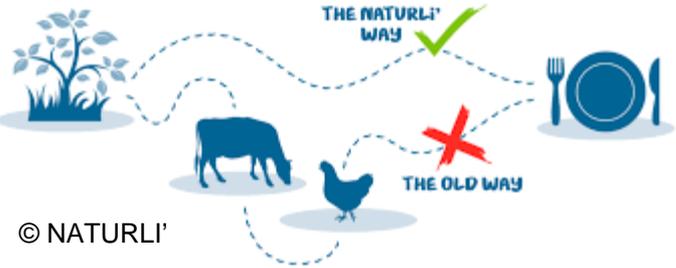


WTF are legumes, anyway?

HUFF POST AUSTRALIA

What needs to be done now to make it really possible to increase legume production in mixtures for food

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50 years anniversary - 1972-2022

Roskilde University was originally established in order to challenge academic traditions and to experiment with new ways to create and acquire knowledge

- Problem oriented approach to knowledge creation
- Interdisciplinary approaches

Methodological and
theoretical toolbox

50%

courses

Use theory and method
in situated practices

50%

project work

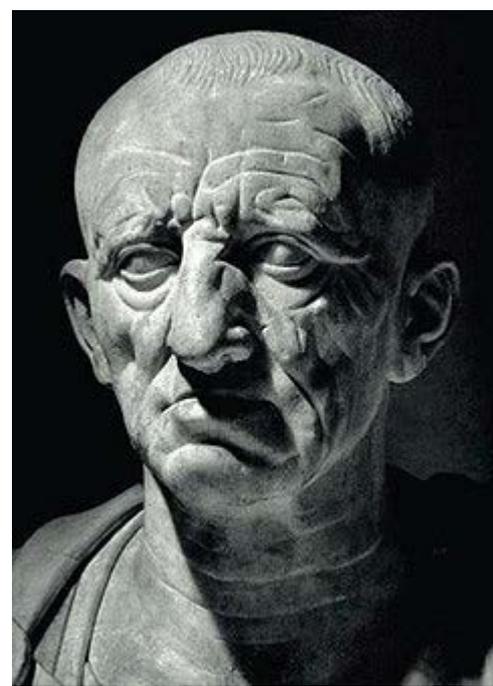
This is not new (forgotten knowledge)



Marcus Porcius Cato

(234–149 BC); Roman soldier, senator, and historian

“De agri cultura” report on agriculture, farming, rituals, and recipes



“Crops which fertilize land: Lupines, beans and vetch”

- Unlike the rich Romans, the common peasants were more dependent on staple vegetables like grain legumes than any other food source.
- Often mixed into bread (wheat) as a readily available sources of protein and became a routine staple in Roman meals.



Heterogeneity rather than homogeneity

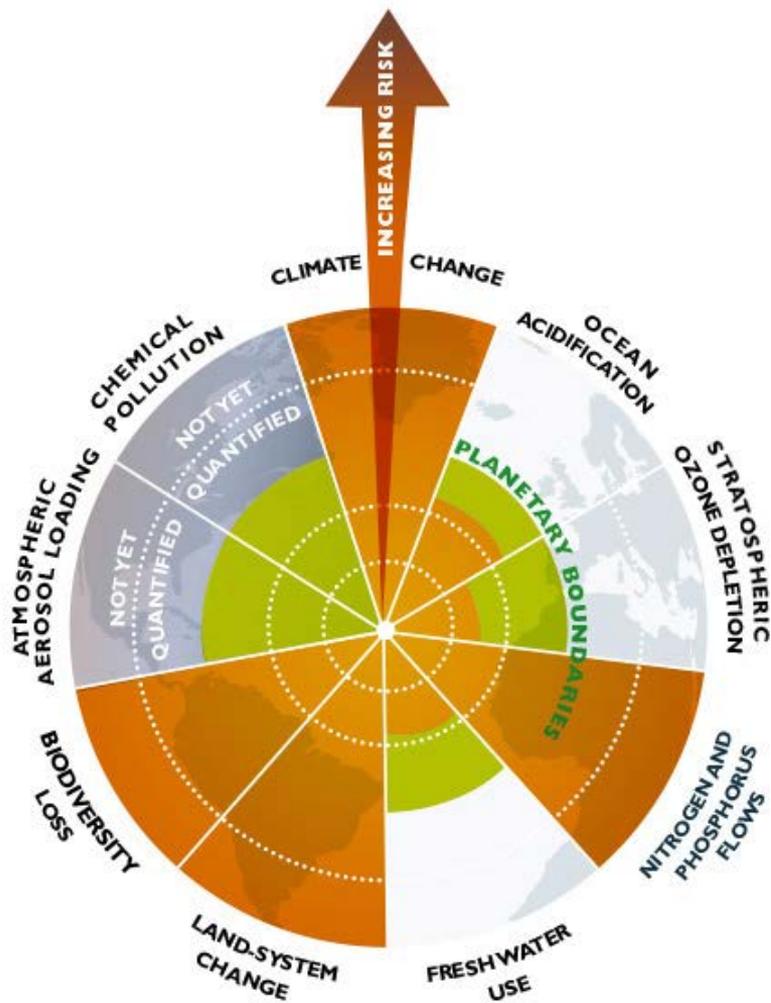
Heterogeneous wheat populations show adaptation potentials to climate change challenges (legumes in mixtures?).

