



**INRAE**

**YOUNG EFFOST- EFFOST-ISEKI webinar**

**'Transition towards sustainable food systems: Needs and possibilities to act', 28/5/2021**



# **Overview on sustainable food systems (SFS): where are we now?**

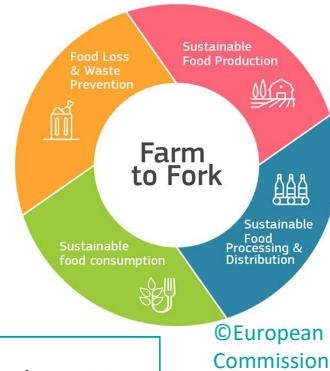
*in relation to Food Science & Technology (FST) and its connections to other domains*

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## ➤ Where are we now with our knowledge about SFS-concept?



Sustainability defined by Brundtland (1987)

**The concept of Sustainable Food Systems:** Sustainability refers to the long-term ability of food systems to provide food security and nutrition in a way that does not compromise the economic, social and environmental bases that generate food security and nutrition for future generations (HLPE, 2020)

Principles of bioeconomy: introduced in 2002 with focus on biotechnology, then on resources bioeconomy and now on (socio-)ecological bioeconomy (sustainable & circular?)

Principles of agroecology introduced by FAO in 2014 (in France in 2012 > legislation)

➤ *converging*

What are system(s) and system boundaries: **radar** with planetary limits (Rockstrom et al, 2009), **doughnut** including social lower limits: (Raworth 2017); **Seven food system metrics elements** with indicators (Chaudhary et al., 2018)

**17 UN-SDG & Green Deal & Soil Mission & Farm to Fork > *stated ambitions***

<https://sdgs.un.org/fr/goals/>

[https://ec.europa.eu/food/farm2fork\\_en](https://ec.europa.eu/food/farm2fork_en); [https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal\\_en](https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en);








<https://ec.europa.eu/jrc/en/science-update/developing-circular-and-sustainable-bioeconomy-europe-new-report-network-experts-bioeconomy-sets-out>;

[https://bioeast.eu/wp-content/uploads/2020/03/Food\\_partnership-update-BioEast-02-2020.pdf](https://bioeast.eu/wp-content/uploads/2020/03/Food_partnership-update-BioEast-02-2020.pdf);

<https://scar-europe.org/>; <https://www.sapea.info/topics/sustainable-food/>

Partnership SFS

## ➤ Where are we now?\*: Some FST-driven developments provide input to challenges

Some Food Science & Technology (FST) developments:		Challenge	SDG / Farm-to-Fork goals
Alternative proteins & new food structure-functions, eco-efficient (mild) processing & recycling,..		Climate change	Climate action, CO2 neutral (GHG), clean energy
Multi-functional & down-scaled bio-refineries, alternative diet compositions,..		Biodiversity loss	Life on land/sea, zero pesticides, 25% organics, low fertilizer inputs,..
New digitalization tools, on-site value creation, 'zero' waste and co-product valorisation schemes,..		Fair access to food for all	Zero Hunger, no poverty, 50% less waste & nutrients loss
Microbiome world, alternative diet compositions, (molecular) gastronomy, novel 'mild' processing,..		One Health / Global health	Healthy & sustainable diets, healthy environments
New packaging concepts, early-warning tools, intelligent systems controls, ..		COVID-19 ++	New safety measures, re-thinking supply chains
Food from salt tolerant crops and algae, new disinfection and storage methods, ..		Drought & salinity	Clean water, precision irrigation, salt tolerant crops
Food & Technology development with and for all stakeholders, in diverse contexts, with diverse targets, generating multiple impacts.....		Crises in general, green-blue environments, ....	Reduced inequalities, sustainable cities, ...

\*e.g. IPCC 2019 'climate', IPBES 2019 'biodiversity', EAT-Lancet 2019 'diets', WRI 2019 'world resources', FAO 2018 'food security', EC 2019 'food loss', numerous articles in TIFS, IFSET, etc.

