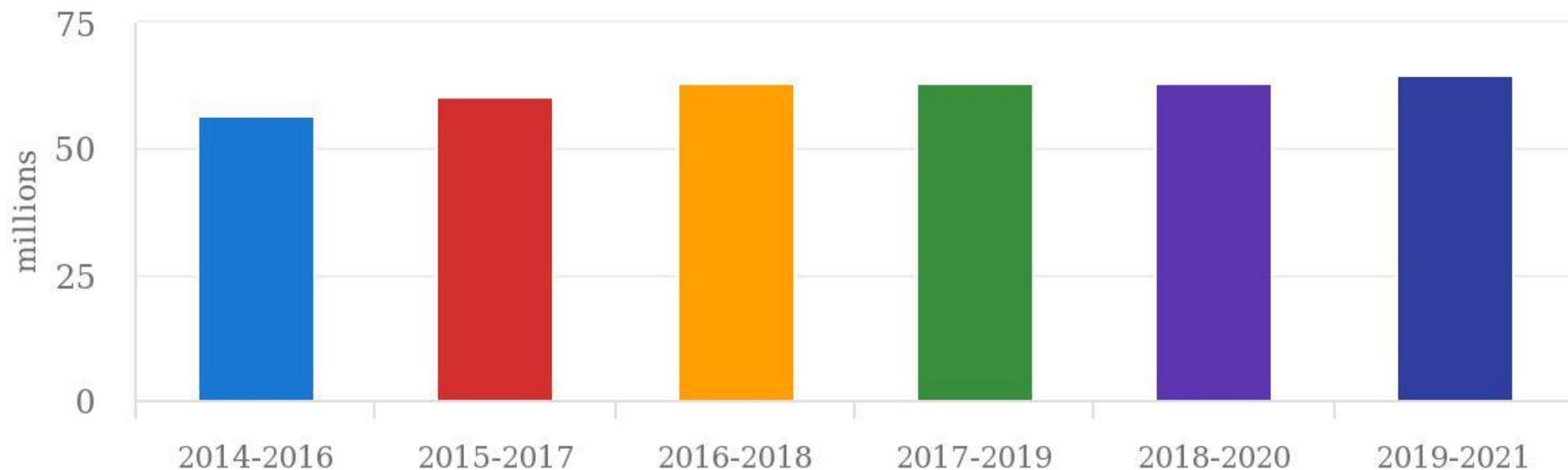
Number of people undernourished (millions) (3-year average)



Source: FAOSTAT (Sep 13, 2022)

Food insecure people [millions] – 3 years average

Number of moderately and severely food insecure people (million) (3-year average)



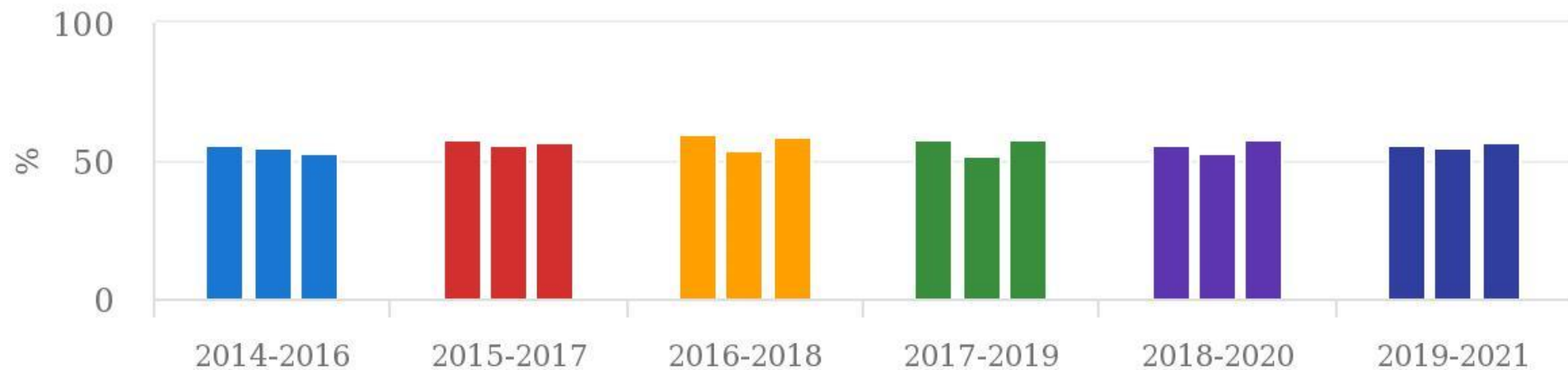
Ethiopia

Number of moderately or severely food insecure people (million) (3-year average)

