Research Institute of Organic Agriculture FiBL
info.suisse@fibl.org | www.fibl.org




Towards a modular and coherent approach to sustainability assessment of food value chains

Christian Schader

Sustainability Assessment of Agrifood Systems,
Center for Sustainable Food Systems, Justus Liebig University, Giessen, 20-21 November 2025

Outline

1. Why do we need a coherent and a modular approach to sustainability assessment?
2. What can we do about it?

Sustainability Assessments in the private sector


BCI
FAIRTRADE
FSC
BSCI
fair for life
FAIR WEAR FOUNDATION
GLOBALG.A.P.
BIOSUISSE
GRMS
tft
FAIRWILD
Clean Clothes Campaign
CARBON TRUST
COTTON MADE IN AFRICA
EICC
FAIR TRADE USA
Ecolabel
Green-e
IFS
IRIS
SAI
veriflora
SQF
RTRS
VCS
USDA ORGANIC
life
ICMM
SGE 21
TourCert
KRAV
Sustainability label
Proterra FOUNDATION
WRAP
SIZA
GMP+ International
SPP

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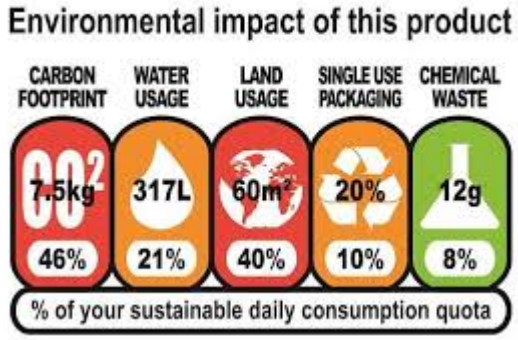
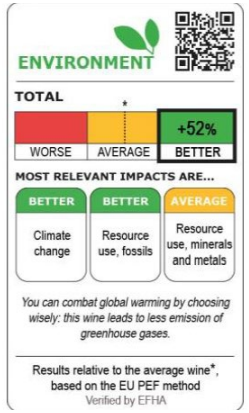
Types of product environmental footprints on food products

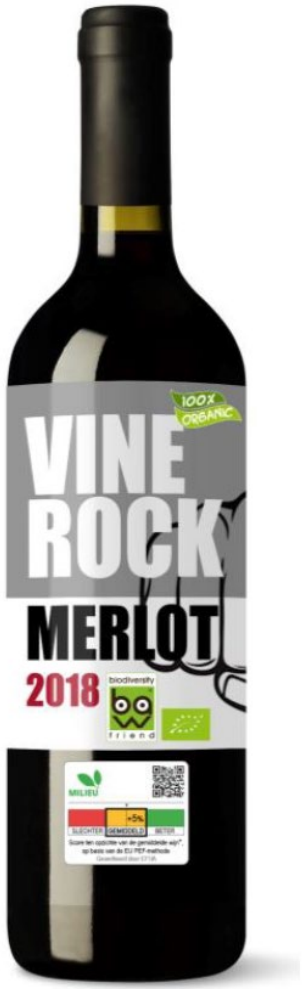
working with the Carbon Trust

100g CO2

per product







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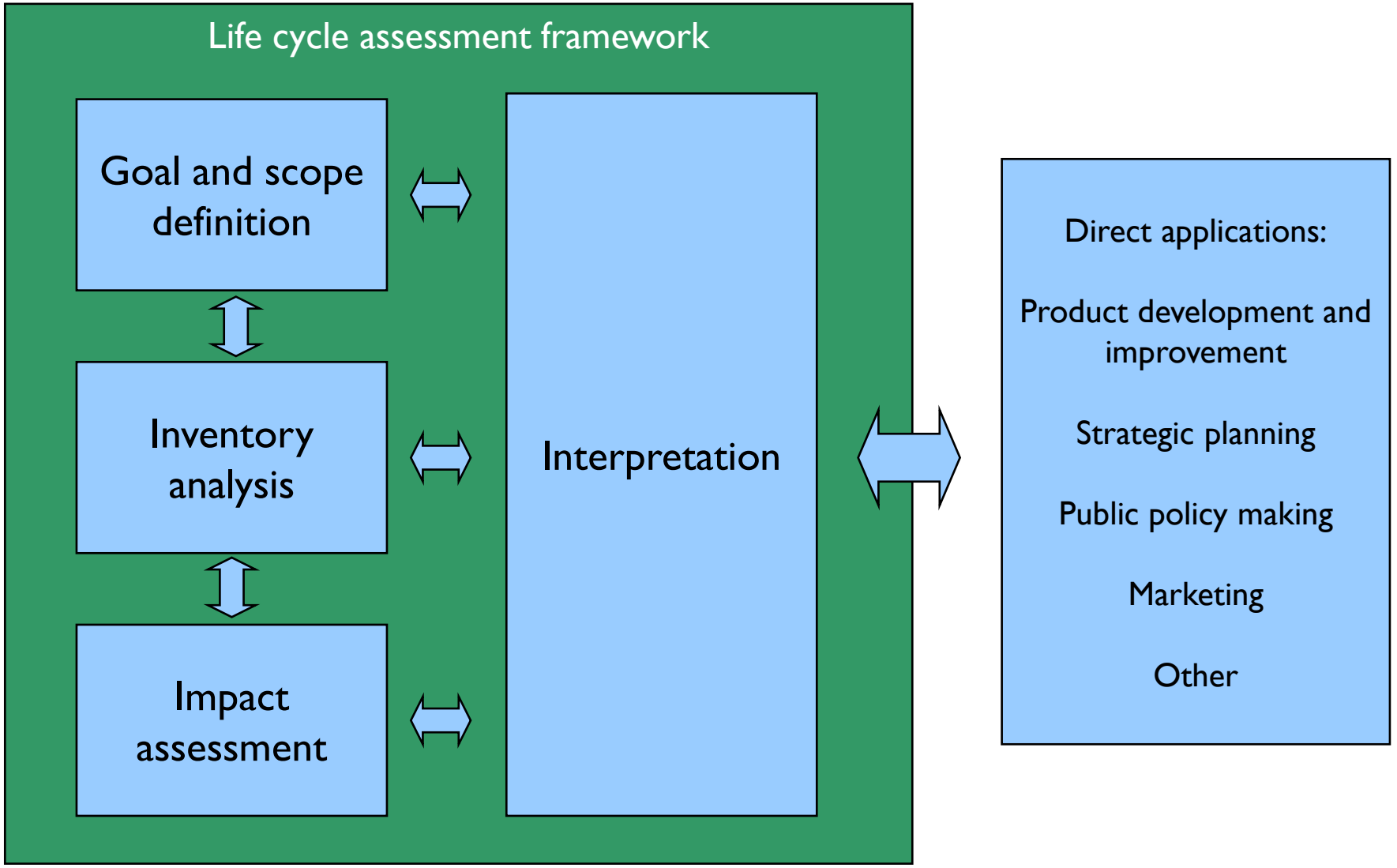
Life cycle assessments (ISO 14040-14044)