➤ Food Science & Technology (FST)- driven developments evoke questions:

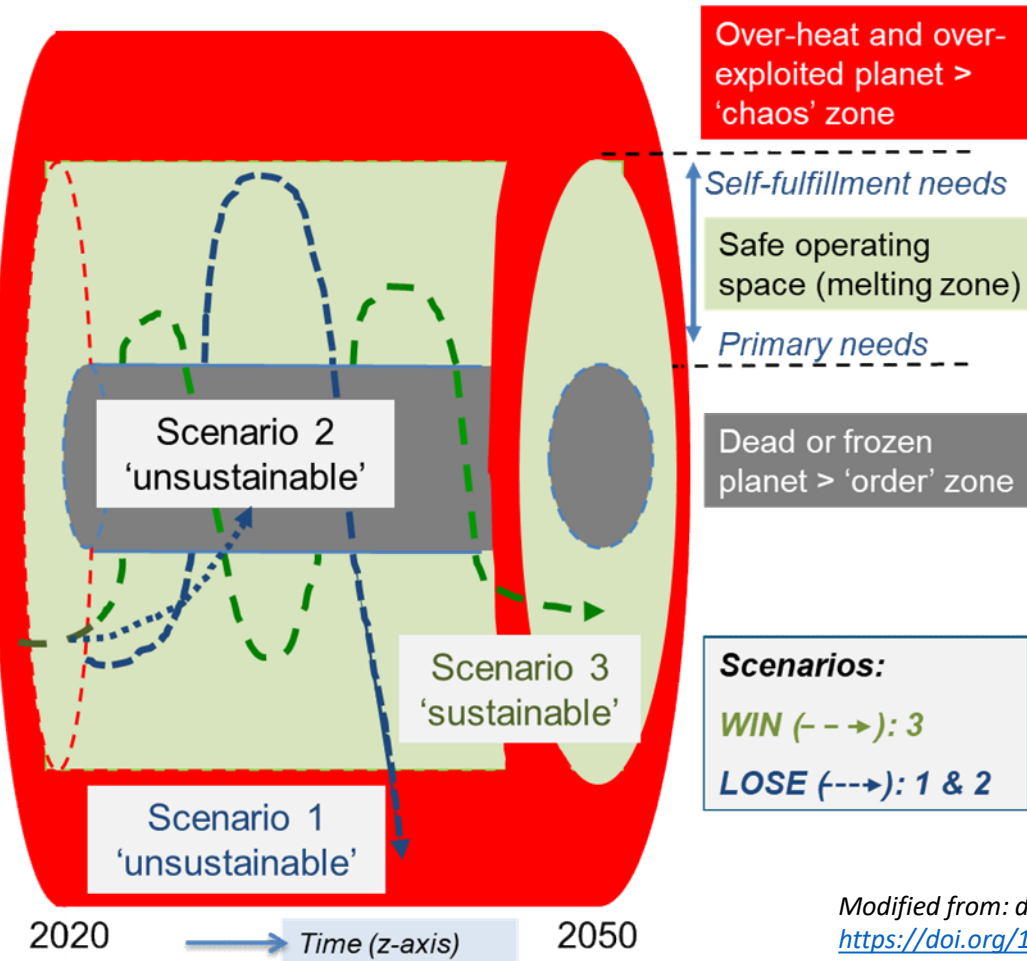
1. *While contributing to these goals and ambitions, do appropriate FST developments automatically result in sustainable food systems?*
2. *Can we guarantee that food systems will be sustainable without FST input (e.g. only from agroecology, sustainable livestock, healthy soil sciences,..) ?*

*Since the majority of consumed food is processed, distributed, (home) prepared, (partially recycled),.. – for nutritional value, food safety, digestibility, taste, cultural diversity, employment, ... reasons – the post-harvest domain may better not be overlooked.*

- Would a reversed chain thinking approach make more sense to define most suitable FST developments (Sustainability Goals and F-to-Fork ambitions as drivers for FST developments to reach sustainable food systems)?
- To answer these questions, one first needs a framework which explicit when food systems are evolving sustainably.

