The Economics of Ecosystems and Biodiversity
TEEB for Agriculture & Food
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Applying the Framework: First Experiences and Lessons Learned

Dr Harpinder Sandhu

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The Economics of Ecosystems & Biodiversity

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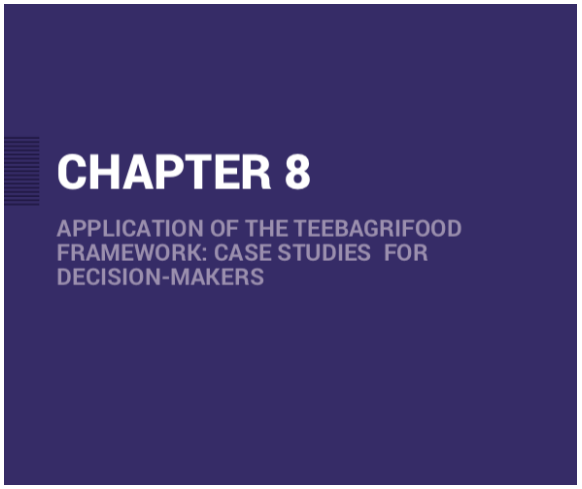
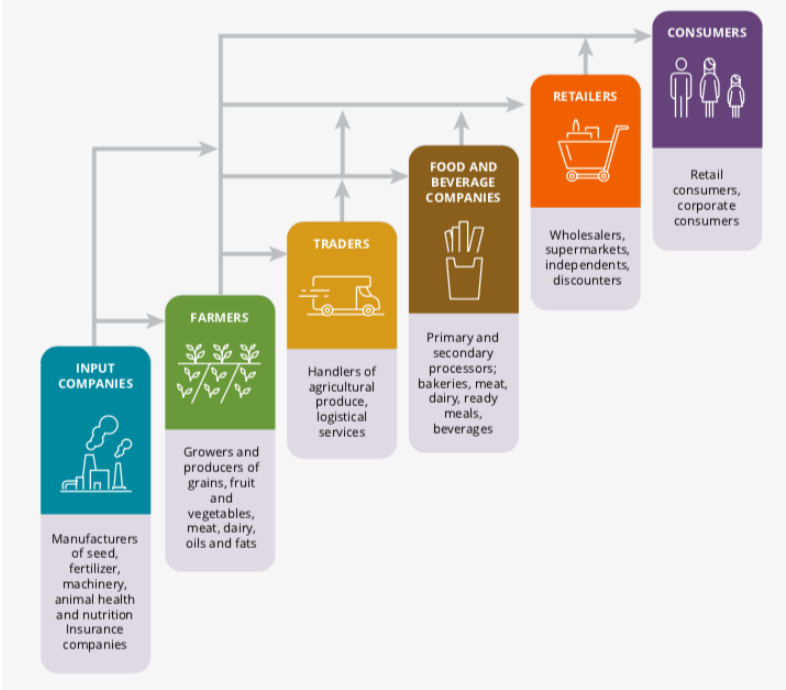
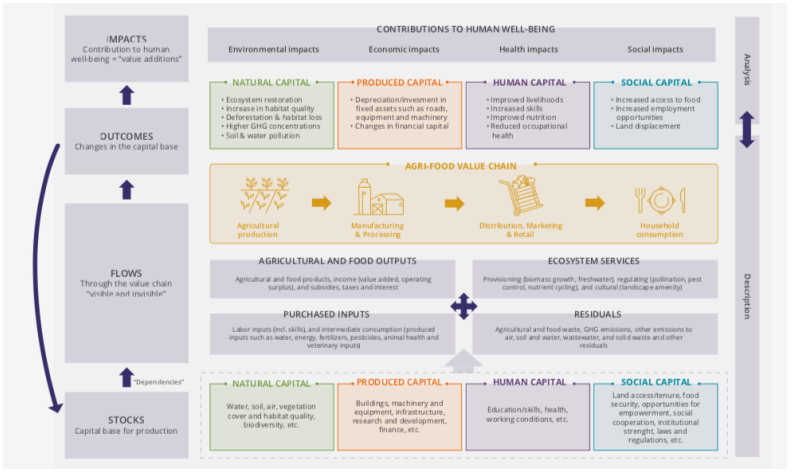
Applications of the framework

An initial exploration of the TEEBAgriFood Evaluation Framework through ten existing case studies that focus on various aspects of the value chain.