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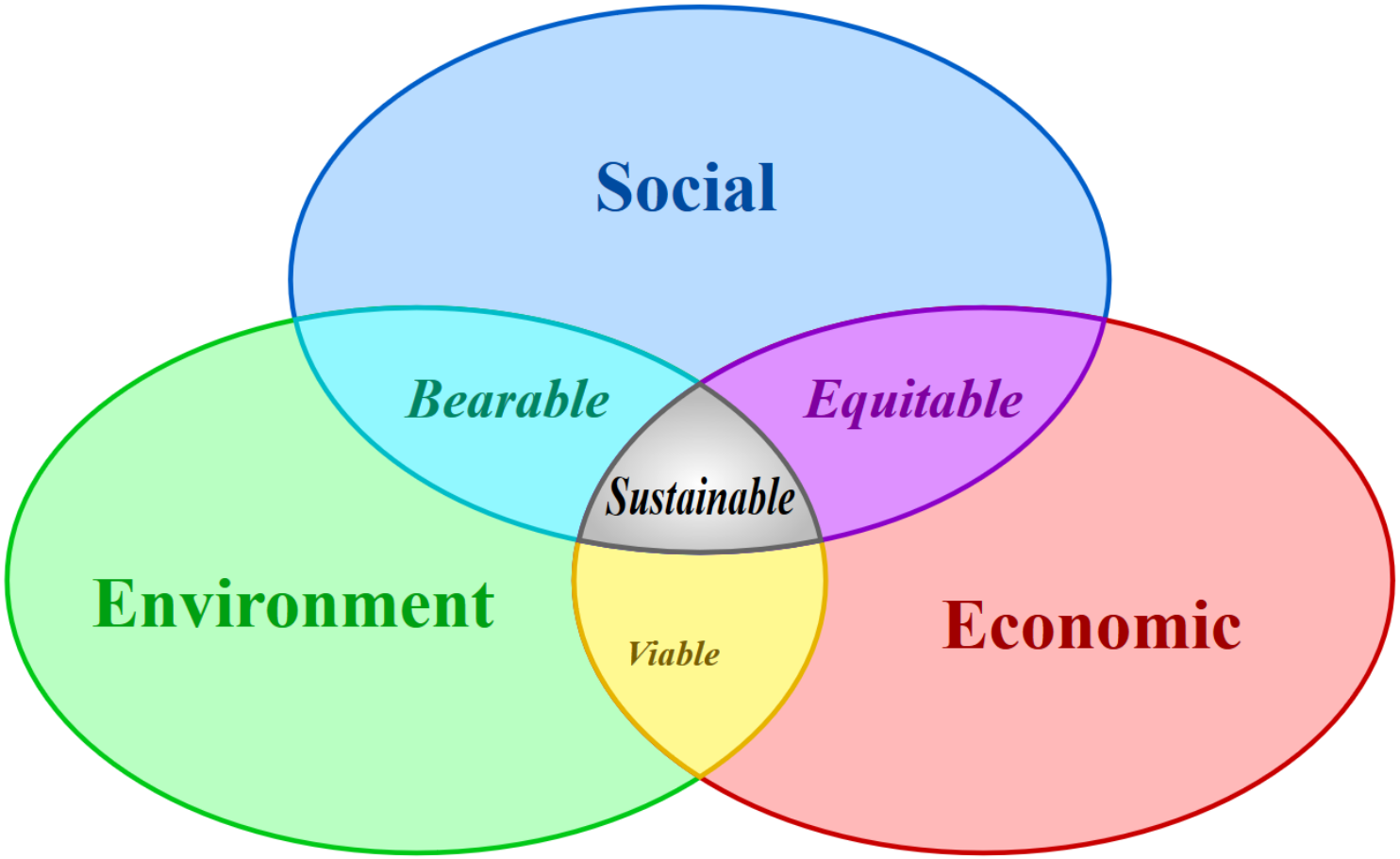
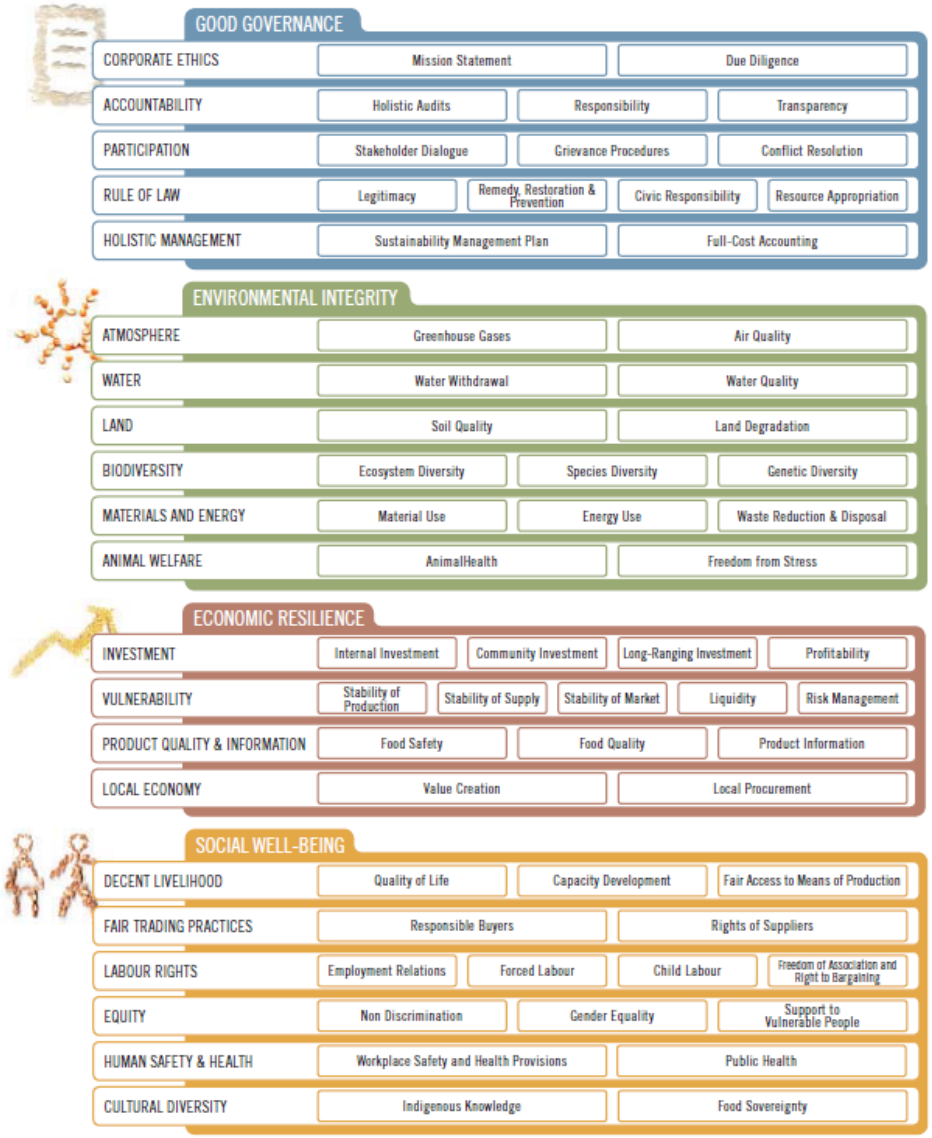
Three pillars of sustainability



Source: Adams 2006

Guidelines for sustainability assessment of agriculture and food systems (SAFA)



- 4 Dimensions
- 21 Themes
- 58 Sub-themes with sustainability objectives

SAFA
SUSTAINABILITY ASSESSMENT OF FOOD AND AGRICULTURE SYSTEMS

Food and Agriculture Organization of the United Nations

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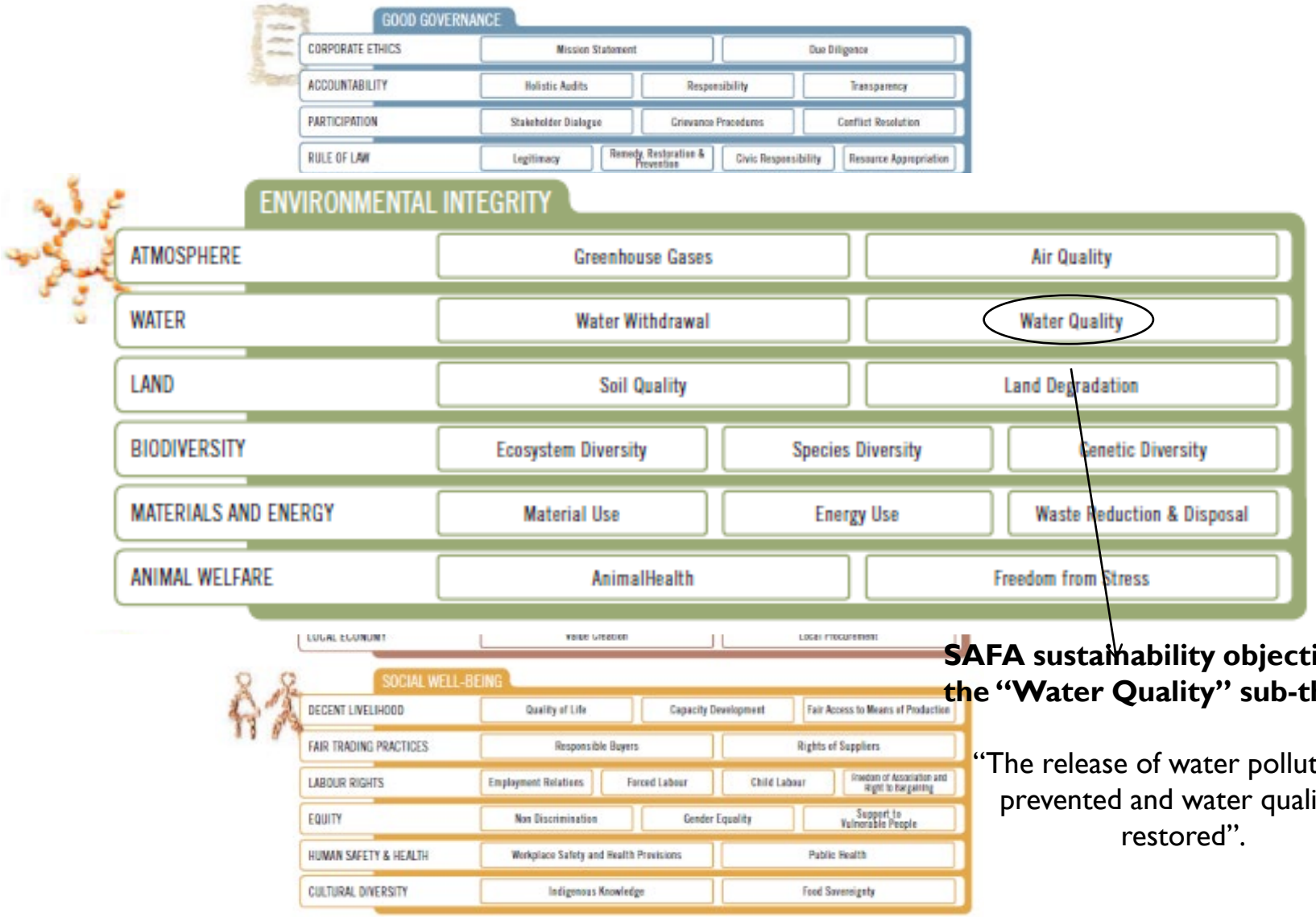
SAFA Guidelines



SAFA sustainability objective for the "Water Quality" sub-theme:

"The release of water pollutants is prevented and water quality is restored".