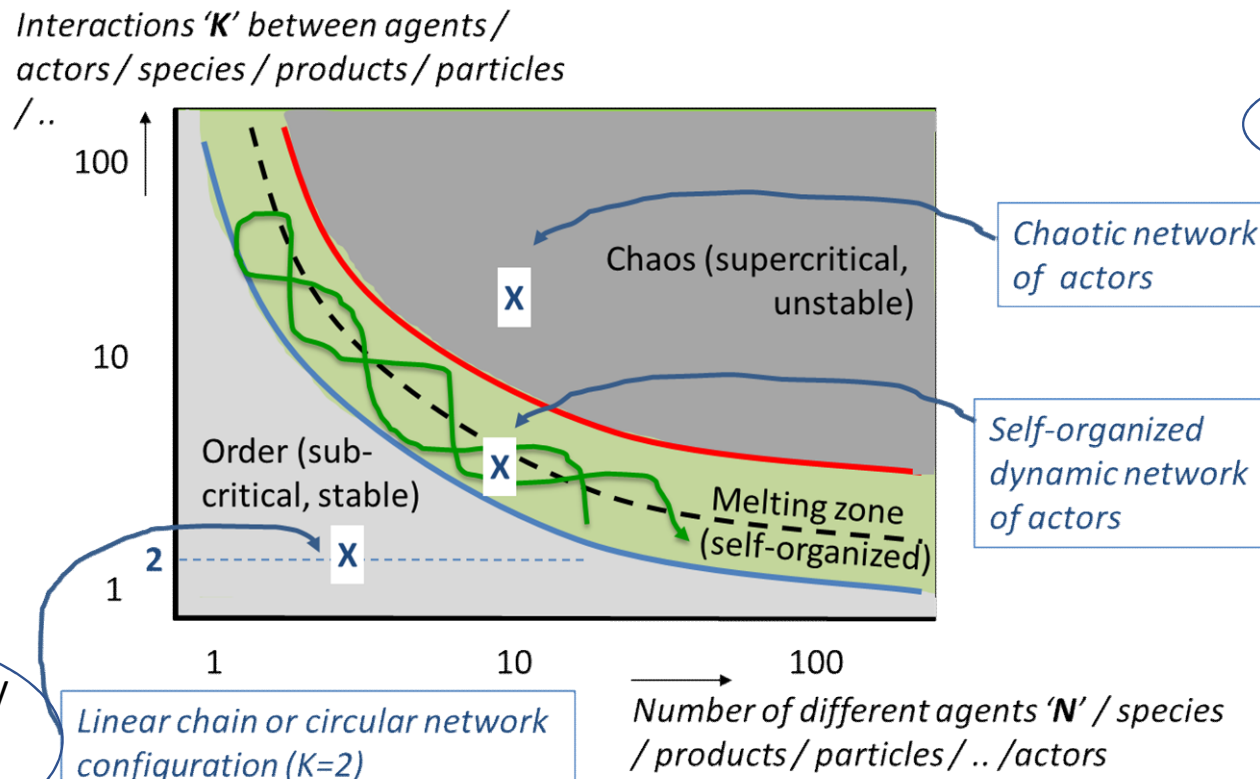
➤ This 'simple cylinder' framework explicits (un)sustainable patterns  
(here, in 3-dimensions, including the time dimension)

*A Sustainable Food System 'X' balances between order and chaos*



Modified from: de Vries et. al. 2021:  
<https://doi.org/10.1007/s10806-021-09850-7>

➤ This cylinder is inspired by laws of physics (I); do they suggest which systems are (un)sustainable? (here, in 2 dimensions)



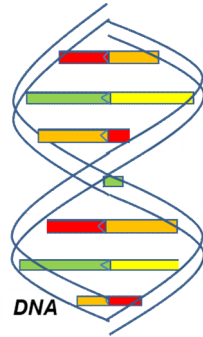
This holds for 'purely (i.e.  $K=2$ )' linear or circular configurations

Image from: De Vries et al. (2021): <https://doi.org/10.1007/s10806-021-09850-7>; Other related references: Prigogine, I., & Stengers, I. (1985); Kauffman, S.A. (1995); Carbonara, N., Giannoccaro, I. & McKelvey, B. (2010).