Sandhu, H., Gemmill-Herren, B., de Blaeij, A., van Dis, R. and Baltussen, W. (2018). Application of the TEEBAgriFood Framework: case studies for decision-makers. In TEEB for Agriculture & Food: Scientific and Economic Foundations. Geneva: UN Environment.







The Evaluation Framework

Internalising nature's values in agriculture and food systems: Measure and communicate natural, social and human capital throughout the entire value chain

teebweb.org

Agricultural management systems: Policy makers can employ the TEEBAgriFood Framework to compare and incentivise farming systems that generate positive outcomes for environment, society and economy.

Agricultural product: Business can evaluate food products throughout the food chain for generating positive externalities. For example, organic vs conventional milk, grain fed vs grass fed beef etc.

Dietary comparison: Policy makers can consider issues of environmental sustainability of diets, along with nutrition and social equity.

Utility of the framework

Policy evaluation: It permits policymakers to understand where, along the food value chain, multiple costs as well as benefits are occurring. It can help to evaluate alternative policies and develop appropriate policy response.

National accounts: It can help to measure various aspects of natural, social and human capital in national accounts for improved accounts.

10 case studies

Family of application	Case study
Agricultural management systems	1. Rice management practices
	2. Organic and conventional agriculture
Agricultural products	3. Beef production- grass fed versus grain fed
	4. Palm oil study
Dietary comparisons	5. Welfare and sustainability effects of diets
	6. Ten different diet scenarios ranging from meat based to vegetarian diets
Policy evaluations	7. Pesticide tax case study
	8. China Ecosystem Assessment
National accounting for the agriculture and food sector	9. Agricultural development in Senegal
	10. Environmental-economic national accounts

Rice management practices

Value chain	Agricultural production	Manufacturing and processing	Distribution, marketing and retail	Household consumption
Outcomes (change in capital)				
Natural capital	Impact on groundwater and surface water quantity and quality			
Produced capital				
Human capital	In disability adjusted life years (DALYs), Health costs related to pesticide use, Moderation of extreme events			Dietary variability
Social capital				
Flows				
Outputs				
Agricultural and food production	Rice yield			
Income / operating surplus	Income			
Purchased inputs to production				
Labour	Wages			
Intermediate inputs (fuel, fertilizer, etc.)	Fertilizers, fuel			
Ecosystem services				
Provisioning	Habitat provisions, energy from husk			
Regulating	Watershed management, Freshwater saving, Nutrient cycling, Soil fertility enhancement, Pest control, Groundwater recharge, Genetic diversity			
Cultural	Cultural Heritage, Maintenance of rice terraces, Tourism, Traditional rituals and spiritual experiences related to rice system, Traditional knowledge on rice cultivation			Access to and consumption of traditional rice varieties
Residual flows				
Food waste				
Pollution and emissions (excess N & P, GHG emissions, etc.)	Water pollution from pesticides, Water pollution from fertilizer			
	Eutrophication			

Descriptive information available

Quantitative information available

Monetized information available

Not included in study

Diet comparison

Value chain	Agricultural production	Manufacturing, processing, distribution and retail	Household consumption
Outcomes (change in capital)			
Natural capital			
Produced capital			
Human capital			Nutritional security
Social capital			
Flows			
Outputs			
Agricultural and food production	Crop yields Livestock production	Energy Food wastage	Food products (vegetarian and meat based) Food wastage
Income / operating surplus			
Purchased inputs to production			
Labour			
Intermediate inputs (fuel, fertilizer, etc.)			
Ecosystem services			
Provisioning	Biomass		
Regulating	High impact on natural resources in grazing land, low impact in cropland		High food print in grazing land, low impacts in cropland
Cultural			
Residual flows			
Food waste			
Pollution and emissions (excess N & P, GHG emissions, etc.)	High GHG emissions in grazing land, Low GHG emissions in cropland		

Descriptive information available

Quantitative information available

Monetized information available

Not included in study

Lessons learned

It goes beyond quantitative and monetary measures and gives room to qualitative discussion as well.

