Next generation research infrastructure:

Accelerated scaling and impacts

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Real world context

- Tremendous heterogeneity, fragmentation in agroecology, environmental context, infrastructure and market access
- Rapidly changing world:
  - Extreme weather
  - Epidemics
  - Conflict
  - Market dynamics
- Buffering capacity decreasing (*Water, land quality and fossil fuels are limited*)

Hyperlocalized solutions

- Recommendations that are suitable to a specific context/farmer's fields
- A learning agenda to support innovation and adaptation where farmers are provided access to build on and tailor recommendations
  - Knowledge
  - Inputs
  - Services

Expanding research infrastructure for impact

- Agricultural research stations have limited inference space
- How to move beyond randomized control trials?
- How to generate relevant knowledge in a context that is complex, uncertain and locally specific?
- How to engage with stakeholders for public-private-civil society learning and scaling out?

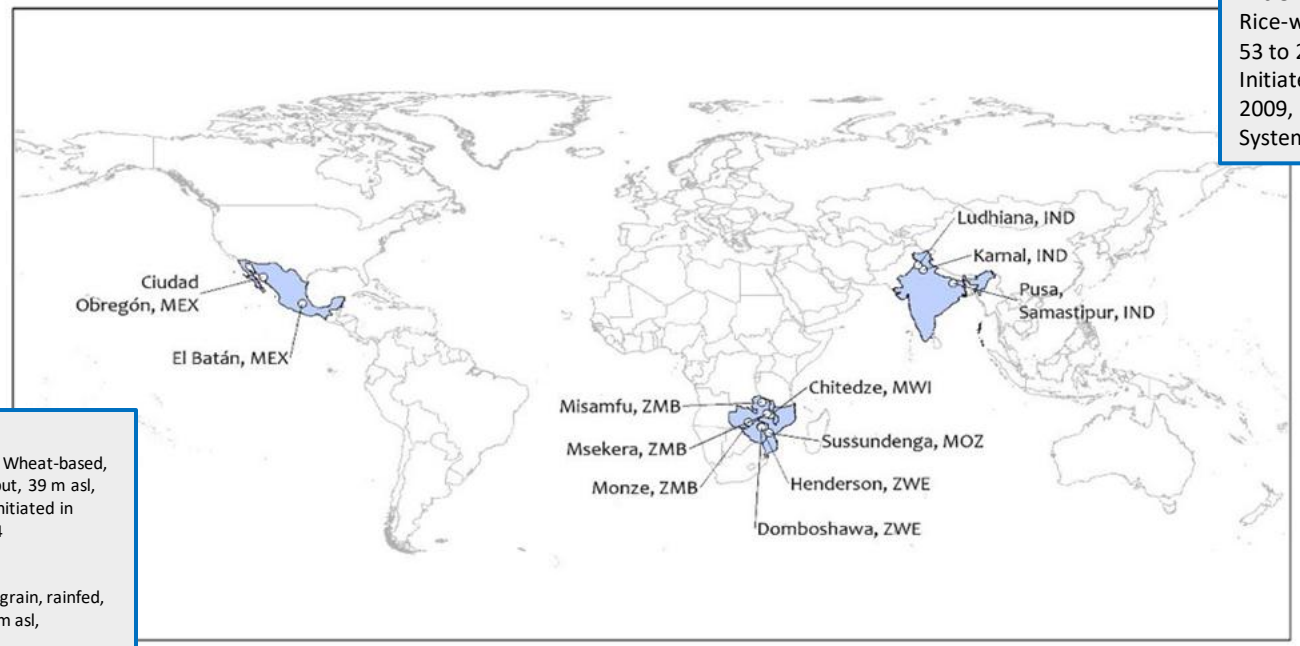
Agile systems science at scale

Ingredients?

- People
- Place
- Process

Agile systems science: working across disciplines

- It takes 'venturesome scientists willing to work across disciplines…'

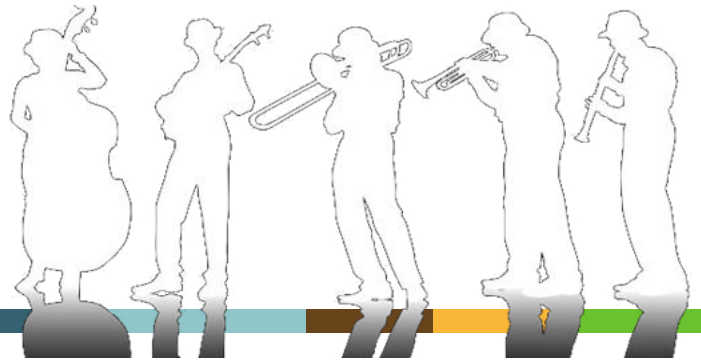


Indo-Gangetic Plains
Rice-wheat, irrigated,
53 to 250 m asl, 6 LTEs,
Initiated in 2006, 2007,
2009, 2012, 2014, 2015 CA Systems