## ➤ What does the concept teach us:

- Even very complex food systems *with many actors* can evolve sustainably; however only if (i) the number of interactions are ‘reasonable’ and (ii) the upper & lower limits are strictly defined.
- Sustainable food systems show sinusoidal-like (2D) or helical patterns (3D).
- The number of Sustainable Food Systems may also follow a ‘unique mathematical expression’, namely a power law ( $= \sqrt{N}$ )!
- NOW, the practical question is: ‘which (complex) Food Systems are self-organized (adaptive and resilient) in such a way that they evolve sustainably?’

>> *This depends on the system elements; which are these?*

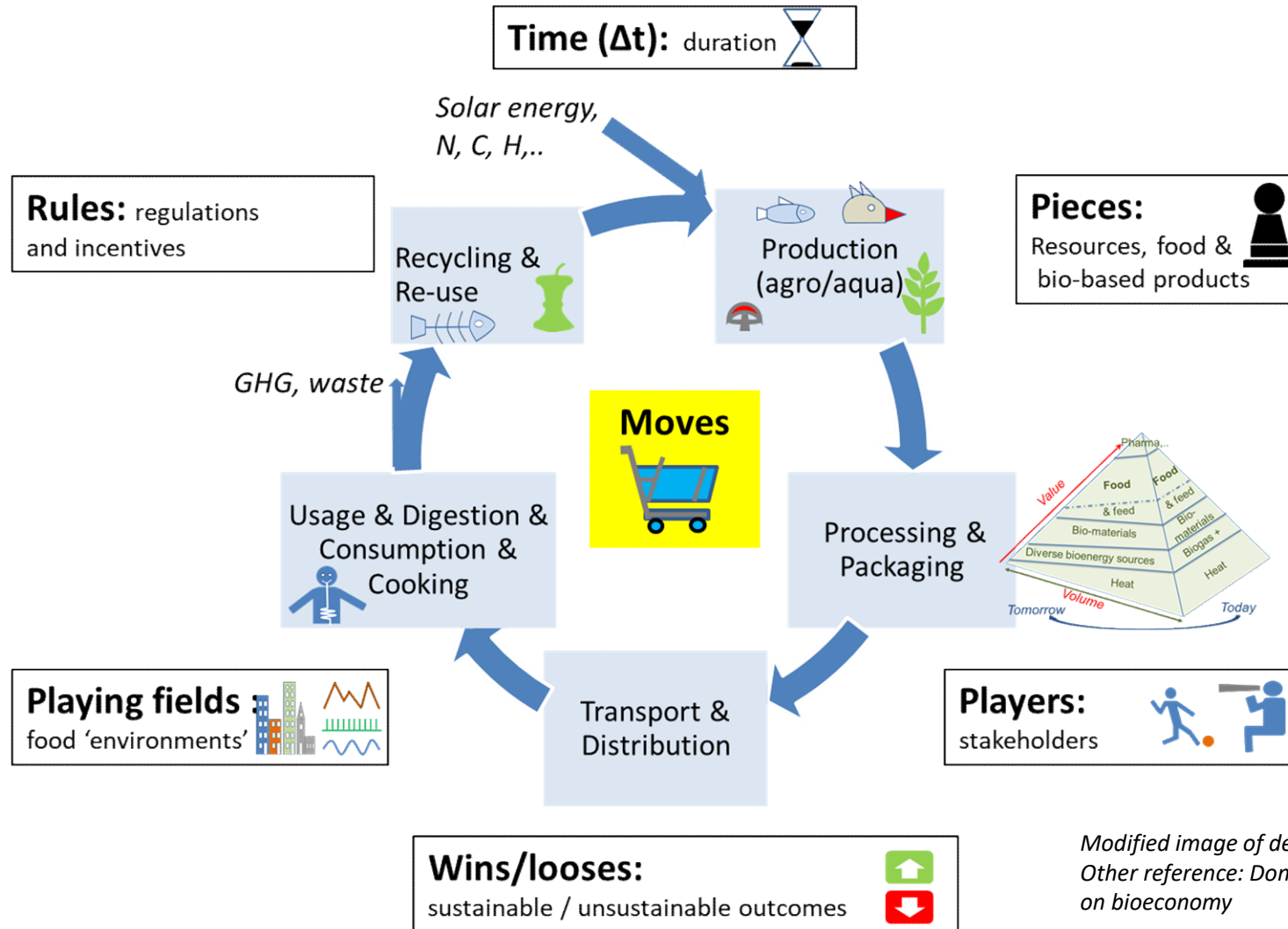


*Helical patterns  
in nature*



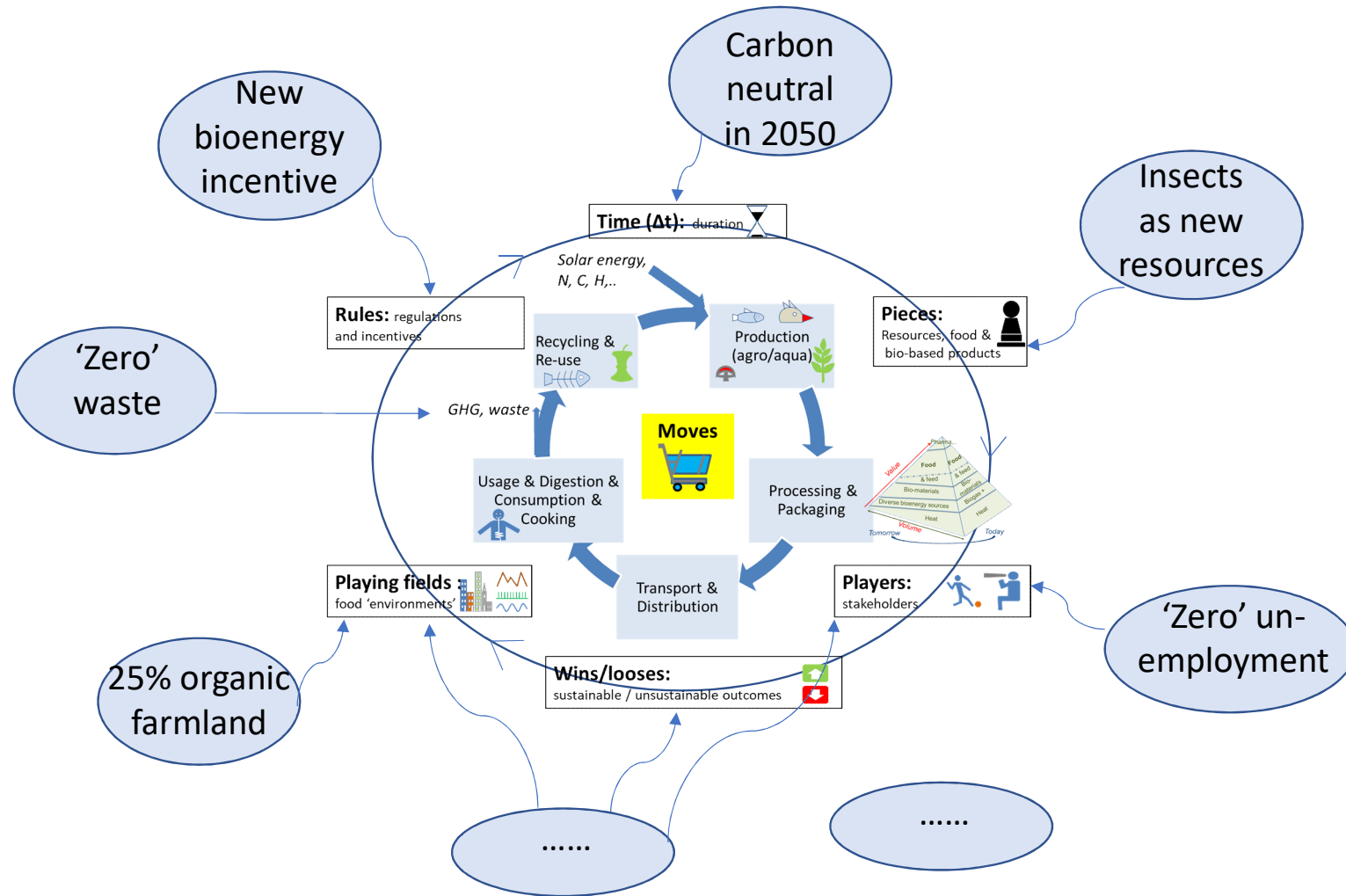
# > The seven building blocks of (food) systems (or of game theory):