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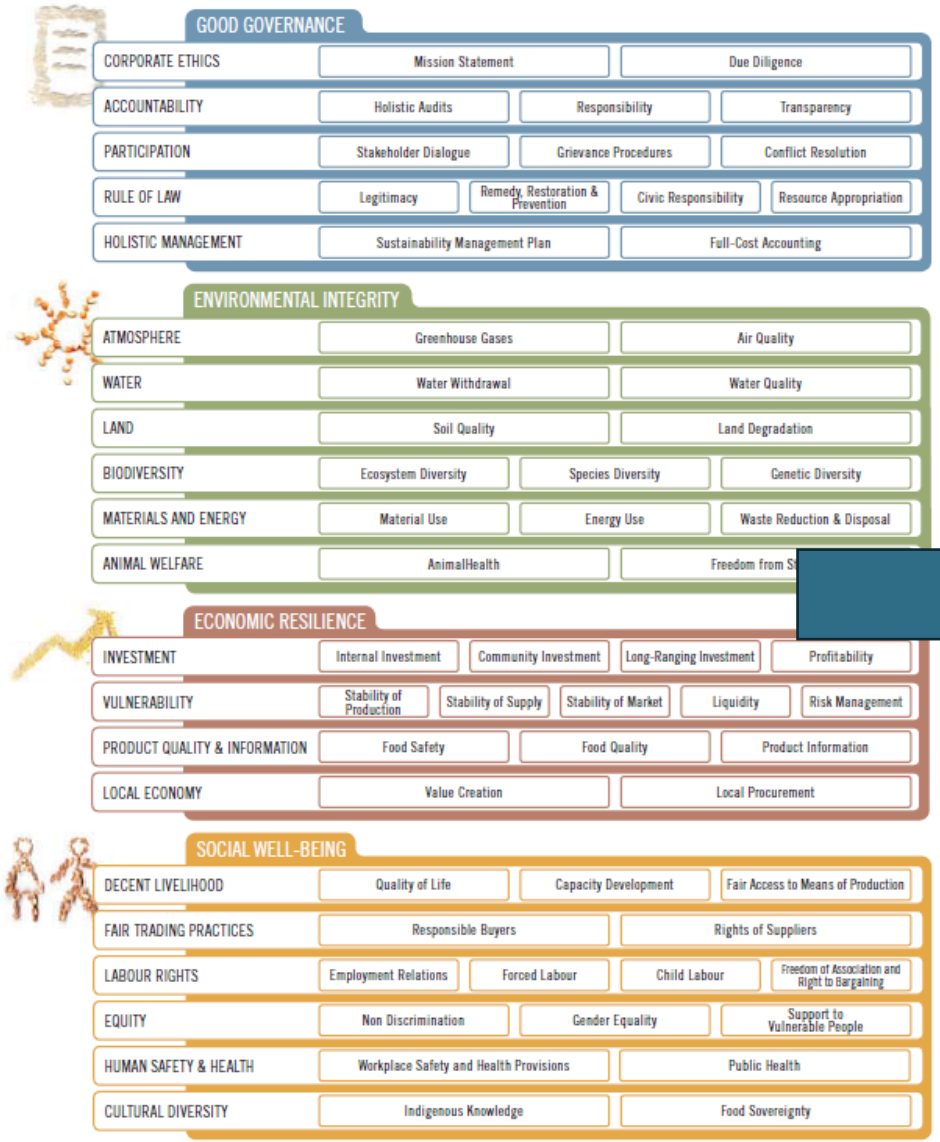
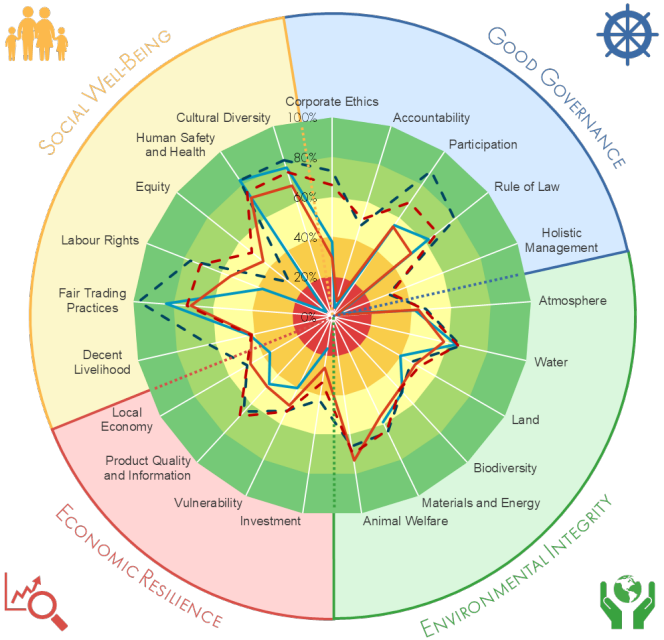
Tools for implementing the frameworks





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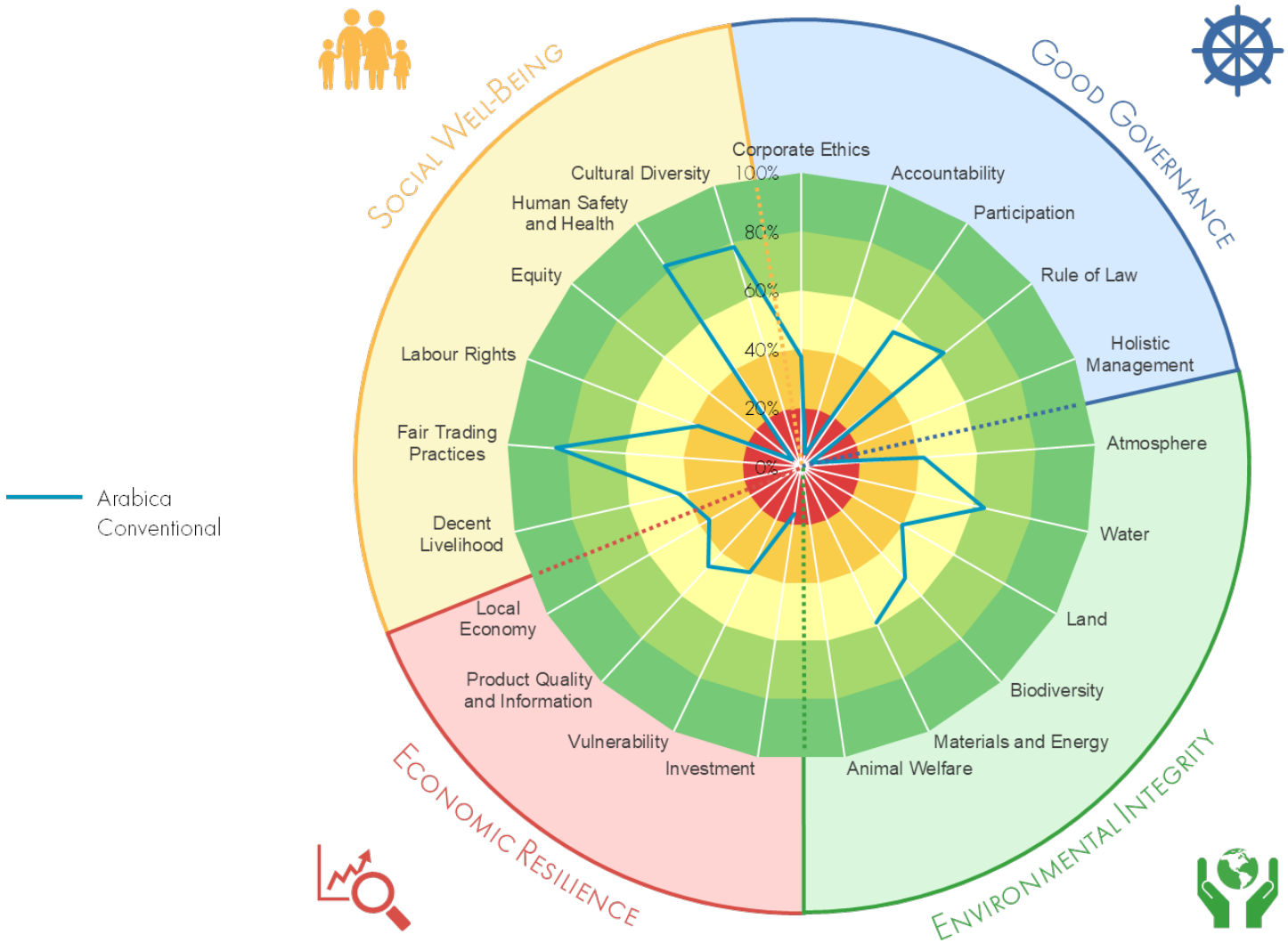
On-farm data collection