BAKWERT aims to pave the way into prosperous ecological value chains.

* cultivation; milling and baking; marketing of baked goods (environmental storytelling).



Planetary boundaries



Source: Steffen et al. 2015¹, © SYKE & SITRA

The anthropocene

- weather variability, natural hazards, and pests and diseases
- shocks to the market like supply shortages due to e.g., drought
- price volatility affecting value chain actors' economic returns
- **reducing the capacity to invest and innovate**

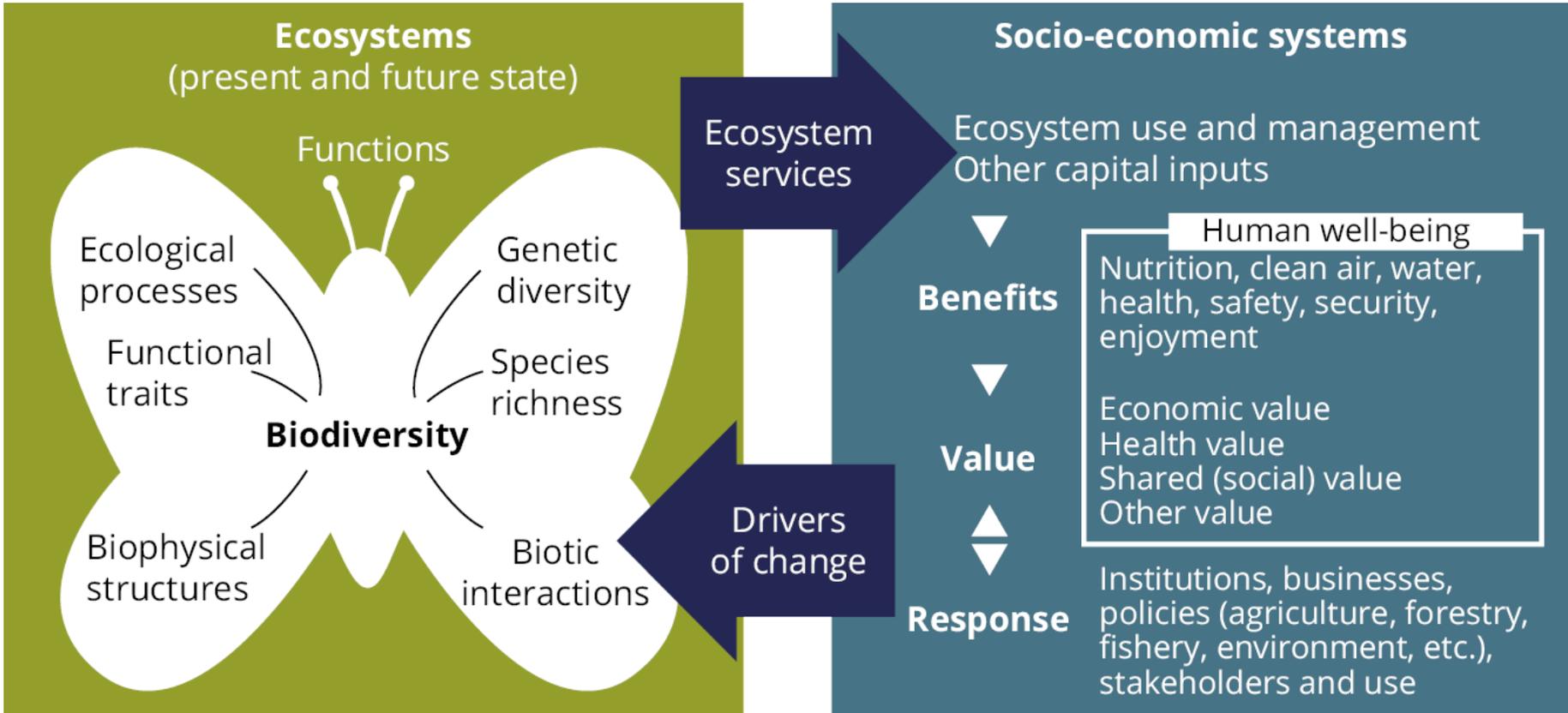
Sustainable development

Hans Carl von Carlowitz - tax auditor and administrator in mining and resources (1645-1714 Freiberg, Saxony).

In the dissertation titled "Sustainable supply of firewood from the forest" from 1713 he proclaimed that "...as an authority we are deeply concerned about the removal of wood and the forest ability to regenerate"



#1 Interconnectiveness (people-nature)