Mexico
Ciudad Obregón Wheat-based, irrigated high-input, 39 m asl, Vertisol;3 LTEs, initiated in 1992, 2005, 2014

El Batán
Maize and small grain, rainfed, low-input, 2249 m asl, Phaeozem;
2 LTEs, initiated in 1991 and 1999

HUBS Chiapas, S. Pacific, Oaxaca
Maize-based rainfed low & high input, CA Systems LTEs, initiated in 2015 & 2016



Southern Africa
Maize-based, rainfed, 1018 to 1547 m asl, Lixisols, Luvisols, Ferralsol, 6 active LTEs, Initiated in 2004, 2005, 2007, 2009, 2010, 2015 CA Systems

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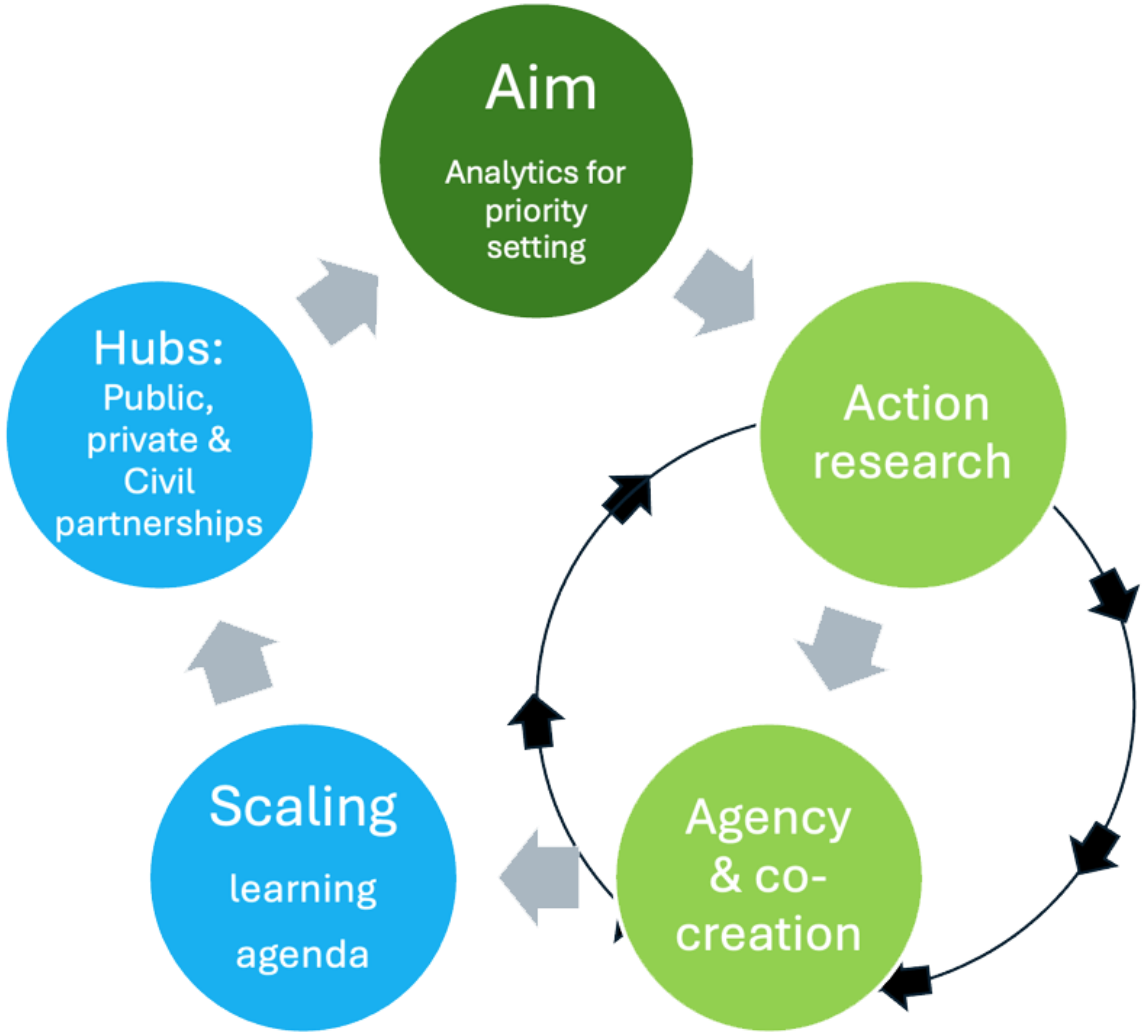
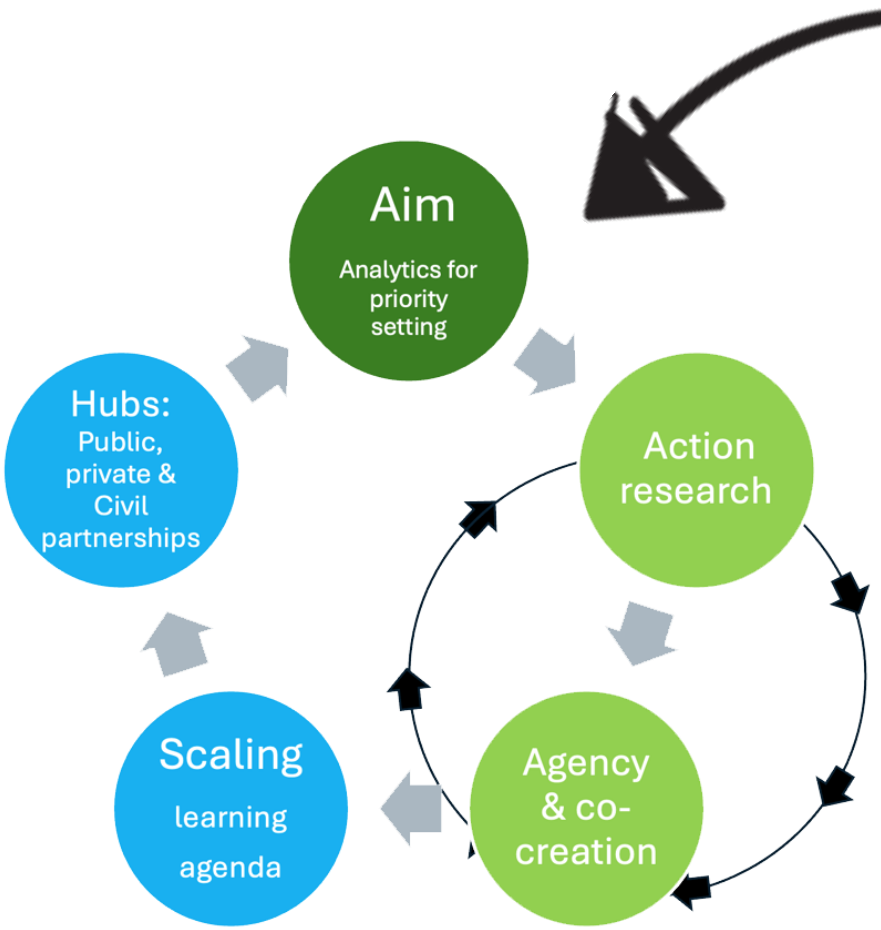
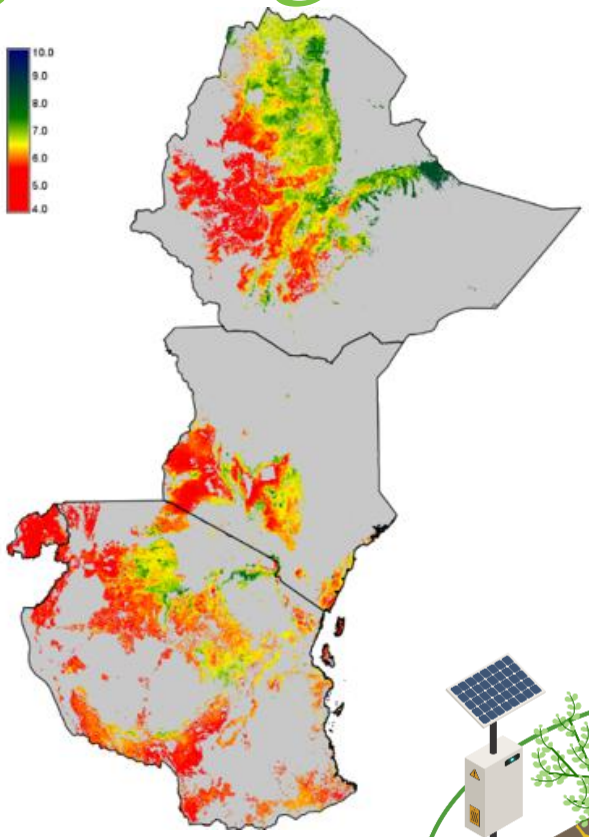
Agile systems science supports adaptation and adoption

