# Technology vs. Agroecology?

## Convergence and Divergence of Smart and Precision Farming, Agroecological Principles and Smallholder Agriculture in Africa

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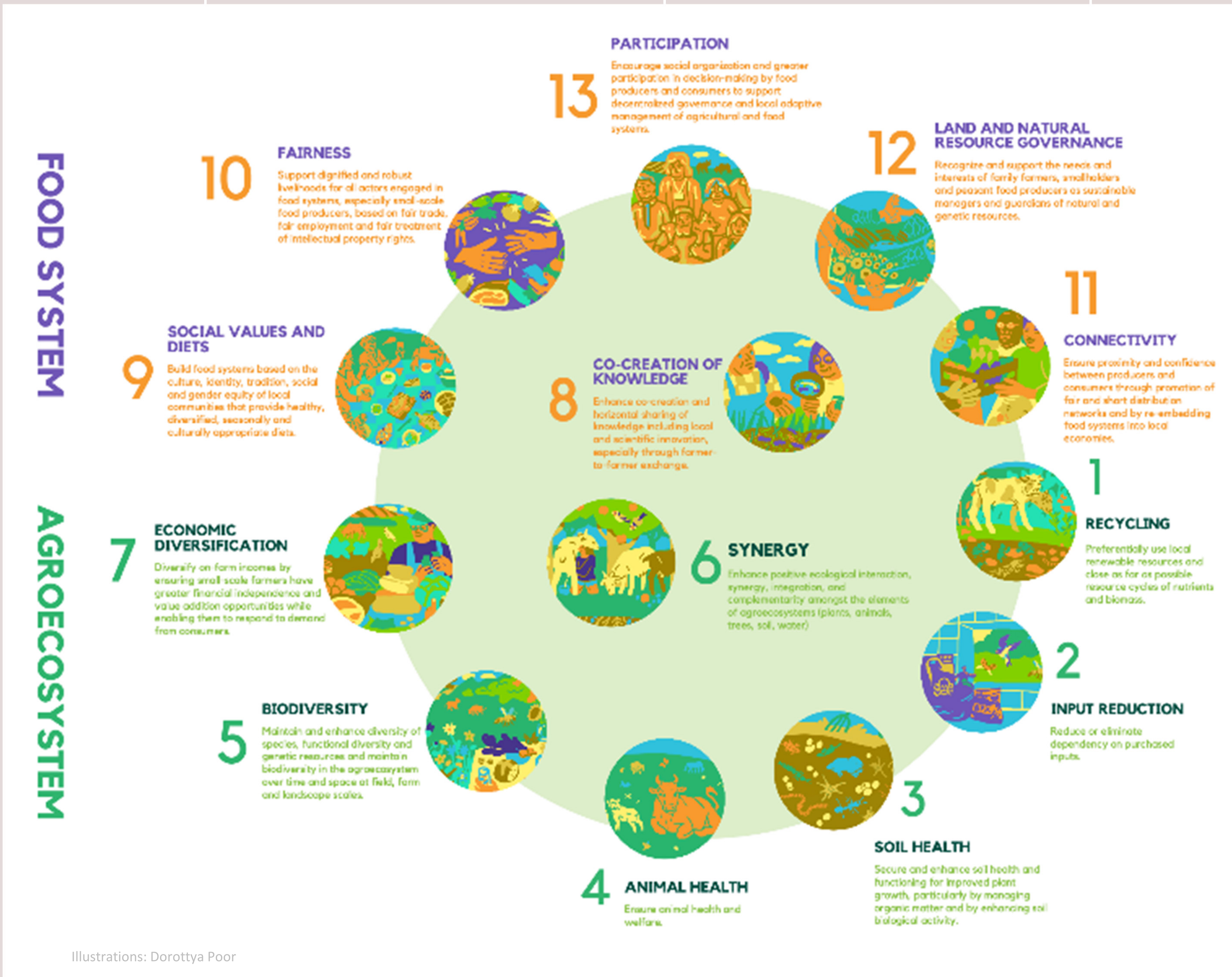
## Background

- Agroecological approaches and smart and precision farming technologies (SPFT) can potentially increase the productivity of smallholder farming in Africa while maintaining the ecosystem`s capacity to deliver ecosystem services thus supporting resilience and sustainability of related agri-food systems.
- 13 agroecological principles (AEP) have been proposed by HLPE (2019) for transitioning to sustainable food systems.

- However, there is lacking evidence of convergence and divergence of SPFT with AEP and viability in smallholder farming contexts.
- Hence, the objective is to exemplarily assess several SPFT from various technology categories using HLPE's principles of agroecology.