Source: FAOSTAT (Sep 13, 2022)

Food insecurity [in % of total population] – 3 years average

Prevalence of moderate and severe food insecurity (%) (3-year average)



- Ethiopia
Prevalence of moderate or severe food insecurity in the total population (percent) (3-year average)
- Ethiopia
Prevalence of moderate or severe food insecurity in the female adult population (percent) (3-year average)
- Ethiopia
Prevalence of moderate or severe food insecurity in the male adult population (percent) (3-year average)



Some sad numbers from UNICEF

- 28 per cent of child deaths are associated with under-nutrition.
- 38 per cent of children under five years are stunted.
- 23.6 per cent of children under five years are underweight.
- 9.9 per cent of children under five years suffer from wasting.
- 22 per cent of women aged 15–49 years are undernourished.



What is a food system?



Let's start with food and food security

Let's start with food. What is food?

- Food is **any substance consumed to provide nutritional support** for an organism. Food is usually of **plant, animal, or fungal origin**, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals.

What is food security?

- Food security means “**access of all people at all times to enough food for an active, healthy life.**”
 - World Bank. 1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington DC.

What is a system?



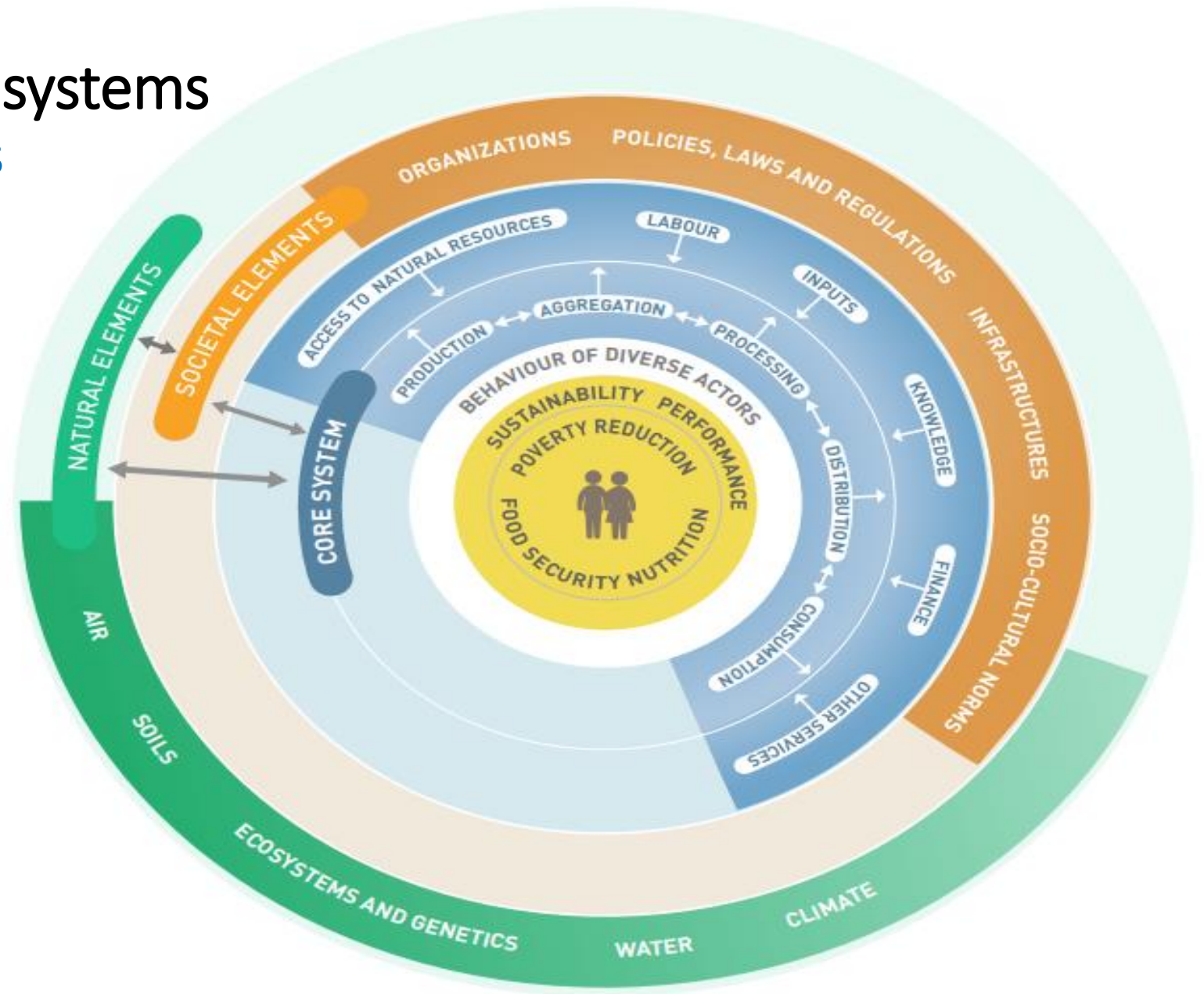
A system can be defined **as an entity**, which is a **coherent whole** such that a boundary is perceived around it in order **to distinguish internal and external elements** and **to identify input and output** relating to and emerging from the entity (Ng, Maull and Yip, 2009) .