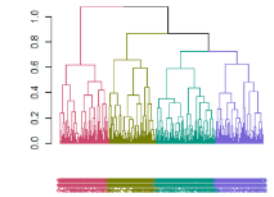
1. **Priority setting at different scales**
2. **Participatory action research** for iterative co-design and evaluation to generate options: **Plan** together, **Act** together, **Iteratively learn** and **Scale out.**
3. **Innovation systems and scaling** for dissemination of options generated: Hub catalyzed business models, extension advisors and village based advisors

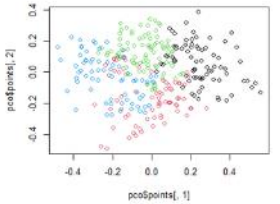


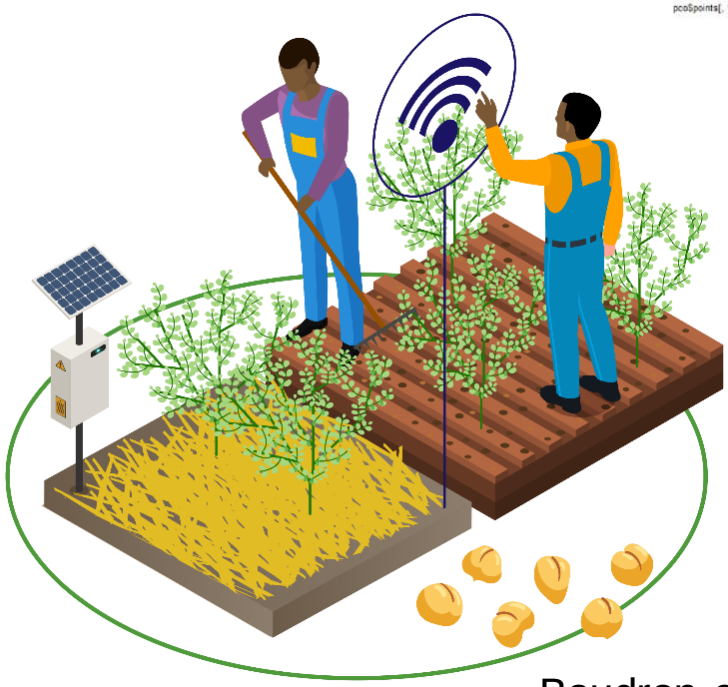