Sustainability Assessment of Coffee Production in Uganda



Source: Ssebunya et al 2019

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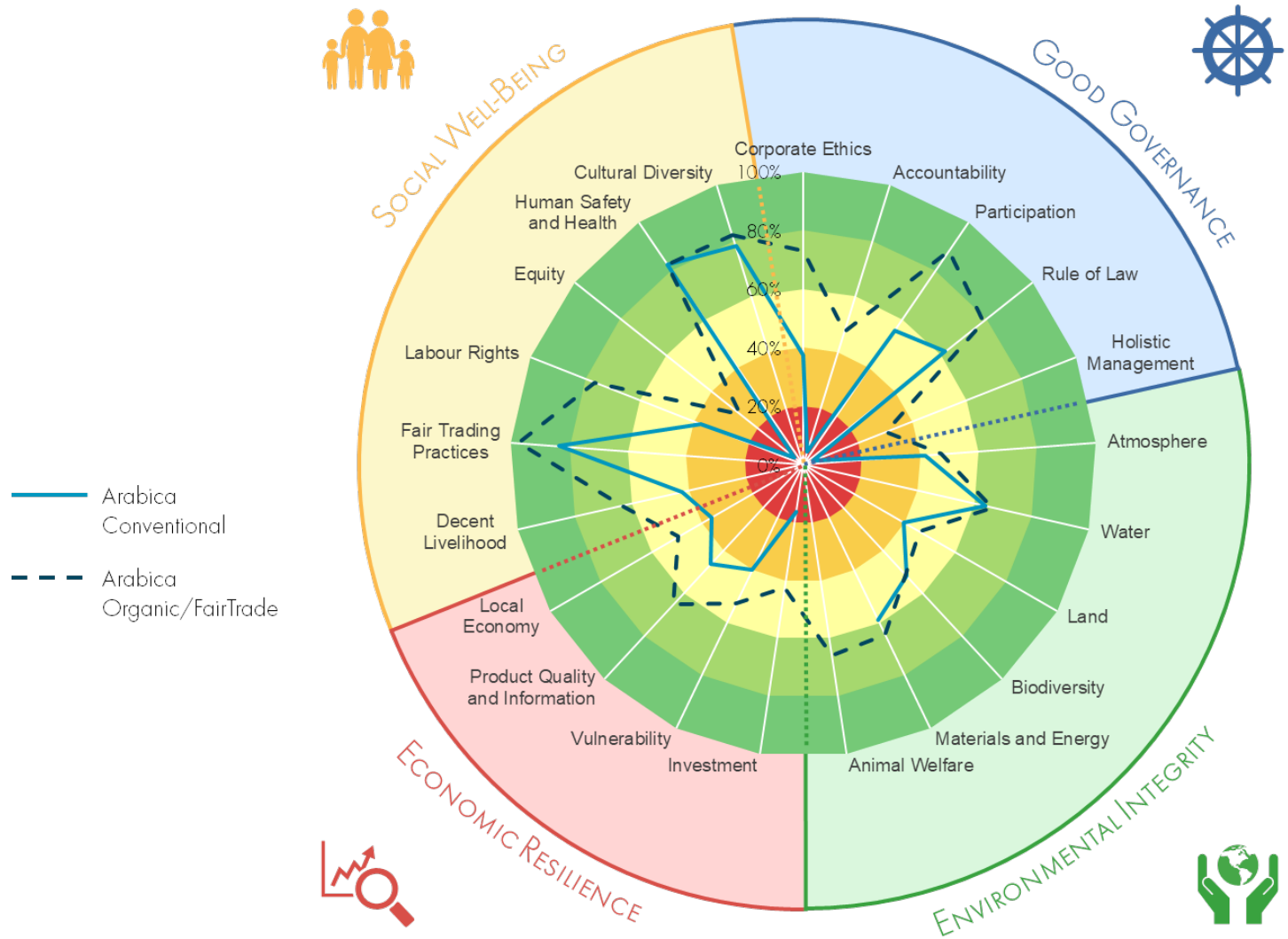
Sustainability Assessment of Coffee Production in Uganda



Source: Ssebunya et al 2019

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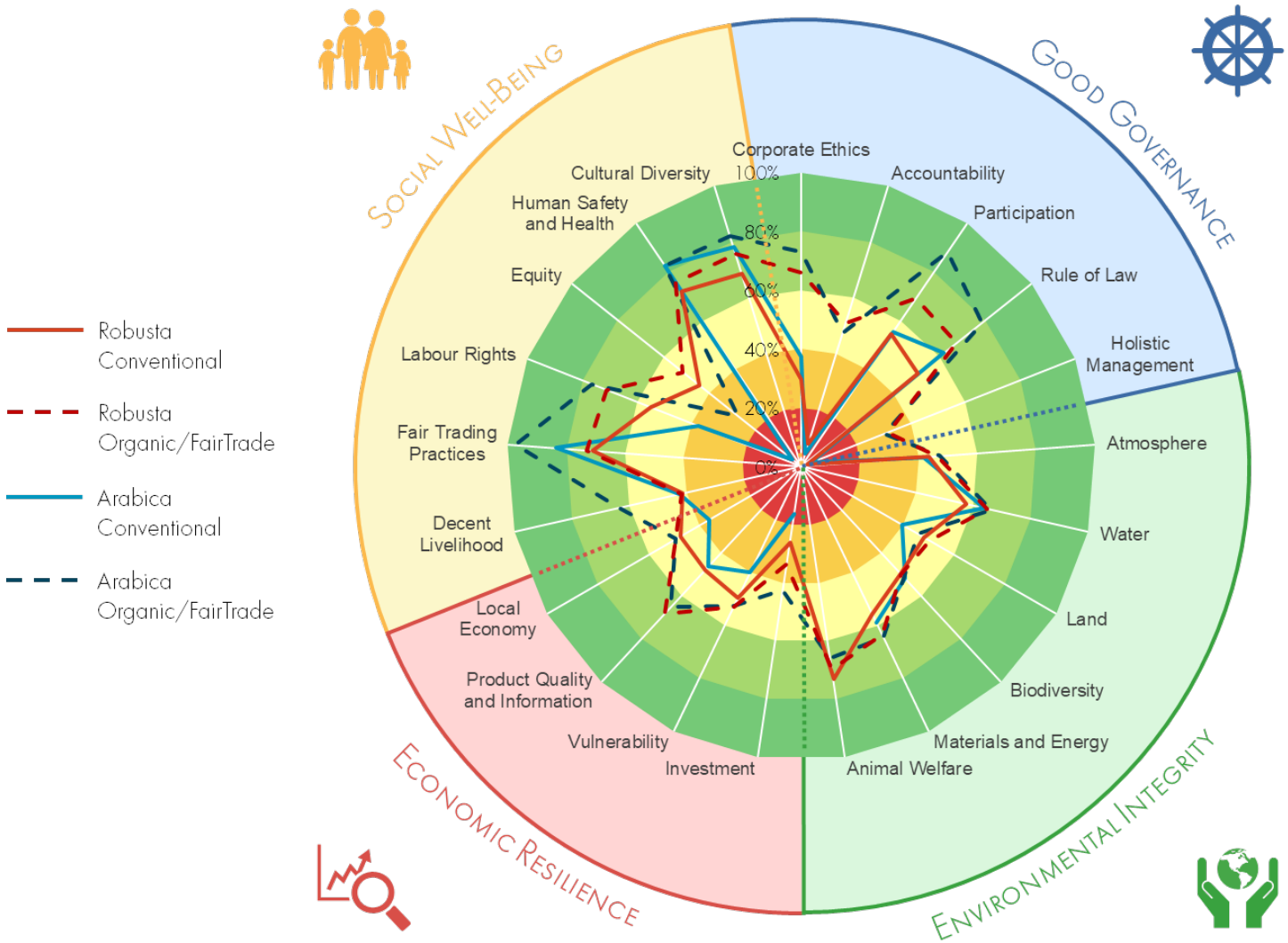
Sustainability Assessment of Coffee Production in Uganda