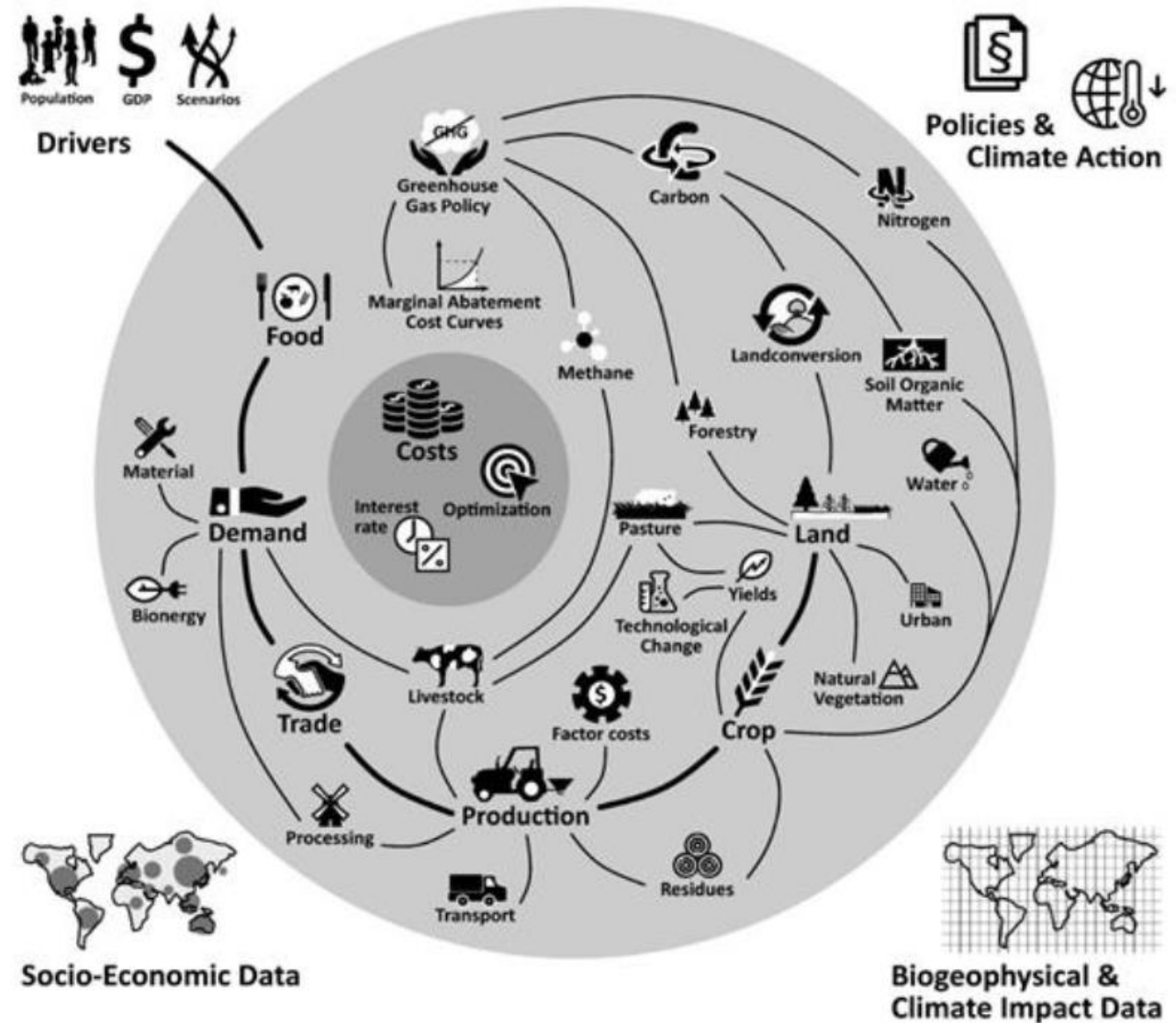
The **focus** is on **the interactions and on the relationships between parts** in order to understand an entity's organization, functioning and outcomes.