The EAT-Lancet Healthy Reference Diet



Source: EAT-Lancet Report, 2019



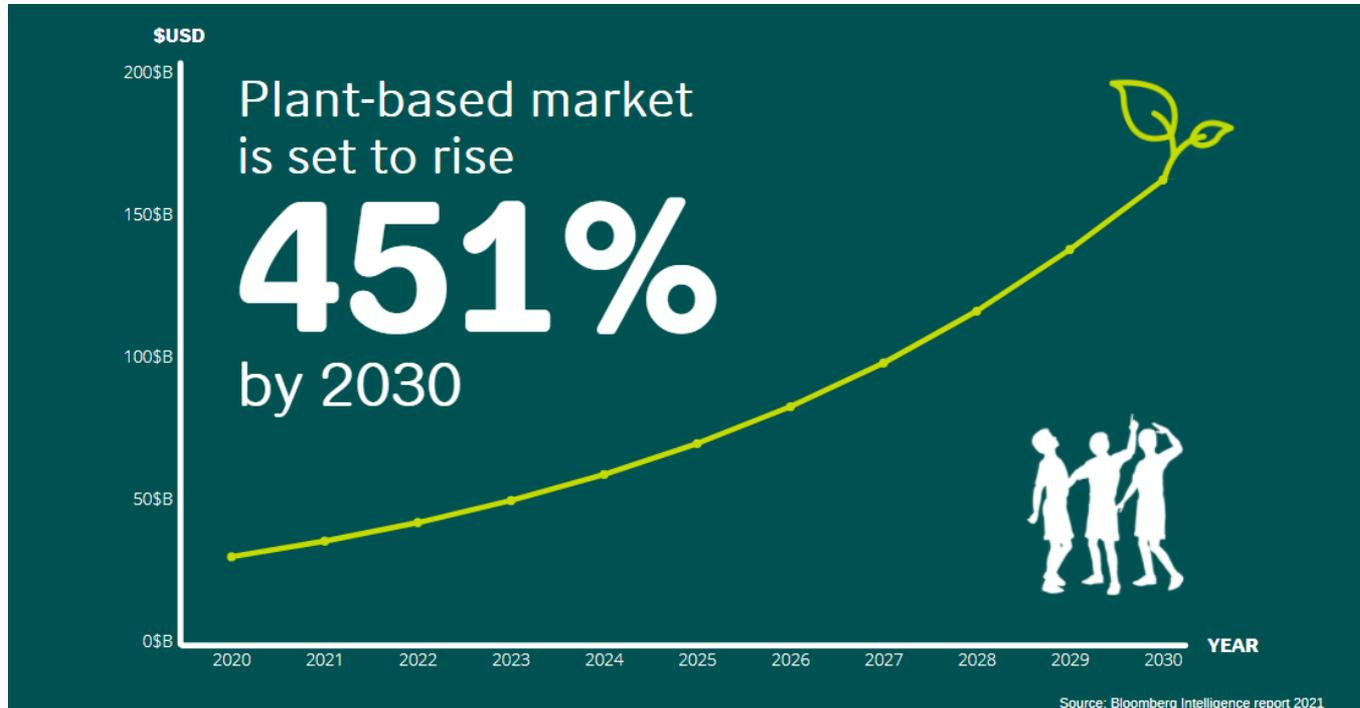
Legume production

- Improve EU **self-sufficiency** in plant proteins and may improve human health
- Produce high quality grain protein and carbohydrates for food (and feed)
- Supply CO₂-neutral and free nitrogen for crop production - reduce N-fertilization
- Reduce greenhouse gas emissions from crop production
- **Self-regulation** due to crop diversification strategies reducing pesticide needs
- Improve the farm economy and climate impact

Alternative to the real thing

- Plant-based food sales grew 10% a year from 2010 to 2020 and, in some EU countries by up to 49% in just the past two years

Source: [smartproteinproject.eu](https://www.smartproteinproject.eu)