Source: Ssebunya et al 2019

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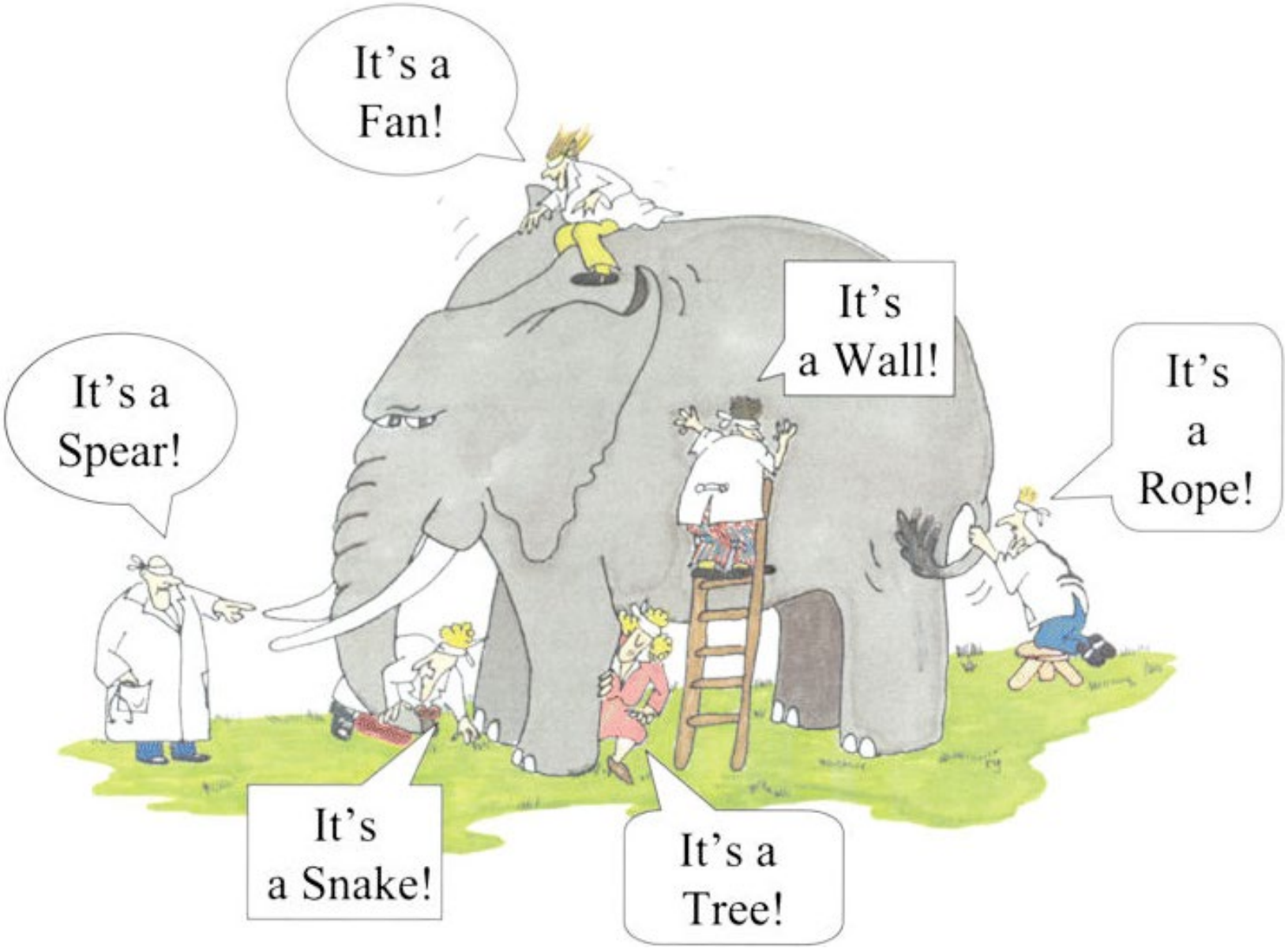

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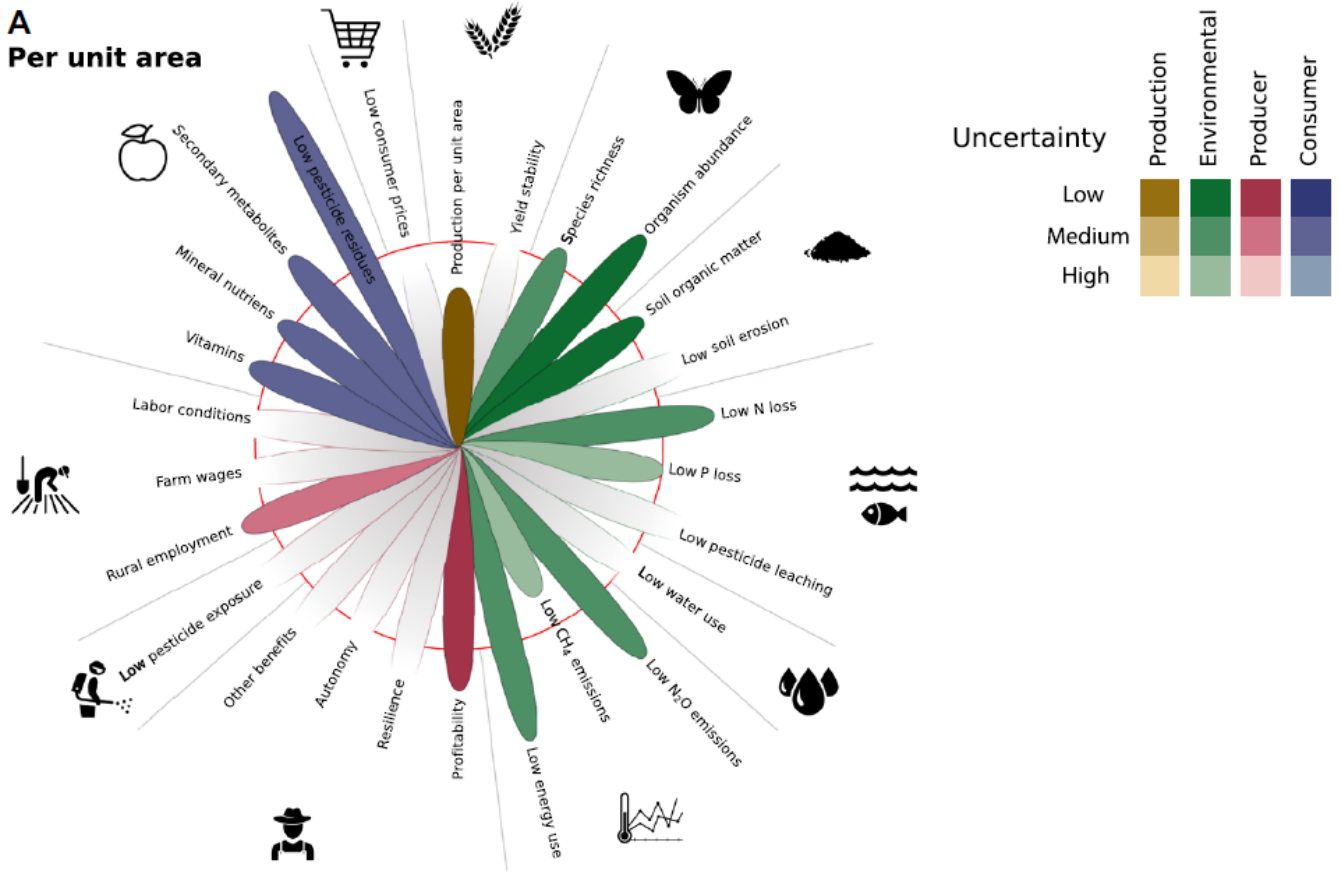
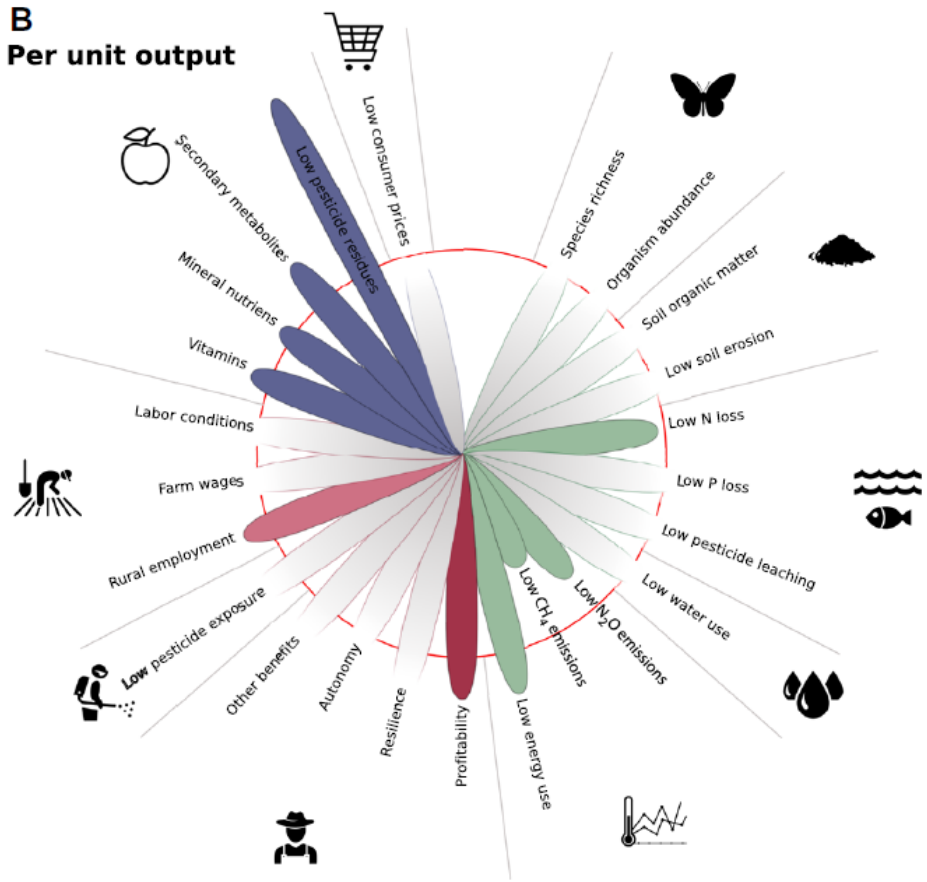
Source: G.R. Guzlas