Before we define food systems

FAO (2018): Food Systems



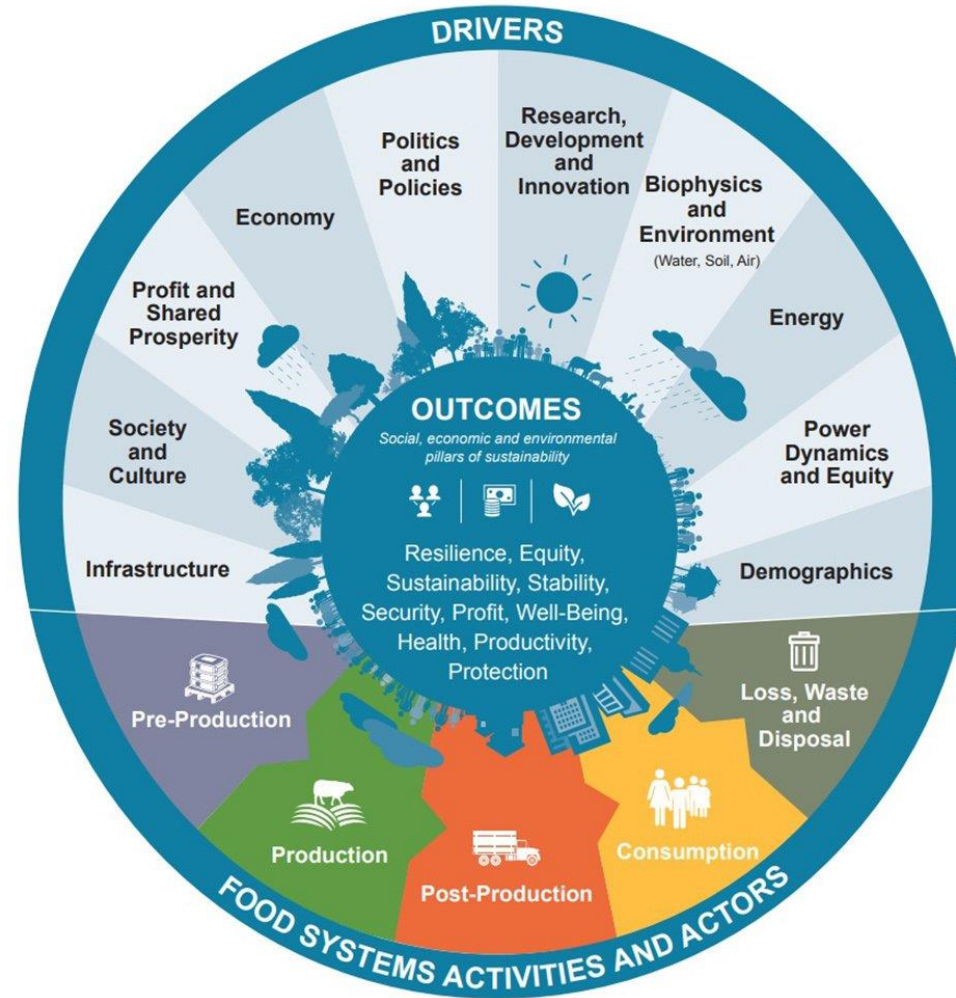
Before we define FSEC (Leip et al., 2021): Food Systems