Plant based meat labels: Germany

2021

FMCG



RETAILER



LOCAL/TRADITIONAL



PURE PLAYERS/ INDEPENDENT



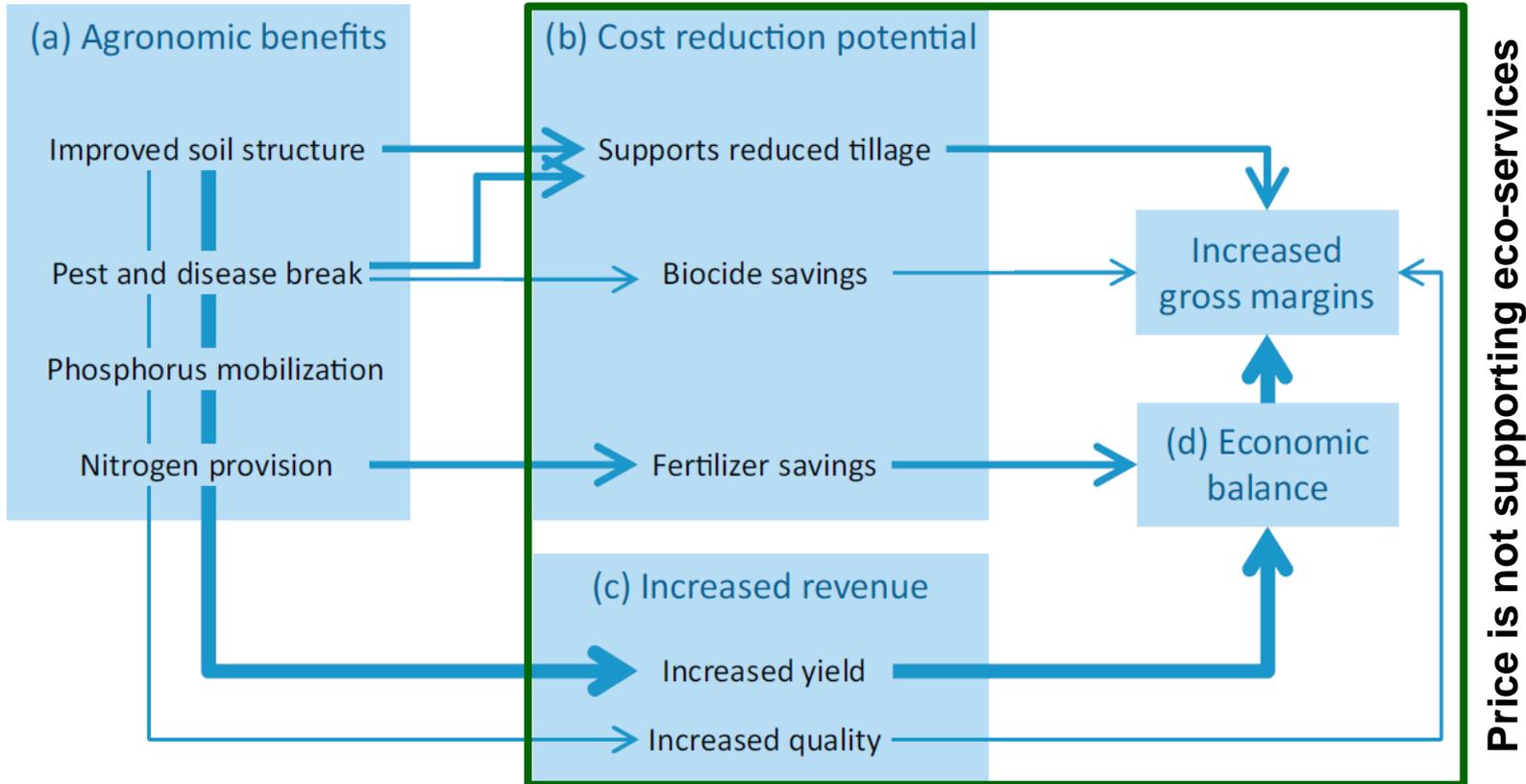
www.futuregroceryshopping.com

Fork-to-farm market pull?