For trade-off analysis, comprehensive data set that goes beyond food production is required.

Often studies comparing yield and other ecosystem services are missing.

Environmental and socio-economic benefits and costs are often studied in isolation from each other, despite them being closely interconnected.

Advances in applications: recent experiences

US corn systems

Farming systems in UK

US corn study

Without framework

	Descriptive information available
	Quantitative information available
	Monetised information available
	Not included in study

		Production	Processing	Consumption
Stocks	Produced capital			
	Social capital			
	Human capital			
	Natural capital			
Flows	Produced capital			
	Social capital			
	Human capital			
	Natural capital			
Outcomes	Produced capital			
	Social capital			
	Human capital			
	Natural capital			
Impacts	Economic impacts			
	Social impacts			
	Health impacts			
	Environmental impacts			

US corn study

With framework application

	Descriptive information available
	Quantitative information available
	Monetised information available
	Not included in study

		Production	Processing	Consumption
Stocks	Produced capital	Buildings, machinery and equipment, irrigation, storage, roads, energy, communications infrastructure, research and development, finance, etc. Section 3.1	Buildings, machinery and equipment, irrigation, storage, roads, energy, communications infrastructure, research and development, finance, etc. Section 3.1	Buildings, storage, energy, communications infrastructure, finance, etc. Section 3.1
	Social capital	Social cooperation, social networks - government policy, Research and development network, farmers cooperatives, groups, laws and regulations, agribusinesses , non-profit foundations, rural community, traditional knowledge holders etc. Section 3.2	Social cooperation, networks - government regulation, industry bodies, cooperatives, laws, business, energy industry, foundations, R&D sector, etc. Section 3.2	Social cooperation, hospitality networks - government regulation, laws, business, healthy food promoting foundations, etc. Section 3.2
	Human capital	Education/skills, health, working conditions, wages, age, etc. Section 3.3	Skills, health, occupational health and safety, wages, age, etc. Section 3.3	Skills, health, occupational health and safety, wages, age, etc. Section 3.3
	Natural capital	Land, soil, water, air, biodiversity, vegetation cover and habitat quality, etc. Section 3.4	Land, water, air, etc. Section 3.4	Land, water, air, etc. Section 3.4
Flows	Produced capital	Crop value, purchased inputs costs, depreciation, taxes, subsidies, farm payments, interest, profits, rent, etc. Section 3.1	Fuel value, other industrial products value in the market, profits, taxes, interest, subsidies, etc. Section 3.1	Fuel value, food value, profits, taxes, interest, etc. Section 3.1
	Social capital	Knowledge new and traditional, trust, linkages, bonds, rules, regulations, etc. Section 3.2	Technical knowledges, patents, trust, linkages, rules, regulations, etc. Section 3.2	Technical knowledges, trust, linkages, rules, regulations, etc. Section 3.2
	Human capital	Wage equity, opportunities for education, training, nutrition, chronic disease risks, etc. Section 3.3	Equity, training opportunity, health, etc. Section 3.3	Equity, training opportunity, health, etc. Section 3.3