Before we define

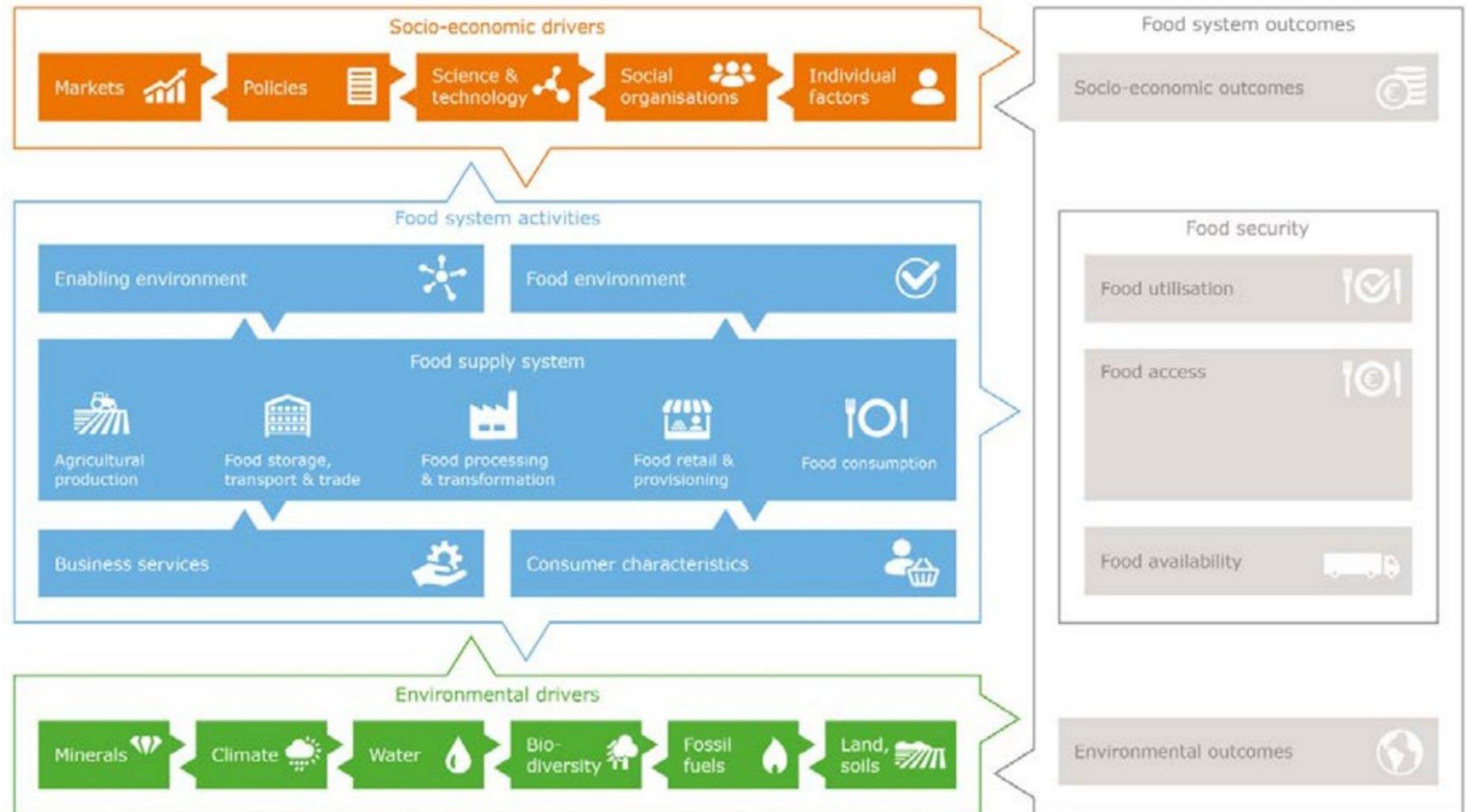
Niles et al (2017)