Sustainability performance of organic farming per ha



Seufert & Ramankutty 2017, Science Advances

Sustainability performance of organic farming per kg of output



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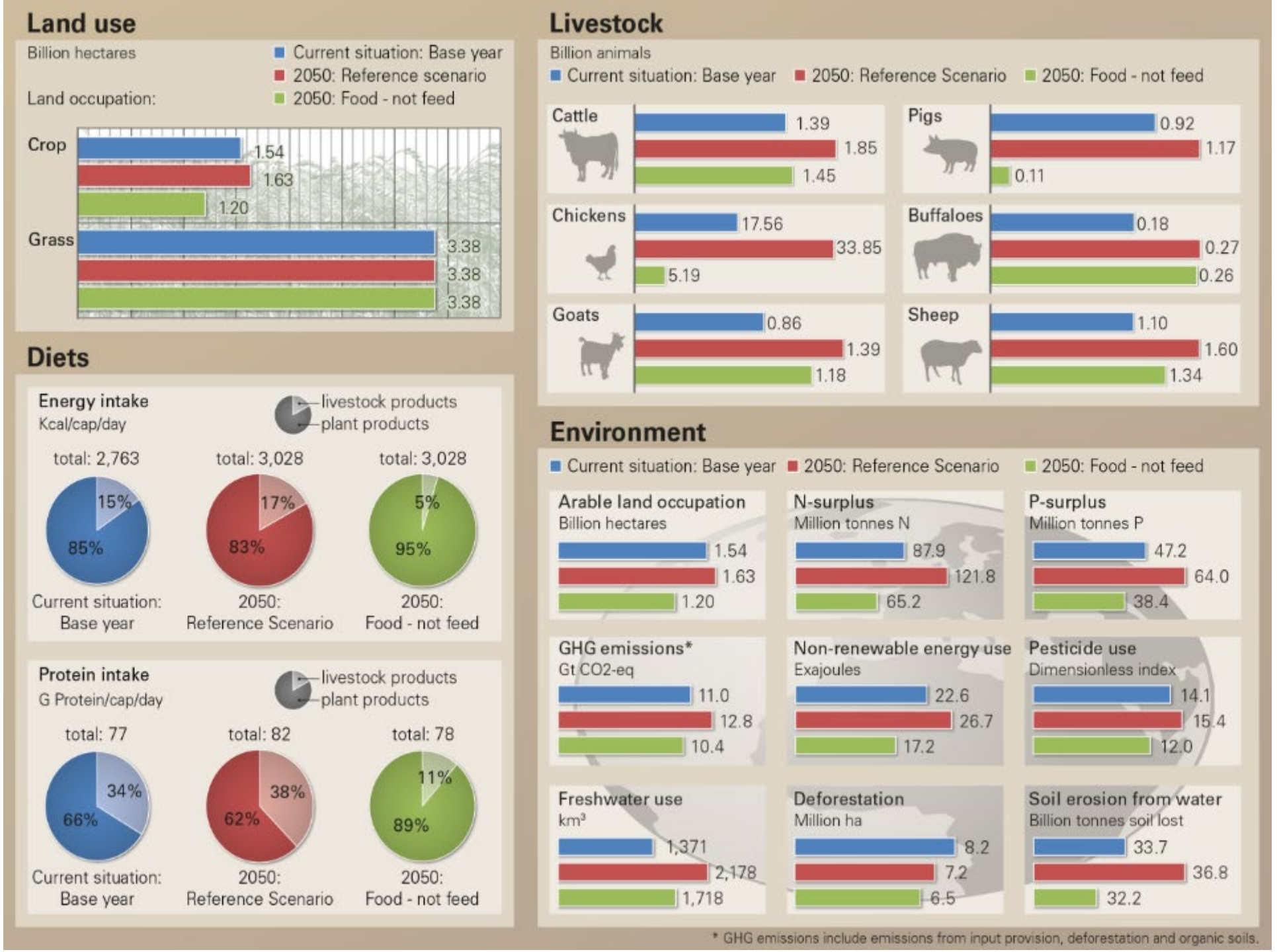
Seufert & Ramankutty 2017, Science Advances



Schader et al. 2015,
Journal of the Royal Society
Interface

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What can we do about it?

- Common framework for sustainability assessment
- Guidance on what tools are needed for which use cases and for how to deal with contradicing results
- Harmonisation of methods and assumptions for specific use cases
- Improvement of data availability and quality for sustainability assessments

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Dimension	Theme	2.4.1 Sub-indicator	PROSA	Data Source
Economic	1. Land productivity	Farm output value per hectare	Gross production value per agriculture area (1000 ha)	FAOSTAT
	2. Farm profitability	Net farm income	Net production value per rural population	FAOSTAT, FishStatJ
	3.Resilience	Access to credit & insurance; farm diversification (value of production)	Credit to agriculture per rural population	FAOSTAT
			Production Value diversification index (Ginl)	FAOSTAT
Environmental	4.Soil health	Prevalence of soil degradation	Soil nutrient Budgets	FAOSTAT
		Nitrogen Balance	kg N per ha of Agricultural Land	FAOSTAT
	5.Water use	Variation in water availability	Economic water use efficiency: Gross production value per Volume of water used	FAOSTAT, FishStatJ, AQUASTAT
	6.Fertilizer risk	Organic source of soil nutrients (manure or composting residues)	NA	FAOSTAT
		Synthetic or mineral fertilizer	Synthetic fertilizer use per area of cropland	FAOSTAT FAOSTAT
	7.Pesticide risk	Use one pesticide no more than two times or in mixture in a season	Pesticide use per area of cropland	FAOSTAT
	8.Biodiversity	Use of synthetic pesticides	Pesticide use per area of cropland	FAOSTAT
		area under a single continuous commodity	Crop and livestock index (ginj)	FAOSTAT, FishStat
Social	9. employment	Wage rate in agriculture	Value added per worker	FAOSTAT
	10.Food security	Food Insecurity Experience Scale (FIES)	PoU	FAOSTAT
	11. Land tenure	Secure rights to land	NA	
Additional	GHG emissions	*NA*	GHG emissions and intensity	FAOSTAT
Additional	Land use change	*NA*	Agricultural and forest land use change	FAOSTAT

)Gs)

AFE AND NUTRITIOUS FOOD

l ensure access by all people, d people in vulnerable nts, to safe, nutritious and ound.

TARGET 2.2

END ALL FORMS OF MALNUTRITION

By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.