	Natural capital	Ecosystem services: Provisioning (grain yield), and regulating (climate regulation, air regulation, water regulation, soil loss). Residual flows: greenhouse gas emissions, water and air pollution, waste water and solid waste, etc. Section 3.4	GHG emissions, water quality, air quality, etc. Section 3.4	GHG emissions, water quality, air quality, etc. during use of fuel and preparation of food. Section 3.4
Outcomes	Produced capital	Positive: Investment in fixed assets such as roads, equipment and machinery, increase in farm size. Negative: Decrease in small farms. Section 3.1	Positive: Investment in fixed assets such as roads, equipment and machinery, increase in number and processing capacity. Section 3.1	Positive: Investment in fixed assets such as roads, equipment and machinery, increase in number and processing capacity. Section 3.1
	Social capital	Positive: Increased number of organisations to provide support to GM corn production. Increased employment in GM corn ethanol value chain - farm companies, consultants etc. Negative: No role of small and diverse farms/farmers in ethanol led corn systems. Loss of small size family farms. Less emphasis on diversified and organic agriculture in policy. No focus on traditional/indigenous knowledge or recognition of cultures. Section 3.2	Positive: Increased number of organisations to provide support to ethanol industry. Generation of employment. Negative: less opportunities for unskilled labour. Section 3.2	Positive: Increased number of organisations to provide support to ethanol industry. Generation of employment. Negative: less opportunities for unskilled labour. Section 3.2
	Human capital	Positive: Improved skills in growing GM corn with use of technology. Negative: Declining health and increased number of chronic disease risks. Migration of rural population to urban areas. Section 3.3	Positive: Improved technical skills. Negative: Declining health and increased number of chronic disease risks. Section 3.3	Positive: Improved technical skills. Negative: Declining health and increased number of chronic disease risks. Section 3.3
	Natural capital	Positive: Increased biomass productivity. Negative: Declining ecosystem services, land use change from grassland to corn monoculture, higher GHG emissions, decline in air and water quality, N in groundwater, loss of biodiversity, loss of cultural heritage etc. Section 3.4	Positive: Negative: Higher GHG emissions, decline in air and water quality, etc. Section 3.4	Positive: Negative: Higher GHG emissions, decline in air and water quality, etc. Section 3.4
Impacts	Economic impacts	Positive for land holders who have economies of scale. Section 3.1	Positive for ethanol industry and other allied industries that manufacture corn products such as beverages. Section 3.1	Low cost food products availability for consumers. Section 3.1
	Social impacts	Clear divide between GM corn large scale farmers and small scale diversified organic farmers. Section 3.2	Clear divide between skilled and unskilled labour, large amount of land and resources are used for fuel instead of food. Section 3.2	Loss of social value associated with community food preparation and consumption. Section 3.2
	Health impacts	Declining health in rural areas and high cost of health in corn production area. Section 3.3	Declining health in rural areas and high cost of health in corn production area. Section 3.3	Relatively high health impacts. Section 3.3
	Environmental impacts	Negative impacts on air, water, soil and biodiversity. Section 3.4	Negative impacts on air, water, soil and biodiversity. Section 3.4	Increase in household waste. Section 3.4