Food System Components, Processes, and Activities



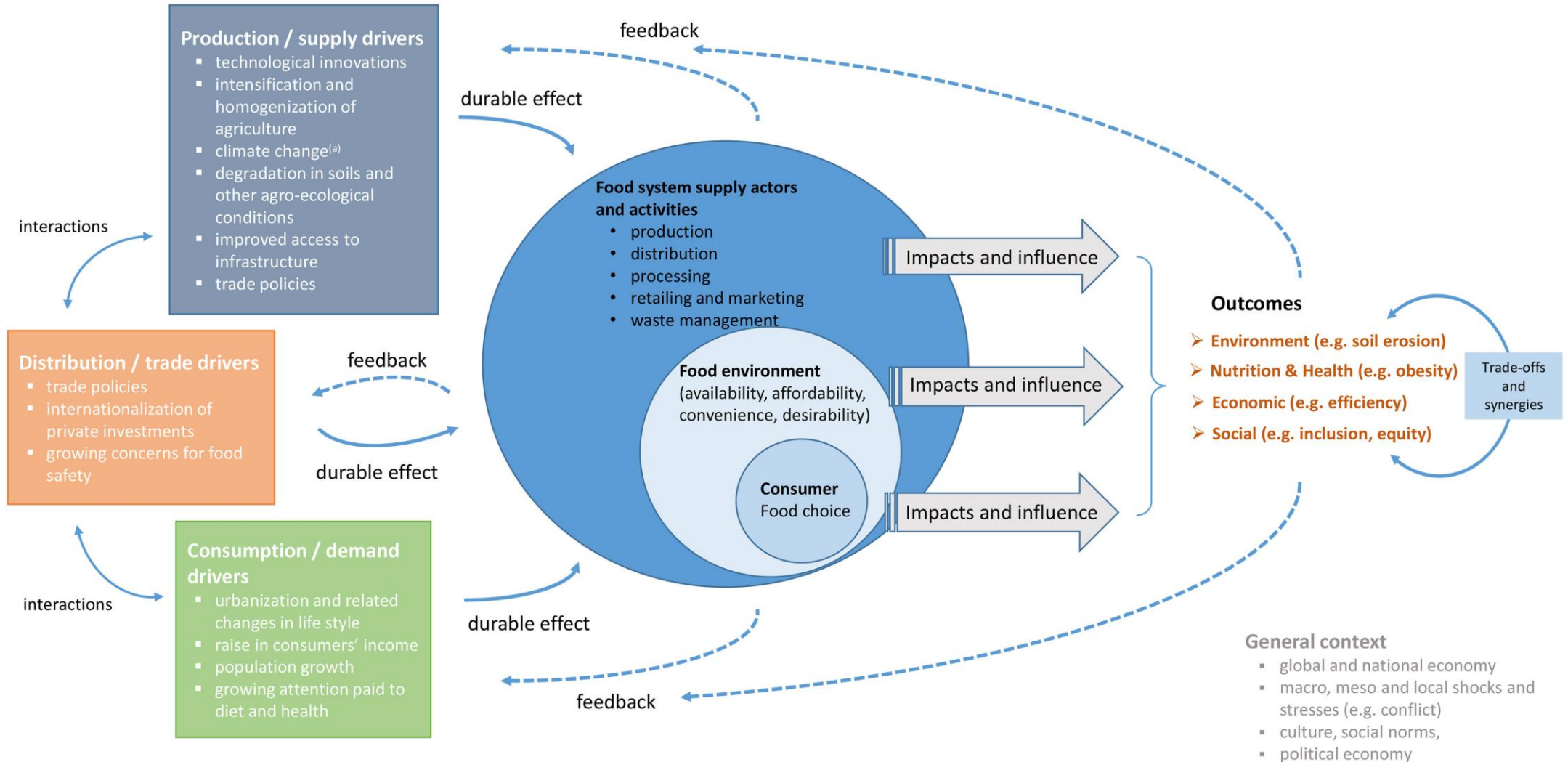
Before we define...

Van Berkum et al (2018)



Before we define.....

Bene et al (2019)






Now food systems -

- A popular definition
 - A food system is an integration of “**all the elements** (environment, people, inputs, processes, infrastructures, institutions, etc.) **and activities that relate to the production, processing, distribution, preparation and consumption of food, and the output of these activities, including socio-economic and environmental outcomes,**” (HLPE, 2017).



Now food systems -

- CGIAR/IFPRI's definition
 - Food systems are the ***sum of actors and interactions along the food value chain—from input supply and production of crops, livestock, fish, and other agricultural commodities to transportation, processing, retailing, wholesaling, and preparation of foods to consumption and disposal.***
 - Food systems also include the **enabling policy environments and cultural norms around food.**
 - Ideal food systems would be **nutrition-, health-, and safety-driven, productive and efficient** (and thus able to deliver affordable food), **environmentally sustainable and climate-smart, and inclusive.**



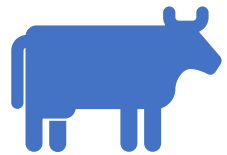
Food
systems
generally
include:

the ***chain of activities*** from producer to consumer;

the factors that influence the chain of activities and are influenced by it; these are ***drivers and outcomes of the food chain***, which have economic, political, environmental, health and social dimensions;

the ***many entities, institutions and people directly and indirectly involved***;

the ***connections between all those elements***, meaning that action in one part of the system has repercussions across the system.



Where Do Livestock Come
In This Complex
Framework?

Livestock in planet-friendly food systems?

One school of thought

- Let's reduce consumption of ASF to the minimum level possible (Willett et al., 2019)..
- Let's all be vegan (Poore and Nemecek, 2018).

Another school of thought

- Livestock can play a key role in feeding humanity if we shift from the **linear extract-produce-consume-discard model** to a circular model.
 - We need a paradigm shift in our food systems.
- **More on this....**



Circularity of the food system

circularity in the food system implies searching for practices and technology that

- minimize the input of **finite** resources (e.g., phosphate rock and land),
- encourage the use of **regenerative** ones (e.g., wind and solar energy), prevent leakage of natural resources from the food system (e.g., nitrogen, phosphorus), and
- stimulate **reuse/recycling of inevitable resource losses** (e.g., human excreta) in a way that adds the highest value to the food system (Ghisellini et al., 2016).