Playing fields, Rules, Pieces, Moves, Players, Outcomes (win-lose), Time / duration





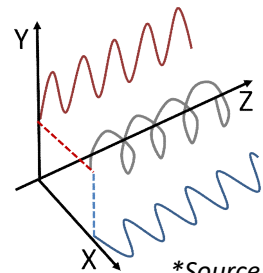
> Each external 'measure/stress/..' impacts all system elements



## ➤ The Q: which food systems (characteristics) 'are' sustainable?

1. A balanced usage of resources is needed (sinus pattern)
2. A balancing behaviour of food system actors (sinus) (thus, not only dominant and excessively rich, but networks of dynamic and co-creating players)

*Intermezzo: the combined balanced usage & behaviour forms a helical pattern in between order & chaos (see picture)*

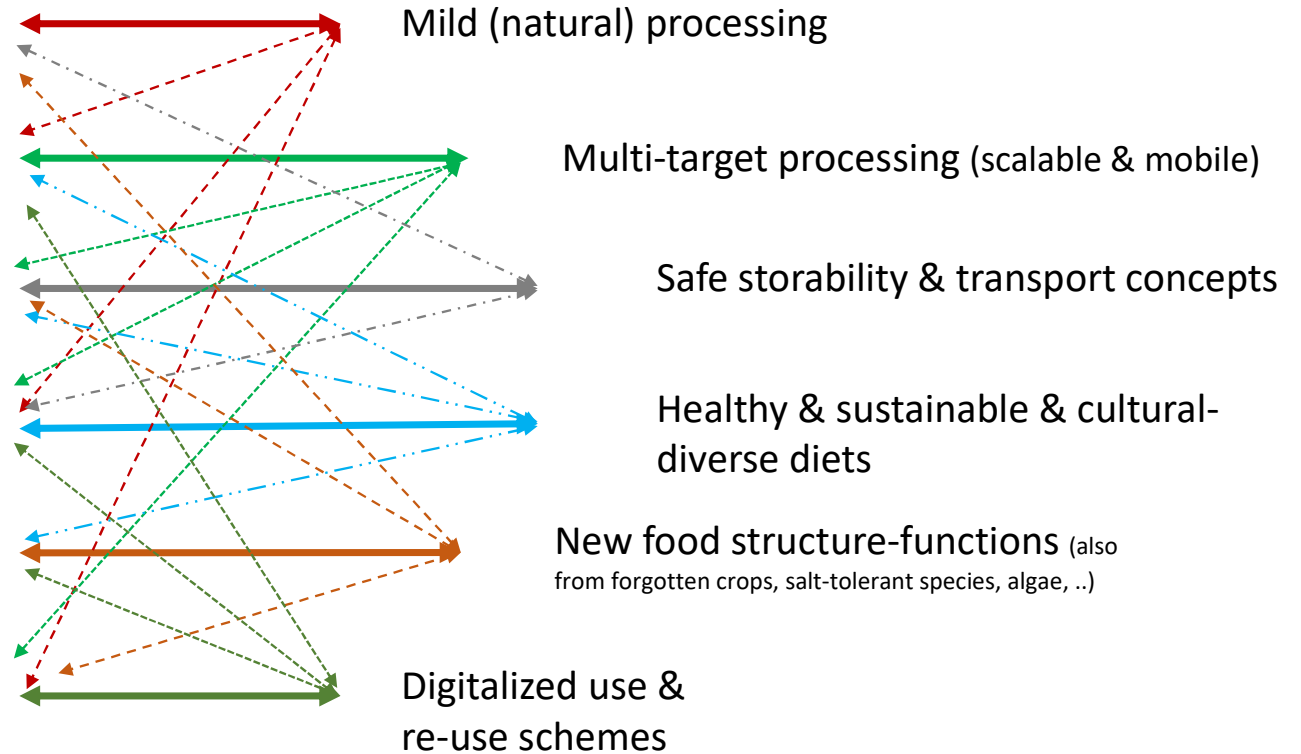


\*Source:  
see below

3. All SFS are **unique**, adapted to a context (i.e. playing field). If multiple Food Systems are individually sustainable the **sum** is also sustainable (scaling factor).
4. All FST development are part of 'moves and pieces'; they should **comply with the rules and goals** that define **both upper & lower limits** of safe & fair operating spaces