Sandhu et al., 2019, Forthcoming

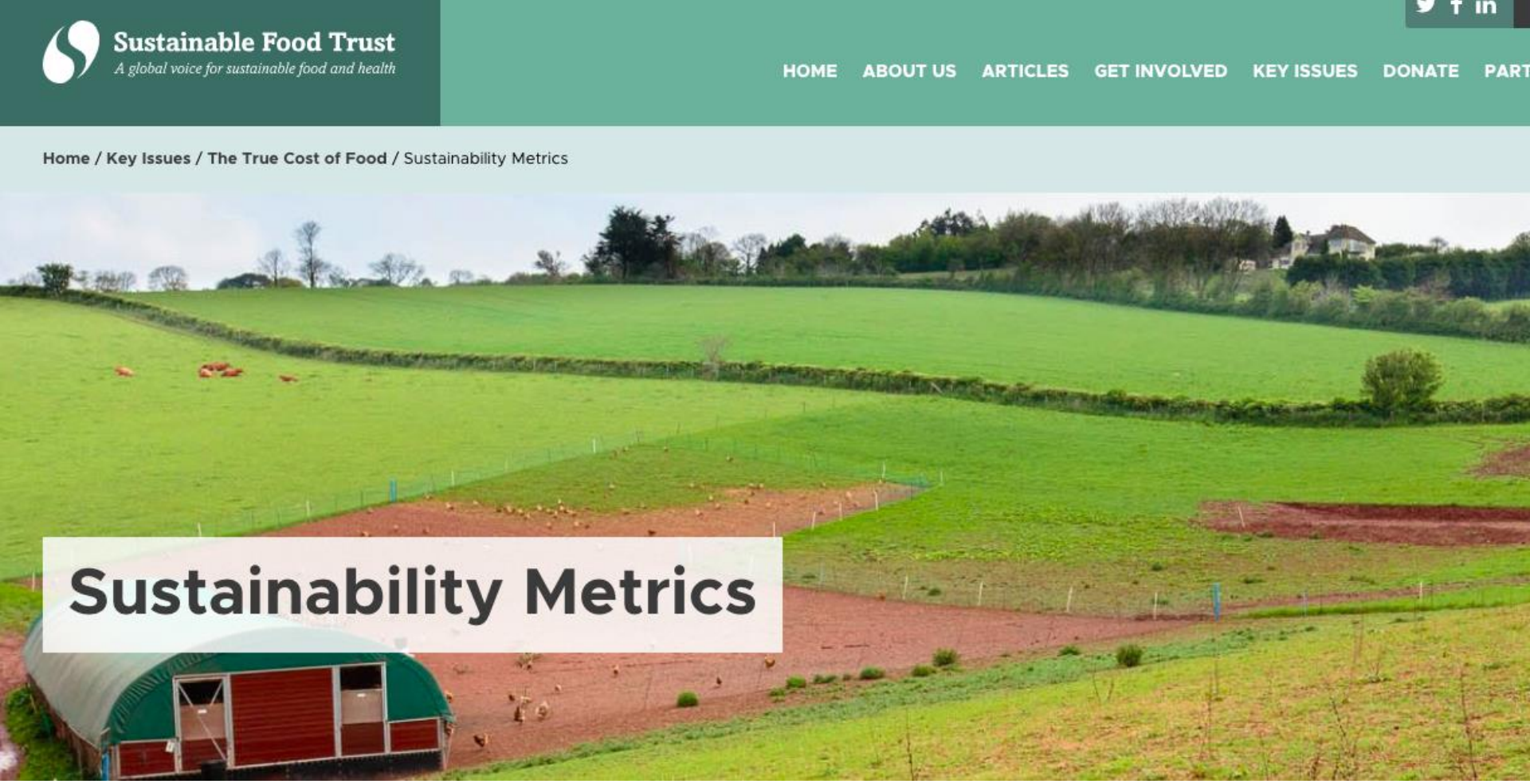
Summary of health and environmental cost in Minnesota, US

	GM corn	Organic corn
Acres planted	7.6 million	28524
Market value ($)	4.5 billion	32 million
Environmental costs ($)	?? billion	Not quantified due to lack of data on organic farms.
Health cost ($)	?? billion	Not quantified.

Sandhu et al., 2019, Forthcoming

Lessons learned

- TEF used here is most appropriate to guide the analyses. However, further improvement is required to allow single unit for various social, economic and environmental indicators.
- Data on all indicators need further research as there are several gaps in current knowledge.
- Guide for the use by practitioners and policy makers will also be useful addition to the existing framework.
- This information need to be communicated to farmers so that they can use it to improve their decision making.



Farm level application in UK

Metrics Development Group

- Sustainable Food Trust
- Estate managers
- Farm managers
- Researchers
- Workshops/Meetings

Metrics Development

Natural capital

- Soil
- Air
- Biodiversity
- Water

Produced capital

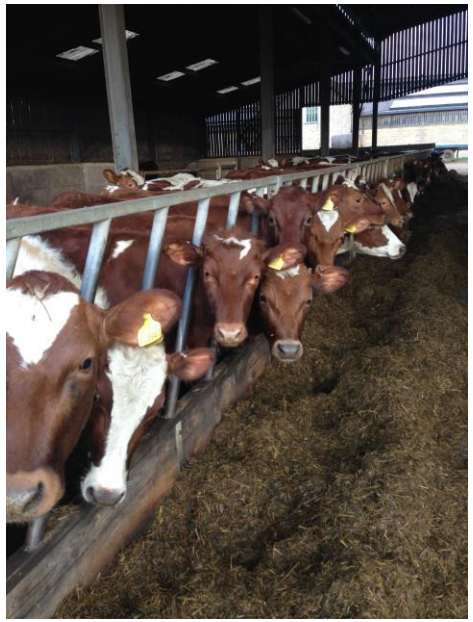
- Energy / Resource use
- Plant and crop health
- Livestock management
- Productivity