TY AND INCOMES OF SMALL-

cultural productivity and ood producers, in particular ples, family farmers, ncluding through secure and er productive resources and cial services, markets and ddition and non-farm

TARGET 2.4

SUSTAINABLE FOOD PRODUCTION AND RESILIENT AGRICULTURAL PRACTICES

By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

IVERSITY IN FOOD

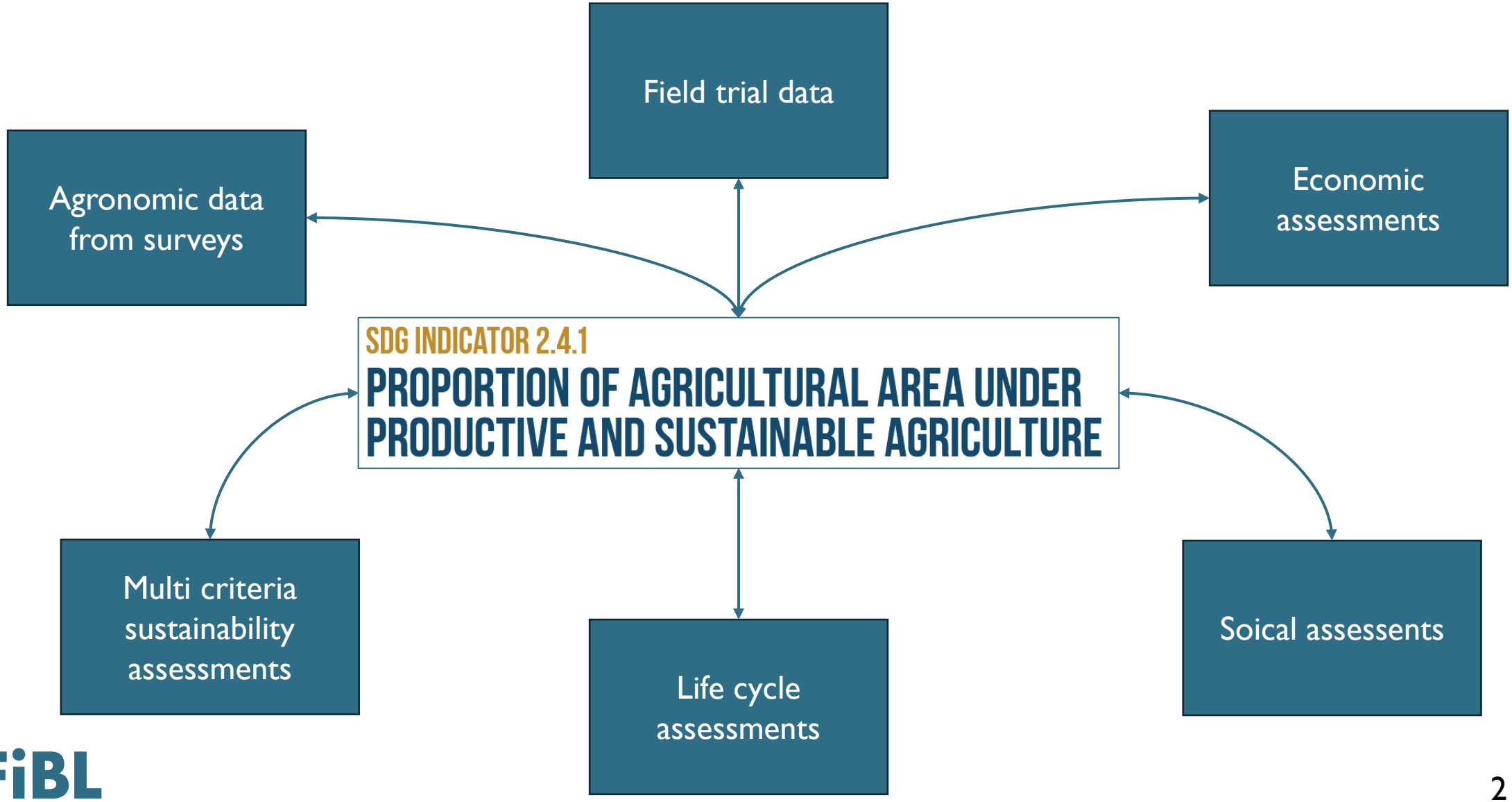
netic diversity of seeds, med and domesticated l wild species, including ed and diversified seed and al, regional and international ss to and fair and equitable g from the utilization of sociated traditional nally agreed.

TARGET 2.6

INVEST IN RURAL INFRASTRUCTURE, AGRICULTURAL RESEARCH, TECHNOLOGY AND GENE BANKS

Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries.

Compiling data from existing assessments



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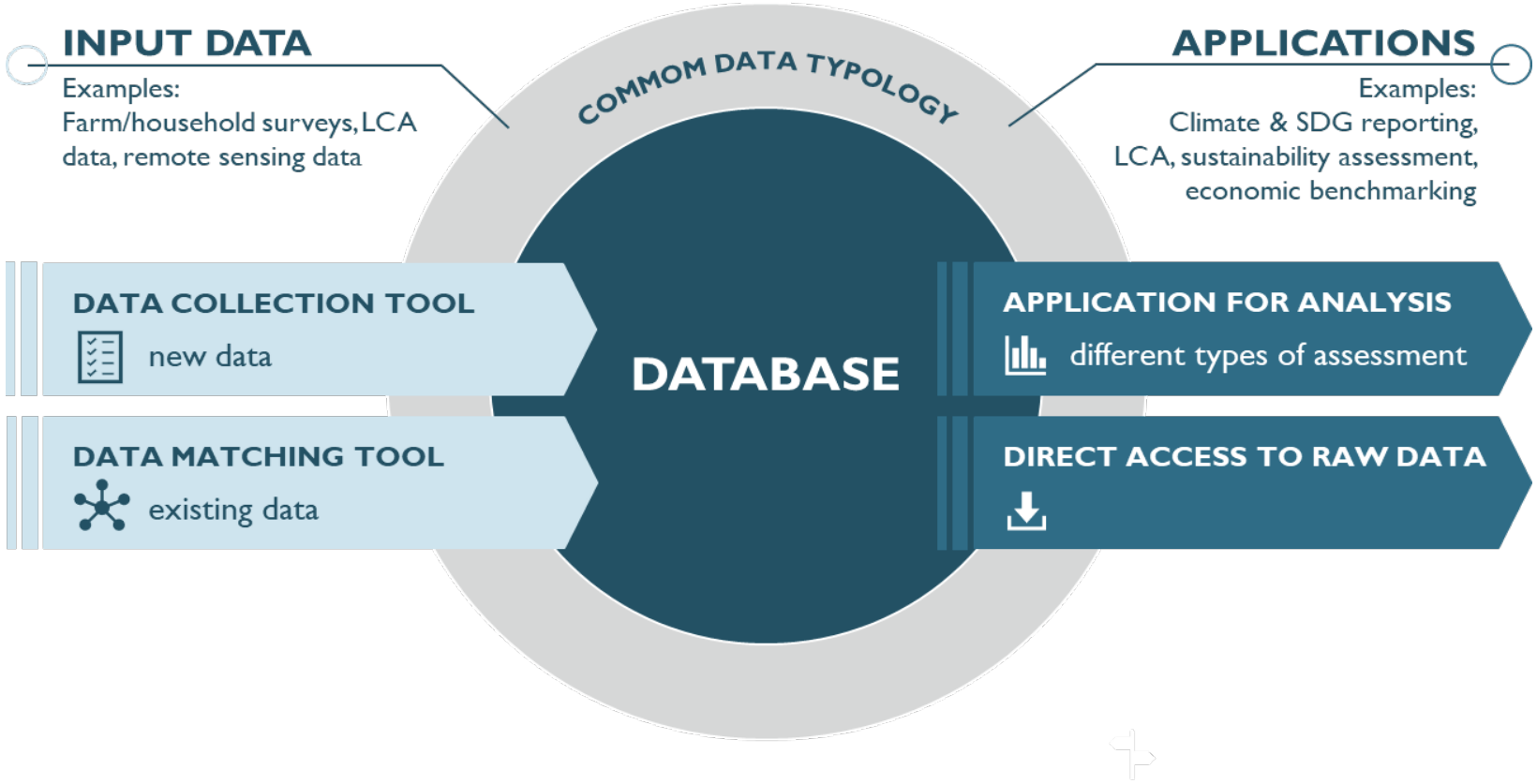
Project objective

- Improving the availability, quality, depth and compatibility of data on agriculture.



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Expert and stakeholder interviews

SELECTION CRITERIA

- Potential end-users and stakeholders of the ontology
- Experience with monitoring and assessment of sustainable agriculture
- At least 4 persons from research, policy/NGOs and business each
- Ideally a global scope of work (at least 2 persons from each continent)

RESEARCH	POLICY/NGOs	BUSINESS
• Wageningen University • INRAE • Oxford University • Cornell University • George Washington University • HAFL • FiBL • World Resources Institute	• FAO • OECD • Roundtable on Sustainable Palm Oil (RSPO) • World Benchmarking Alliance	• Bio Inspecta • Rainforest Alliance • Sustainable Food Systems GmbH • OLAM International • Nestlé Nespresso S.A.