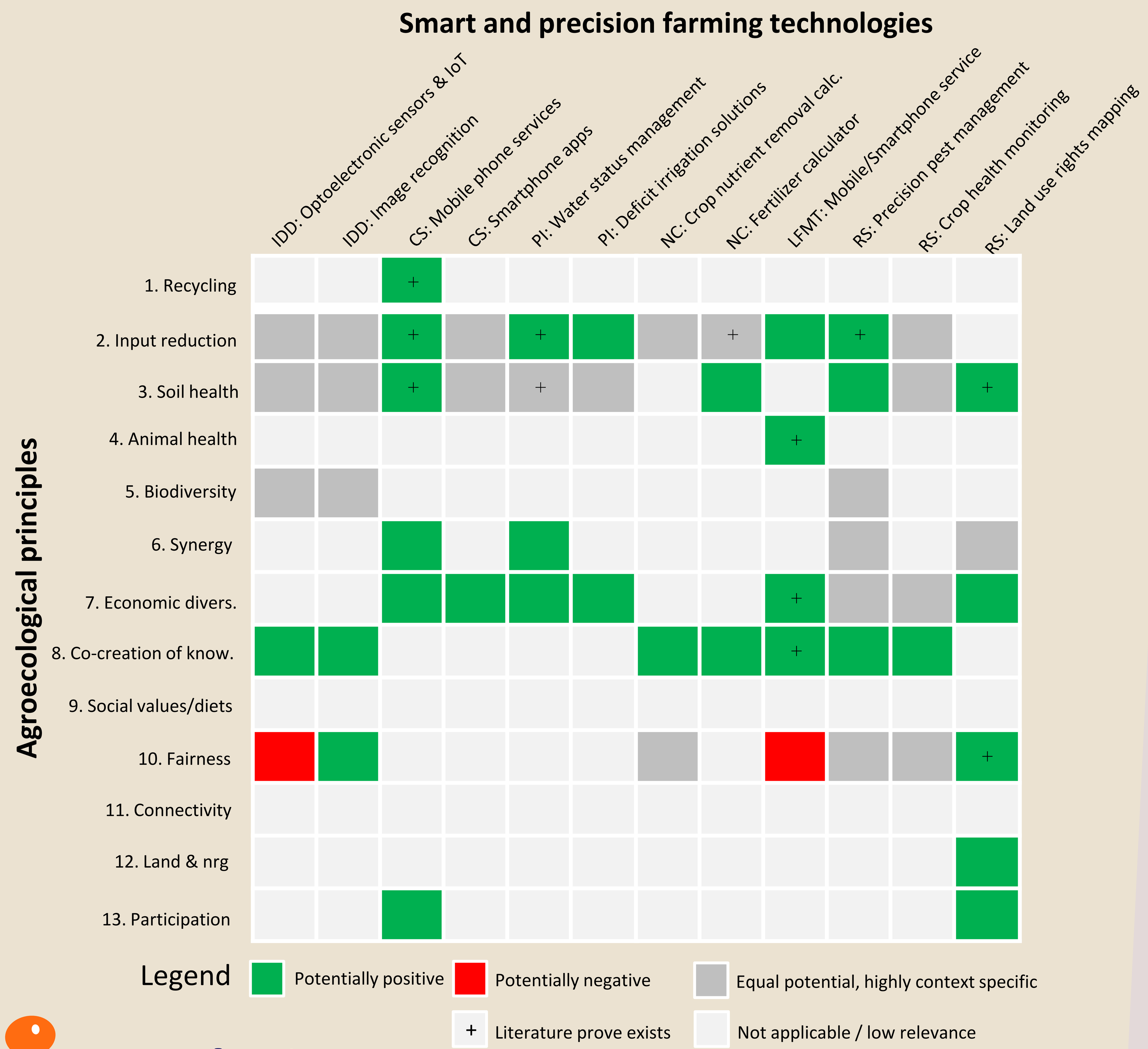



## Methodology

1. Convergence of SPFT with AEP:
- Applying the 13 agroecological principles as an assessment framework for selected SPF
- Exploratory literature review
- Insufficient literature -> Qualitative assessment (expert evaluation)

2. Viability of SPFT for smallholder farmers:
- Capital demand:
  - → Low: <=50 Euro
  - → Medium: 50-250 Euro
  - → High: >250 Euro
- Capacity/knowledge demand:
  - → Low = Usable by illiterate person
  - → Medium = Literacy necessary/basic digital skills
  - → High = specific technical knowledge necessary
- Technical environment:
  - → Not decisive
  - → Partly decisive
  - → Decisive

## Results




| Smart & Precision technology | | Enabling environment | | |
|---|---|---|---|---|
| **Main category** | **Sub-category** | **Capital demand** | **Capacity/ knowledge demand** | **Technical environment** |
| **Insect and disease detection (IDD)** | Optoelectronic sensors and Internet of Things (IoT) | High | High | Decisive |
| | Image recognition (smartphone apps) | Medium | Medium | Partly decisive |
| **Crowd sourcing (CS)** | Mobile phone services / app | Low | Low - medium | Partly decisive |
| | Smartphone applications | Medium | Medium | Partly decisive |
| **Precision irrigation (PI)** | Water status management support | High | High | Decisive |
| | Deficit Irrigation solutions | High | Medium | Partly decisive |
| **Nutrient calculator (NC)** | App - Crop nutrient removal calculator | Medium | High | Decisive |
| | Fertilizer calculator | Medium | High | Decisive |
| **Livestock/farm management tools (LFMT)** | Mobile phone/Smartphone applications | Low - Medium | Medium | Partly decisive |
| **Remote sensing / UAV (RS)** | Precision pest management | High | High | Decisive |
| | Crop health monitoring and decision support | High | High | Decisive |
| | Documenting land use rights with digital maps | High | High | Decisive |

## Conclusions

- Very few studies on impact e.g., pesticide reductions?
- Returns of technologies need to be evaluated within the whole-farm context (Harris, 2019)
- Little is known yet about social impacts and power effects (Hackfort, 2021) -> Concentration of power and control over technologies? -> Concentration versus resilience? -> Digital divide / inclusiveness, access to technologies, gender aspects
- Data ownership by companies and on-selling of field data -> There is need for a legislative framework in many countries
- Who should drive the development? -> NGOs, public institutions vs. private sector?
- Methodology to evaluate complex systemic interrelations of socio-ecological systems and technologies?

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