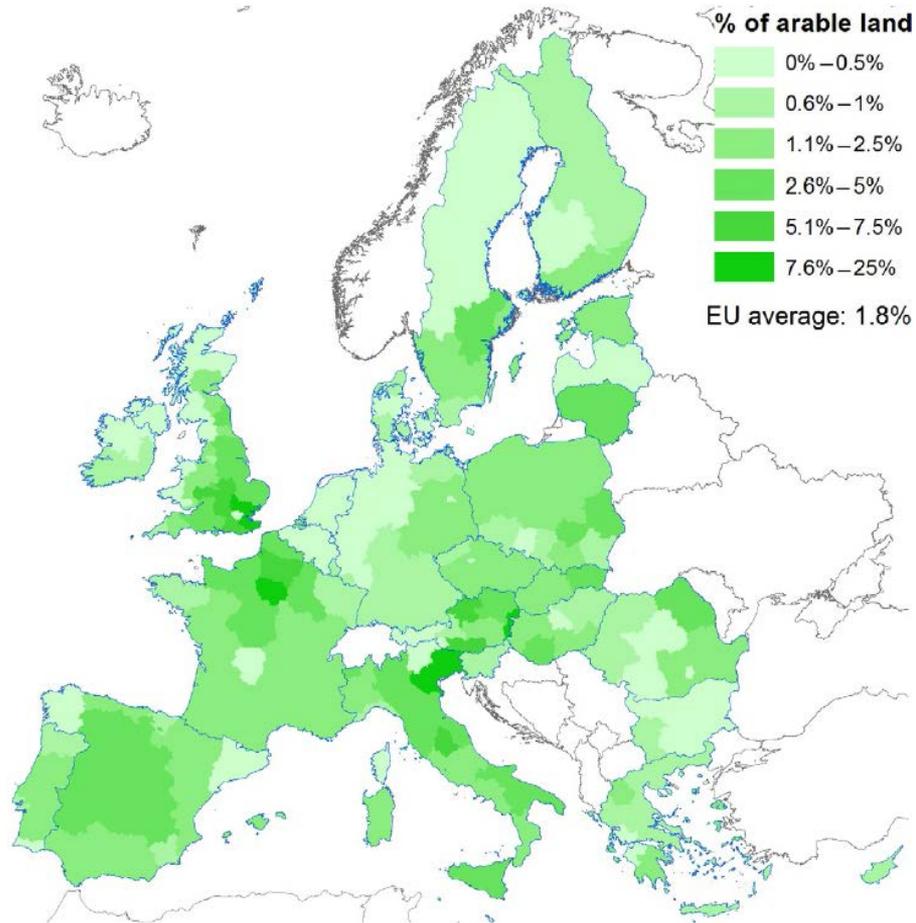


*The Farm to Fork Strategy is at the heart of the European Green Deal

Production of leguminous raw materials



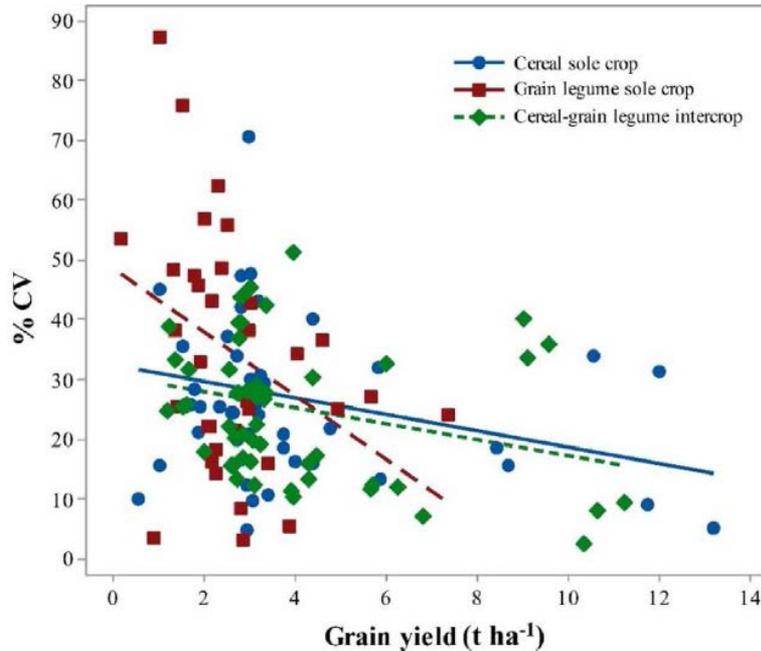
Source: Preissel et al 2015



Canada ~ 12.5%
USA ~ 32%



Source: Raseduzzaman and Jensen, 2017



Who is taking the risk?

- Grain legume compared to non-legume yields are more variable
- This may explain that European farmers tend to turn to non-legumes
- Expansion of legume production for food may be hindered by this yield variability (risk)

From simplification to diversification



**Crop
production**

+ 14%



**Pest and disease
control**

+ 63%



**Water
quality**

+ 50 %



**Soil
quality**

+ 11%



Source : Bellouin, D., Ben-Ari, T., Malzeieux, E., Seufert, V. and Makowski, D., 2021. Positive but variable effects of crop diversification on biodiversity and ecosystem services. *Global Change Biology*.

1. From producing a variety of crops and cultivars on a farm (<1950)
2. - to an agroecosystem simplification by chemical and mechanical inputs (>1950)
3. - to a reintroduction of crop diversification strategies (>2022)

Grain legume–cereal intercropping: The practical application of diversity, competition and facilitation in arable and organic cropping systems