Complete circularity can hardly be achieved. Because we can't measure and/or recover everything.



In circular food systems

- Arable land is used **primarily to produce nutritious foods from plant biomass** that fulfil the nutritional requirements of **humans**
 - Not only proteins and calories but also essential micronutrients such as vitamin B12, iron and zinc.
- Therefore, the **choice of our future crops and their rotations** should be based on
 - their **main and by-products** and
 - their **food value for humans** and non-food value for the **soil and/or farm animals**.



In circular food systems

- To secure soil quality, **by-products could be used to feed the soil and fertilize the crop.**
 - Another option is to first feed these by-products to farm animals to produce ASF for humans, and subsequently recycle the animal and human excreta to the soil.
 - In this way, we could produce ASF and maintain soil quality.
- According to Van Zanten et al. (2018) if raised based on recycling by-products and biomass from grasslands, farm animals **can provide only up to one third (9–23 g) of the daily protein needs of an average global citizen (~50–60 g).**
 - This is without using additional arable land, as arable land is used to produce food instead of feed crops.
- **Allocating each by-product for either the soil or the animal is a critical research question.**



There are many unknowns around livestock's role in circular food systems

- We do not know exactly how much food could be derived from farm animals fed solely with low opportunity-cost feeds: this will depend on:
 - **the quantity and quality of by-products and grass resources available for animals**
 - **the type of animals,**
 - **how efficiently farm animal utilize these feed and the development of new technology.**



Livestock in circular food systems...

- In low-income countries the consumption of ASF is still likely to grow.
- The average supply of animal protein in Africa, for example, is currently only 13 g per person per day (Van Zanten et al., 2019).
- Increasing the consumption of ASF in Africa, especially in households where diet diversity is low and malnutrition is high, will make an essential contribution to human nutrition.
- Farm animals in the developing agrarian world not only contribute to food security by supplying essential nutrients, but also by providing traction, manure, liquidity, income, insurance, social prestige, and financing (FAO, 2016).
 - They are not meant only for generating cash income.

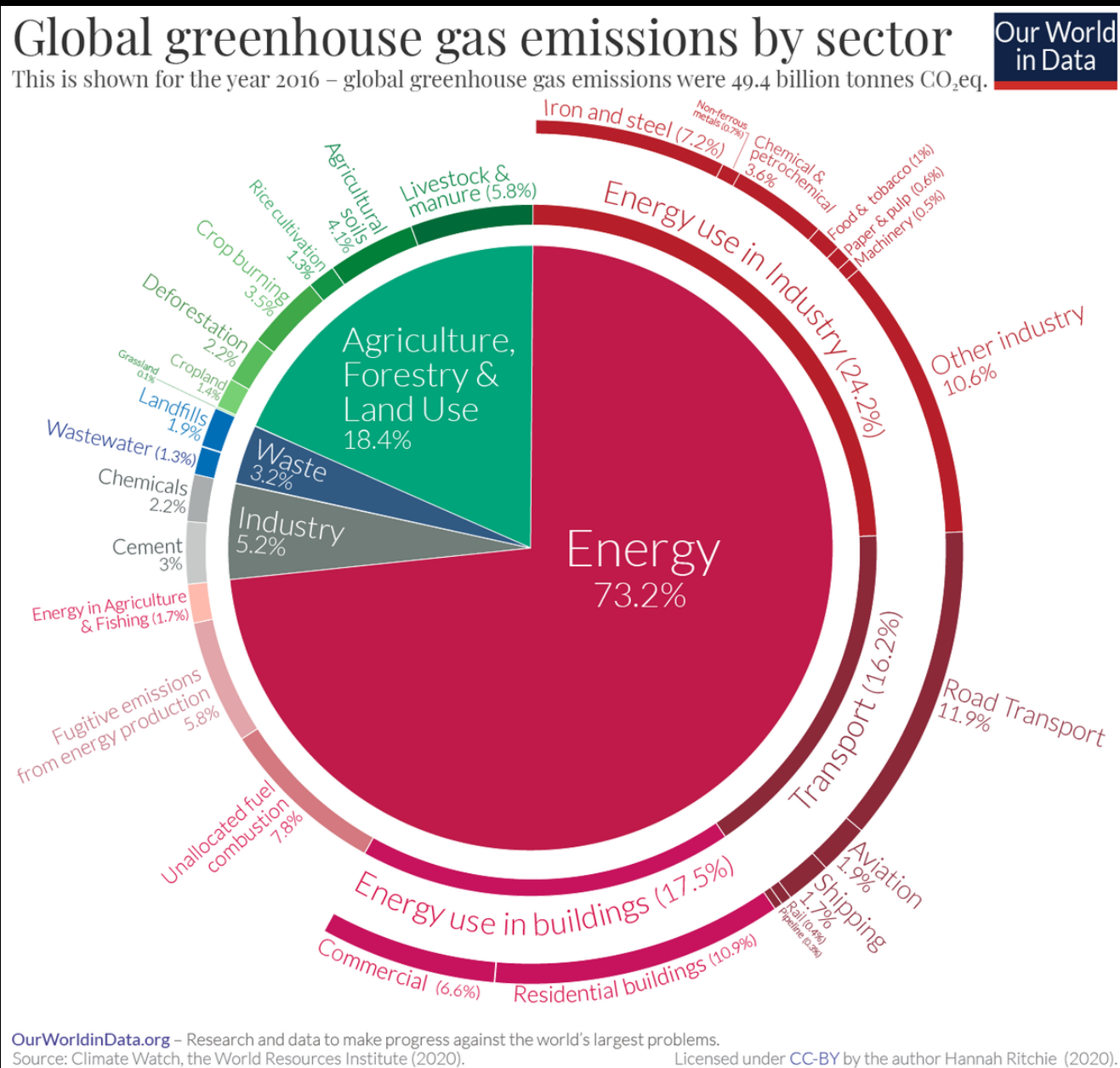
We need to start looking at livestock differently..