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Choice sustainability assessment approaches piloting

General approach to sustuainability assessment	Specific methods/tools
Multi Criteria Assessment	SDG241 and PROSA (Tubiello et al. 2022)
	SMART-Farm Tool (Schader et al. 2022)
	TAPE (Mottet et al. 2020)
Life Cycle Assessment	HESTIA (Poore and Nemecek 2018)
	Cool Farm Tool (Hillier 2012)
Profitability Analysis / Efficiency analysis	Gross Margin calculations and environmental economic efficiency analysis (Schader et al. 2022, Heidenreich et al. 2022)
Environmentally Extended Cost Benefit Analysis	True Cost Accounting (Michalke et al. 2022)
Mass flow modelling	SOL-m based sustainability impact assessment (Schader et al. 2015, Muller et al. 2017)
Agronomic data / field trial data	Field trial data (Krause et al. 2024)

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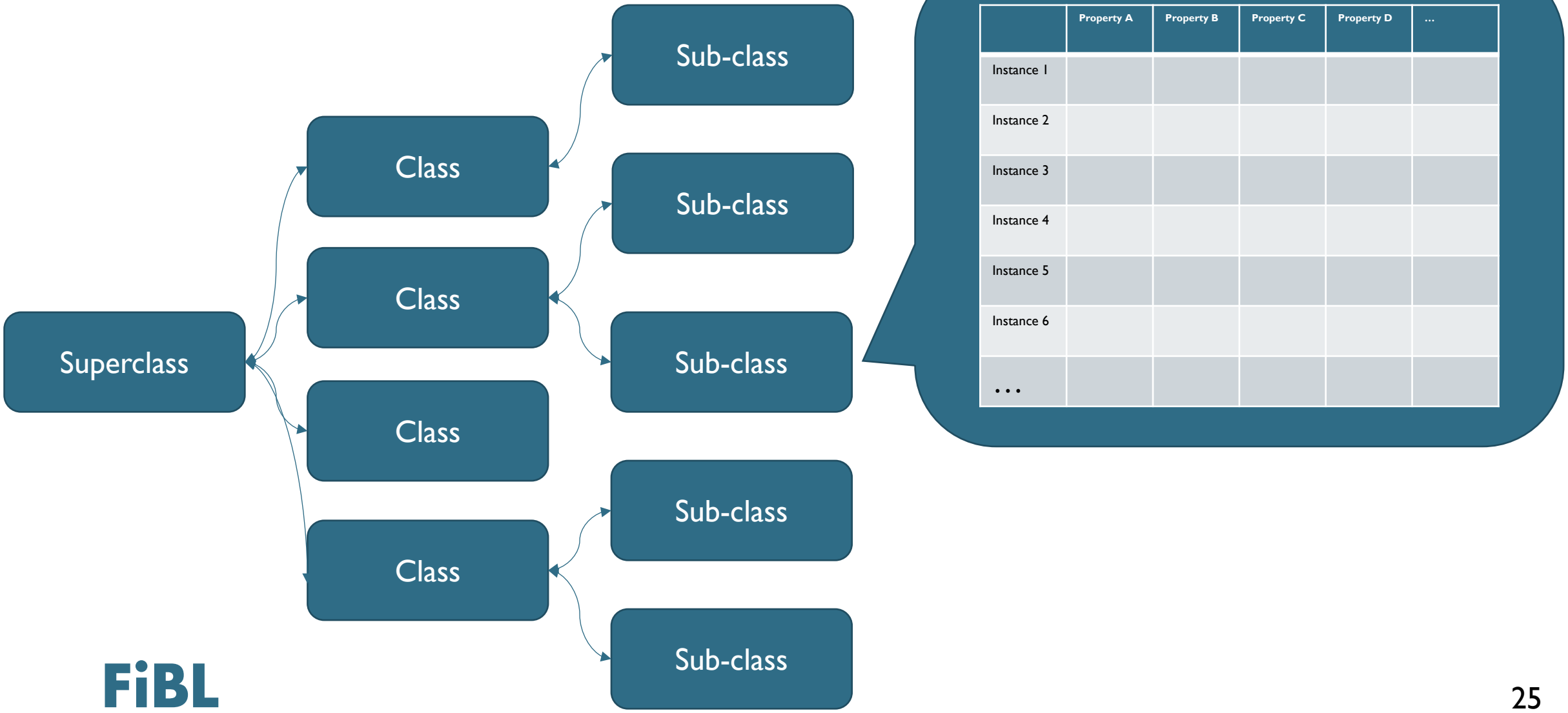
Structure of the ontology



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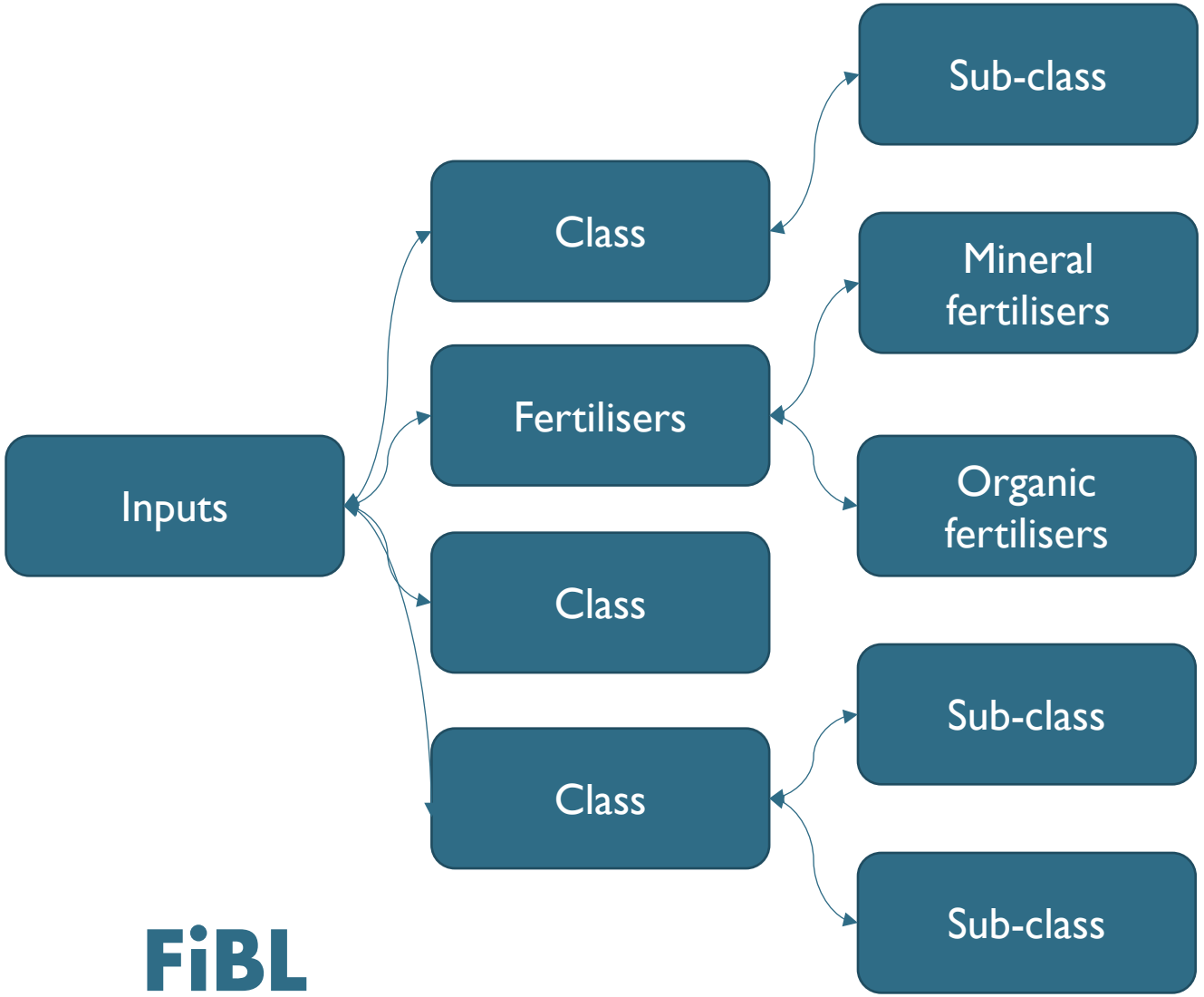
Structure of the ontology



	N content	P content	Origin	Transport distance	…
Cow manure A					
Pig slurry A					
Pig slurry B					
Poultry manure organic					
Compost A					
Compost B					
…					

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Overview of superclasses

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Schader et al. In prep.

Conclusions

- There is currently **no common framework for sustainability assessment**
  - **Lack of comparability** of results
  - All approaches have strengths and limitations => **no one-size-fits all solution**
- Full and high-quality sustainability assessment are **too costly**
  - Primary **data collection time consuming** and reason for poor data quality
  - Data requirements are often very similar (LCA, MCA, economic assessments, etc)
  - No common classification for data available
- **Generic framework for sustainability assessments**
  - **Modularity** to allow to focus on specific aspects of relevance
  - **Coherence** to allow to fit results into a bigger picture and reuse data
- **Impacts of the framework**
  - Increase data **availability and quality**
  - Reduce **cost** of sustainability assessments
  - Improve **comparability**

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