Henrik Hauggaard-Nielsen^{1,*}, Bjarne Jørnsgaard², Julia Kinane¹, and Erik Steen Jensen¹

Plant and Soil 236: 63–74, 2001.
© 2001 Kluwer Academic Publishers. Printed in the Netherlands.

Temporal and spatial distribution of roots and competition for nitrogen in pea-barley intercrops – a field study employing ³²P technique

H. Hauggaard-Nielsen^{1,3}, P. Ambus¹ & E.S. Jensen²



Field Crops Research 70 (2001) 101–109

Field Crops Research
www.elsevier.com/locate/fer

Interspecific competition, N use and interference with weeds in pea–barley intercropping

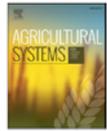
H. Hauggaard-Nielsen^{a,*}, P. Ambus^a, E.S. Jensen^b



Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/agsy



Exploring transitions towards sustainable farming practices through participatory research – The case of Danish farmers' use of species mixtures

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Methodological Reflections on Monitoring Interactive Knowledge Creation during Farming Demonstrations by Means of Surveys and Observations

Ane Kirstine Aare^{1,*}, Hanne Cooreman², Cristina Virto Garayoa³, Esther Sótir Arrieta³, Natalia Bellostas³, Fleur Marchand² and Henrik Hauggaard-Nielsen¹