Social capital

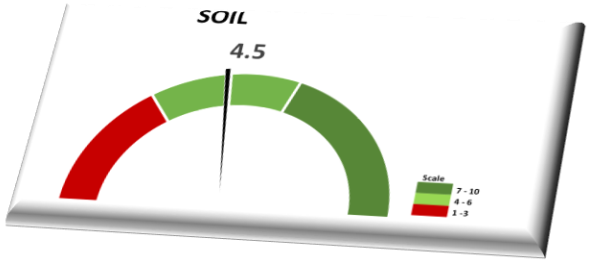
Human capital

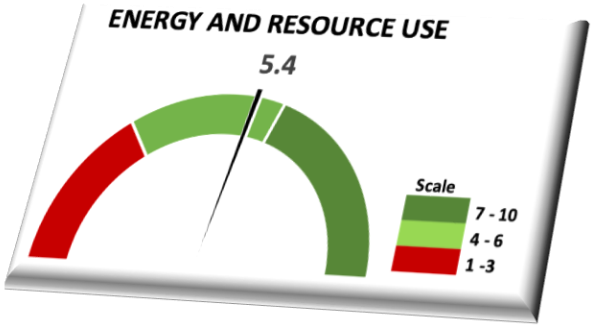
Case Studies

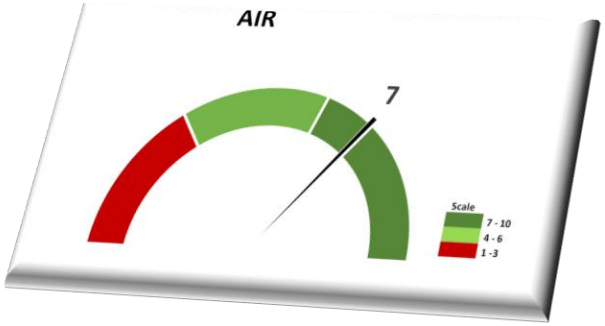
- Farm A: Sheep farm
- Farm B: Organic dairy farm
- Farm C: Conventional arable farm