# ➤ Where are we heading to? A new balance between Mission-driven FST challenges and Science-creativity-driven FST activities

Challenge	SDG / Farm-to-Fork goals
Climate change	Climate action, CO2 neutral (GHG), clean energy
Biodiversity loss	Life on land/sea, zero pesticides, 25% organics, low fertilizer input, ..
Fair access to food for all, always (also during COVID)	Zero Hunger, no poverty, 50% less waste & nutrients loss, New safety measures, re-thinking supply chains
One Health / Global health	Healthy & sustainable diets, healthy environments
Drought & salinity	Clean water, precision irrigation, salt tolerant crops
Crises, green-blue environment,	Reduced inequalities, trade-offs, leverage points, sustainable cities, ...
....	...





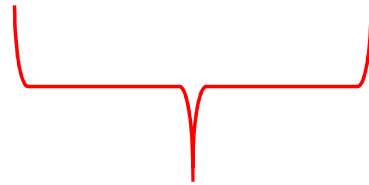
## ➤ Final considerations

- Climate-neutral or bio-diversity or clean water or ... are *the drivers* for FST.
- If FST is overlooked in a system, who takes *responsibility* for safe alternatives of food preservation, reaching zero waste in closed systems, get alternative protein diets, ..?
- Saying NO to technologies, to new food products and global food chains is NO OPTION; *however, finding new balanced solutions between different potential options is urgent.*
- Eco-technological innovations only will not suffice; but, together with organisational and social innovations, solutions can be found for reaching Sustainable Food Systems.
- A new, inclusive, Partnership on Safe & Sustainable Food Systems is then needed to cross borders of specific stakeholder groups, production sectors (moves), single resource-product chains, playing fields, and targeted regulations.

Making the healthy and sustainable choice the easy choice



Making the healthy and sustainable choice the *safe, tasteful, digestive, diverse, accessible, social, job-creating* and easy choice.



FST gives a positive flavor to the enormously challenging pathways ahead of us

Making the transition happen: informed choices and efficiency gains

- ▶ **The creation of a healthy food environment which makes the healthy and sustainable choice the easy choice.**

It is estimated that in the EU in 2017 over **950,000** deaths were attributable to unhealthy diets (one out of five).

A healthy and plant based diet reduces the risk of life threatening diseases and the environmental impact of our food system.
- ▶ **Food labelling to empower consumers to choose healthy and sustainable diets**

The Commission will propose mandatory harmonised front-of-pack nutrition labelling and develop a **sustainable food labelling framework** that covers the nutritional, climate, environmental and social aspects of food products.
- ▶ **Stepping up the fight against food waste**

**Halving per capita food waste** at retail and consumer levels by 2030.

The Commission will propose legally binding **targets** to reduce food waste across the EU by 2023.
- ▶ **Research and innovation**

**EUR 10 billion** under Horizon Europe to be invested in R&I related to food, bioeconomy, natural resources, agriculture, fisheries, aquaculture and environment. **Knowledge transfer will be essential.** The CAP's Farm advisory services and Farm sustainability data network will be instrumental in assisting farmers in the transition.
- ▶ **Promoting the Global transition**

Making European food famous for its sustainability can add a competitive advantage and open new business opportunities for European farmers.

The EU will collaborate with third countries and international actors to support a global move towards sustainable food systems. **A sustainability food labelling framework will facilitate consumer choice.**

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*Thanks to all colleagues, young and many years young for their inspiration in the past years and collective actions.*

*Thanks to you for your attention and good luck with your pathways towards more sustainable food systems;*

*Hopefully, our pathways will cross!*

<https://www.effost.org/effost+international+conference/effost+conference+2021/>

<https://www.inrae.fr/en> ; <https://scar-europe.org/index.php/food> ; <https://umr-iate.cirad.fr/>

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