- The conventional product carbon footprint approach focuses on reducing the environmental impact of food production.



Are we careful enough?
(Digression)

- To start with, if you doubt what you have been told about livestock being the protagonists of GHG emissions, I am with you.
 - At least the conclusion needs to be disaggregated in many ways.



Livestock and GHG emission....

Cars or livestock: which contribute more to climate change?

by [Anne Mottet and Henning Steinfeld](#) | [FAO](#)

Tuesday, 18 September 2018 08:36 GMT



We need to start looking at livestock differently..

- Product footprints, however, do not encompass the full complexity and circularity of food systems as they do not address interlinkages within the food system or the issue of feed-food-fuel competition.
- Example:
 - Feeding more concentrates instead of roughage to cattle would reduce the footprint of beef (De Vries et al., 2015), but at the same time increase feed-food competition and thus increase the land use of the entire food system (Van Zanten et al., 2018).
 - Similarly, the use of animal manure in cropping is not necessarily more resource use efficient at the crop level (indeed, sometimes less efficient) than the use of mineral fertilizers (Schröder et al., 2010). Yet, at the level of the entire food system, it is efficient to utilize manure instead of mineral fertilization.
- Therefore, we need to develop context specific metrics for measuring the sustainability of the circular food system.



Recommendation? Take it from food system economic commission

<https://www.foodsystemeconomics.org/resources>

Livestock production:

- *Trade-off:* Future demand for livestock is expected to rise. Intensification of extensive livestock systems will lead to a substantially lower increase of total agricultural water use in 2050 compared to 2010 (12% increase vs. 23% increase) but – through a shift from pasture to cropland- leads to higher irrigation water demand which can lead to water scarcity in regions such as Sub-Saharan Africa and South Asia.
- *Solutions:* Intensification of low-intensity livestock systems, e.g. by substituting residues, food waste and grazed biomass as feed source with higher quality and nutrient-rich feed, can mitigate some of the consequences of an increasing livestock demand that is currently responsible for over 80% of all agricultural non-CO2 emissions. Highly intensive livestock systems, on the other hand, need to be de-intensified to improve animal welfare and reduce negative environmental impacts such a nitrogen pollution.



Final words [heavily borrows from Van Zanten et al (2019)]

- We don't know yet exactly how to move towards a circular economy.
- Nonetheless, we most likely need a mix of socio-economic and institutional measures, such as:
 - **true pricing,**
 - **subsidizing sustainable initiatives,**
 - **increasing taxes on use of finite resources while lowering taxes on labor,**
 - **legislation enabling safe recycling of food waste as animal feed, and**
 - **clear emission ceilings.**
- Concurrent investment is needed in education and transparent information:
 - to increase awareness of the **unsustainability** of our present food system and
 - to **change social norms and values** in favor of more sustainable practices.



No one solution

- Let's understand our food system
- Let's invent our own ways of dealing with the key challenges of the system - with careful consideration of the context
- Let's promise to ourselves not to run away with a component or stay in our silos.
 - Remember Aristotle's golden phrase "the whole is greater than the sum of its parts."



Thank you very much!



References (not complete)

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