Front. Agr. Sci. Eng. 2021, 8(3): 450–473

<https://doi.org/10.15302/J-FASE-2021415>

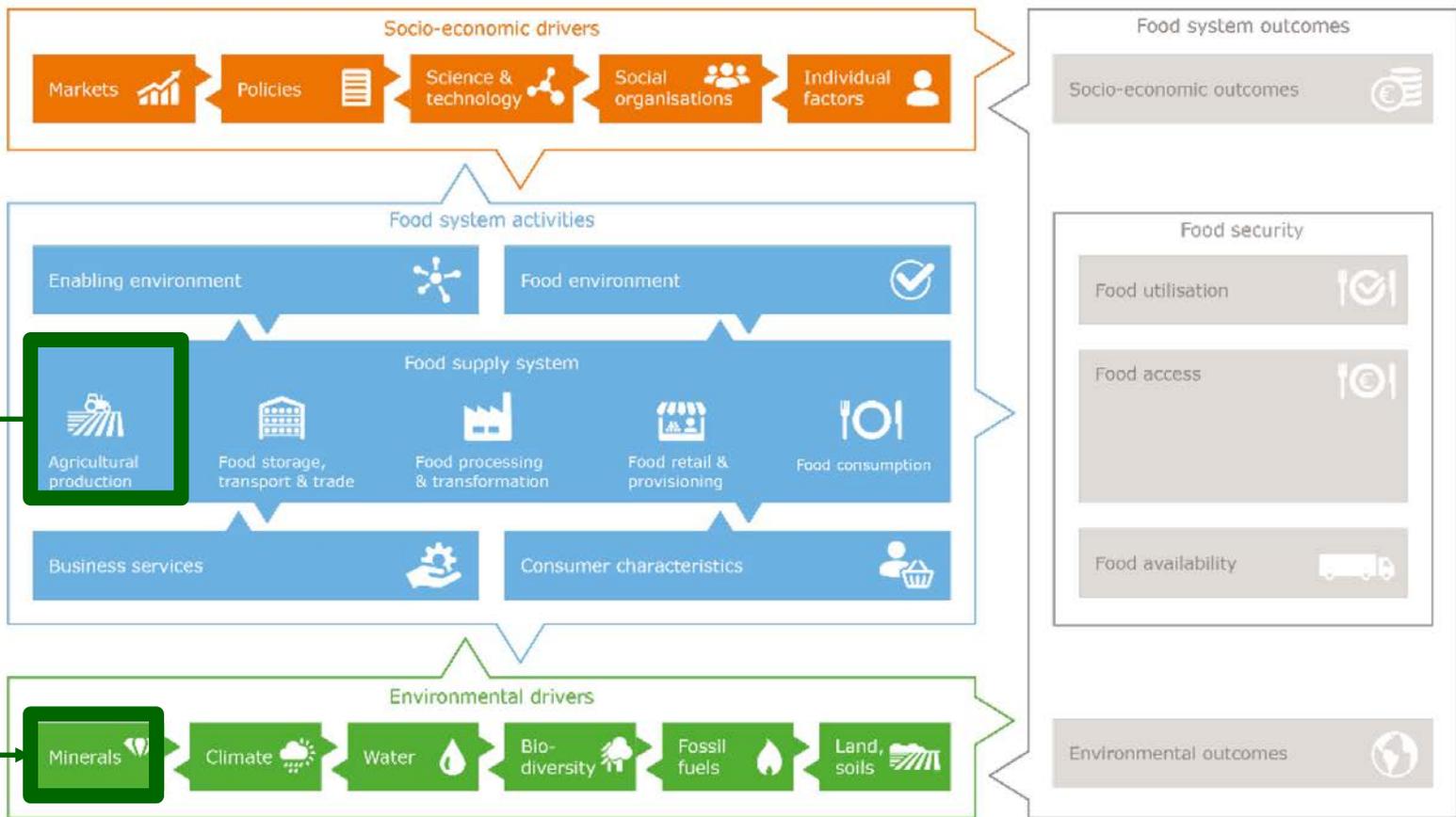
RESEARCH ARTICLE

TRANSLATING THE MULTI-ACTOR APPROACH TO RESEARCH INTO PRACTICE USING A WORKSHOP APPROACH FOCUSING ON SPECIES MIXTURES

Henrik HAUGGAARD-NIELSEN¹, Søren LUND¹, Ane K. AARE¹, Christine A. WATSON², Laurent BEDOUSSAC³, Jean-Noël AUBERTOT⁴, Iman R. CHONGTHAM⁵, Natalia BELLOSTAS⁶, Cairistiona F. E. TOPP⁷, Pierre HOHMANN⁸, Erik S. JENSEN⁹, Maureen STADEL⁹, Bertrand PINEL⁹, Eric JUSTES¹⁰