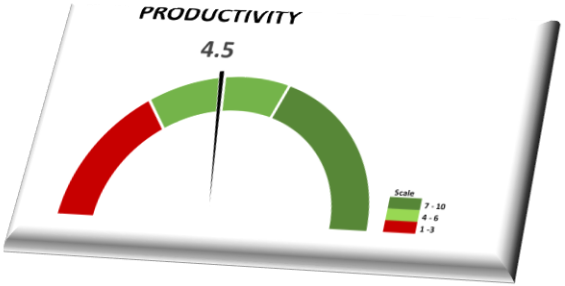


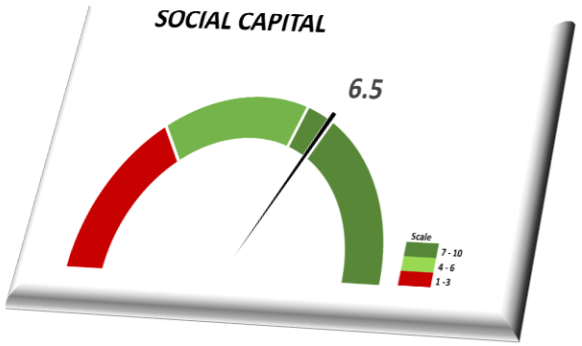
Outputs
Sheep Farm

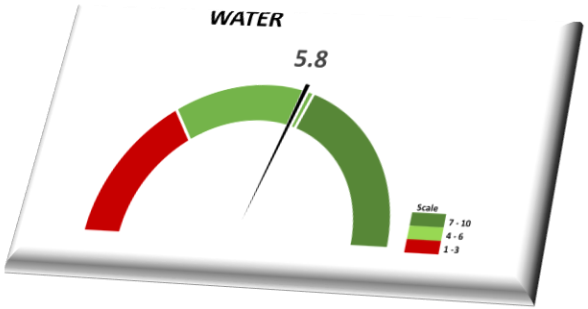


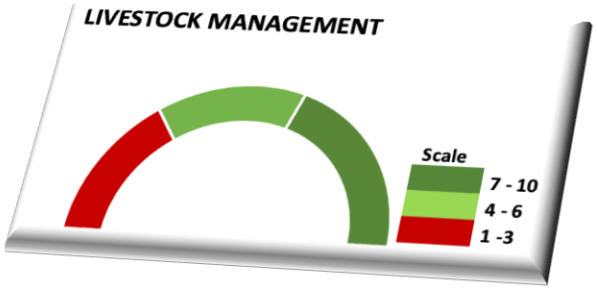


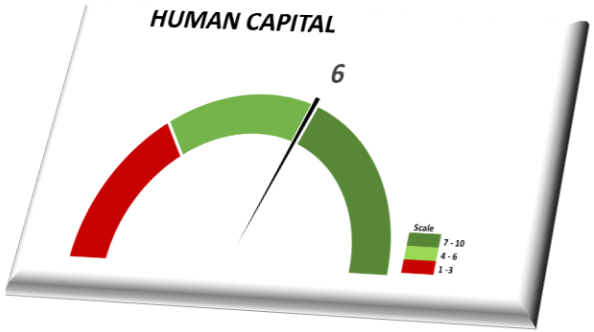


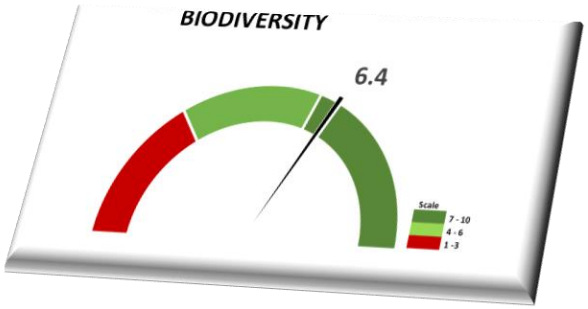


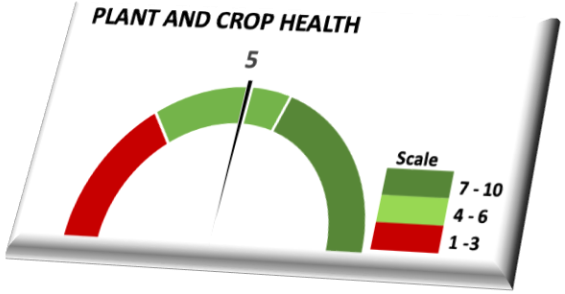




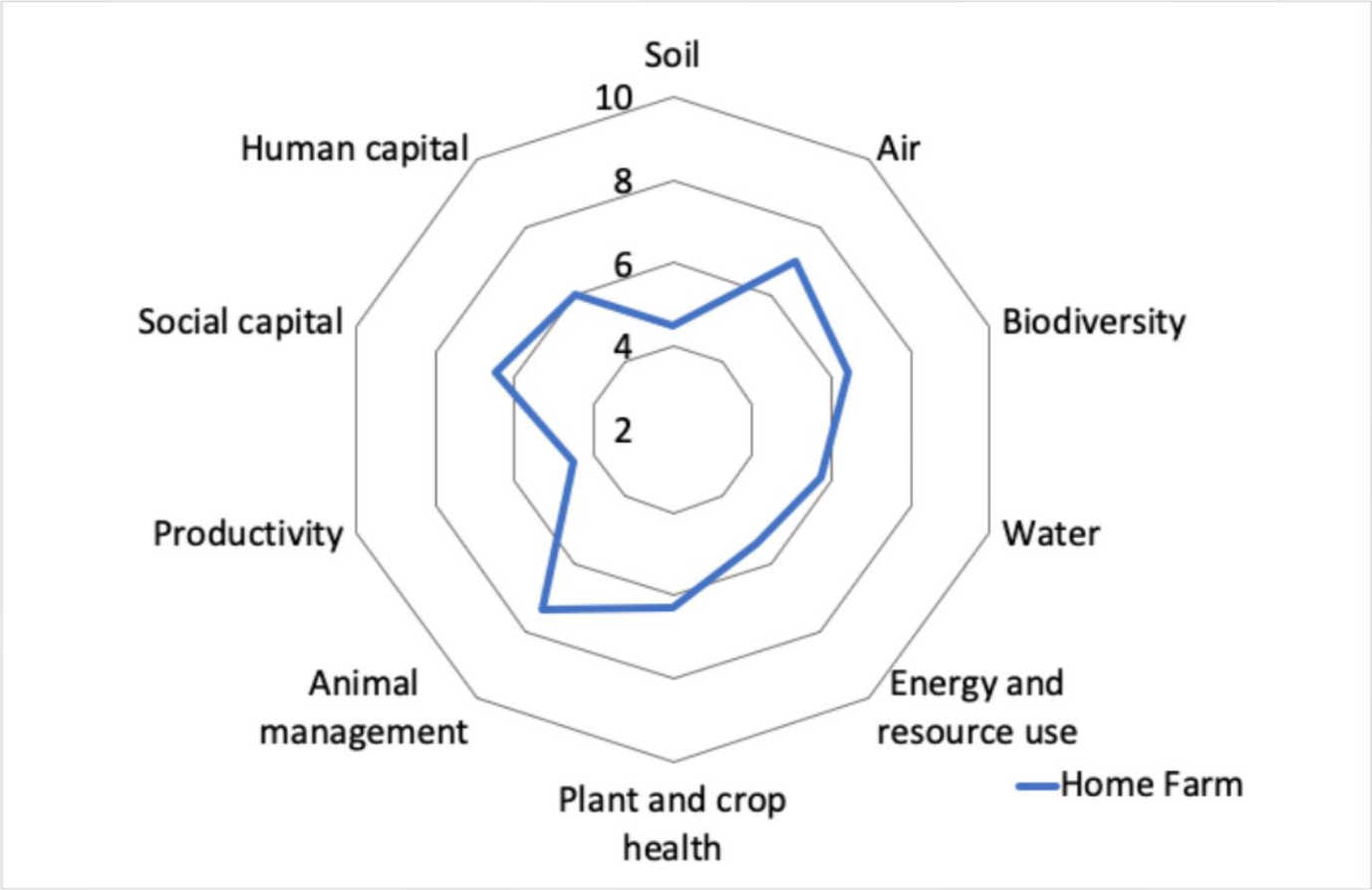








Summary


Soil
10
Air
8
6
Biodiversity
4
2
Water
Energy and resource use
Plant and crop health
Animal management
Productivity
Social capital
Human capital
Home Farm

Lessons learned

TEEBAgriFood framework allows to capture social and human capital indicators along with other production related indicators.

Recommendations can be developed and communicated to farmers, market and policy makers in easy to understand metrics.

Need to develop a benchmark for each indicator for different farming systems.

Some reflections….

- SCOPING: Scope of the evaluation should be stated clearly.
- AIM: Purpose and goal of the evaluation should be clearly developed in consultation with stakeholders.
- QUALITY OF DATA: Data available from literature should be reviewed thoroughly and peer reviewed scientific papers, government reports, policy documents should be used.
- METHODOLOGY: Multi-disciplinary approach is required to apply TEF, therefore, evaluation teams should include biophysical scientists, social scientists, environmental scientists along with health systems experts and policy experts, if possible.
- COMMUNICTION: A communication strategy should be developed in order to maximise the impact of evaluation.
- DEALING WITH SO WHAT? There is need to reflect on how to engage with decision makers at farm, agri-business, government and society level to achieve desired outcomes.

Q&A

Thank You

@001harpinder