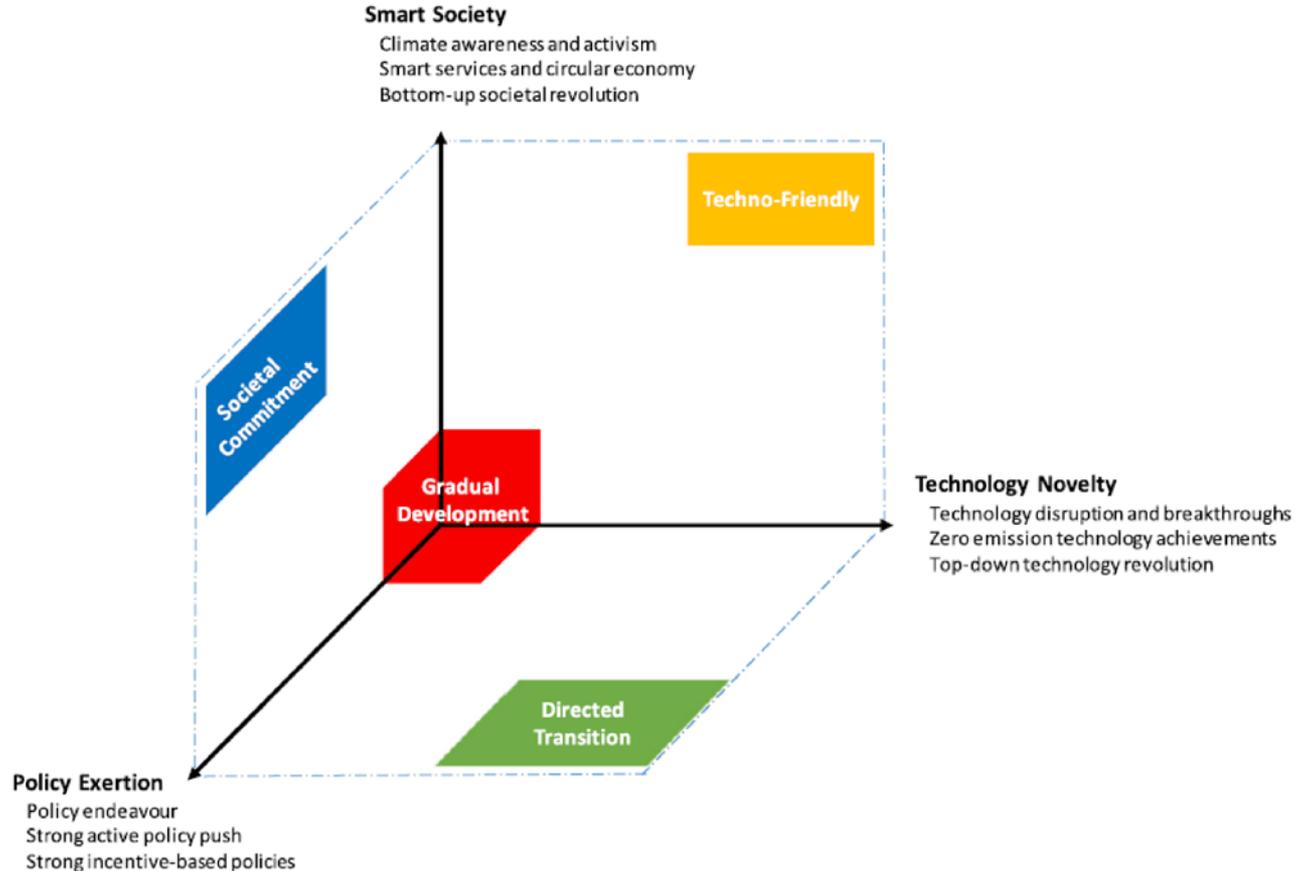
#2 Interconnectiveness (multi-level approach)



Knowledge building (across)

Source: Borman et al, 2022

How to make it happen?



Source: Zwickl-Bernhard and Auer, 2021

Conclusion: How to make it possible?

- Achieving climate and biodiversity (health?) ambitions requires a paradigm shift in the agri-food sector – radical rather than incremental (gradual) transitions
- Increasing consumer demand for plant-based foods
 - * *institutional changes and favorable EU regulatory framework*
 - * *support local exemplary frontrunner showcases*
- Raw materials for direct human consumption require new (old) farmer skills
 - * *harvest, storage and separation machinery after harvest, when mixed*
 - * *challenging purity requirements and sanitary quality of food products*
- Agri-food knowledge building for new (and old) entrants to this value chain
 - * *co-creation through exemplary dialogues between stakeholders*
 - * *educate consumers (and policymakers)*
 - * *spur the growth of viable startup companies*