AIM: Analytics for priority setting





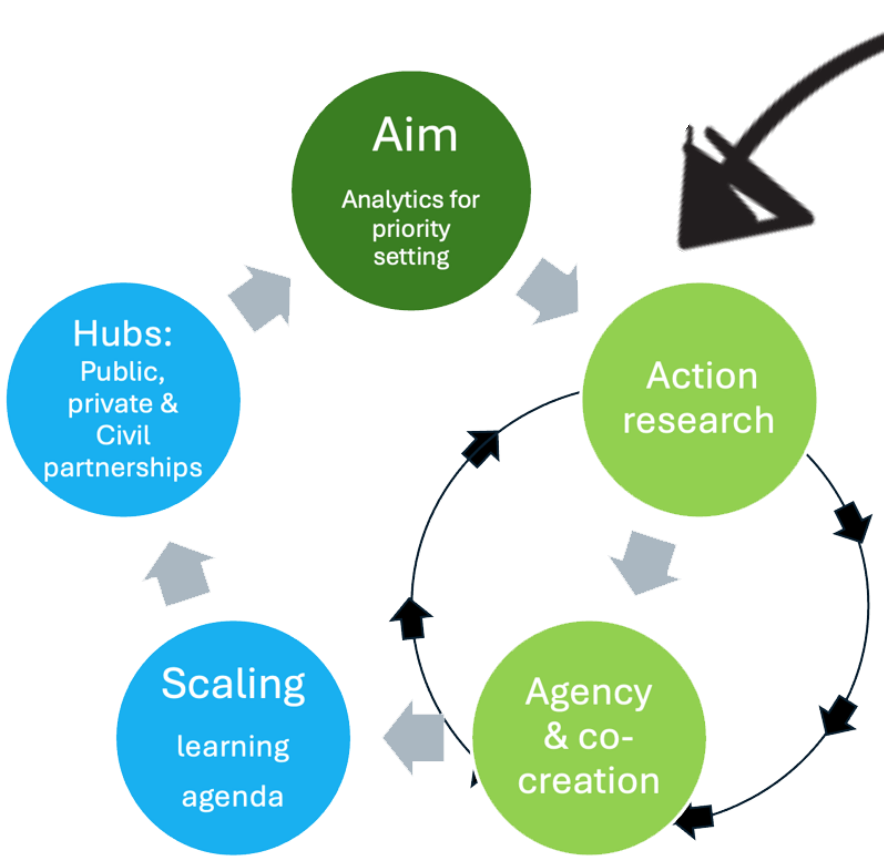




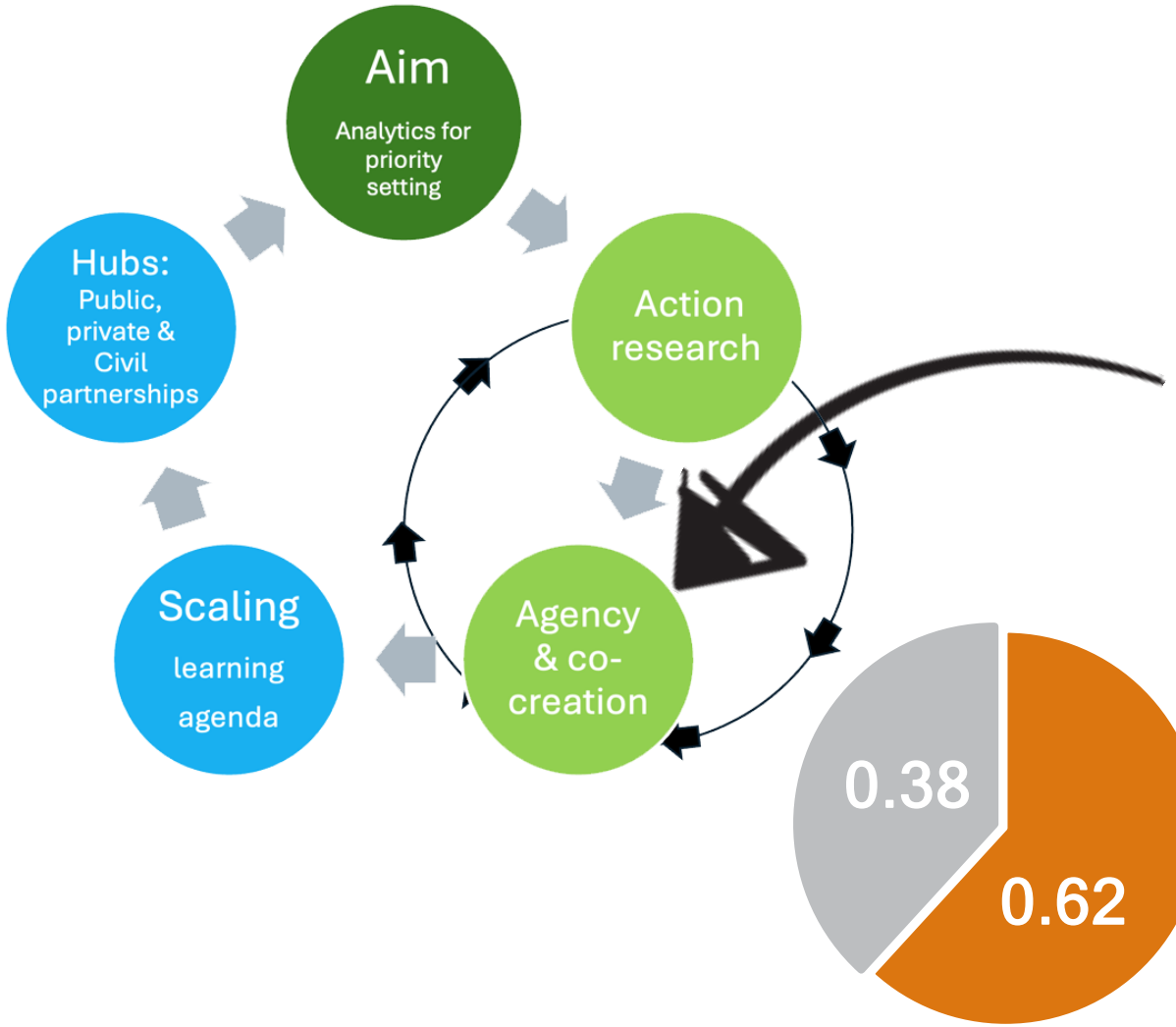


Baudron et al., 2022

ACTION RESEARCH:



AGENCY & CO-CREATION:



- Geospatial analysis and farm typologies capture heterogeneity for representative sites
- Gender aware, farmer engaged approach in maize breeding

Significant share of couples disagree on best performing maize genotypes

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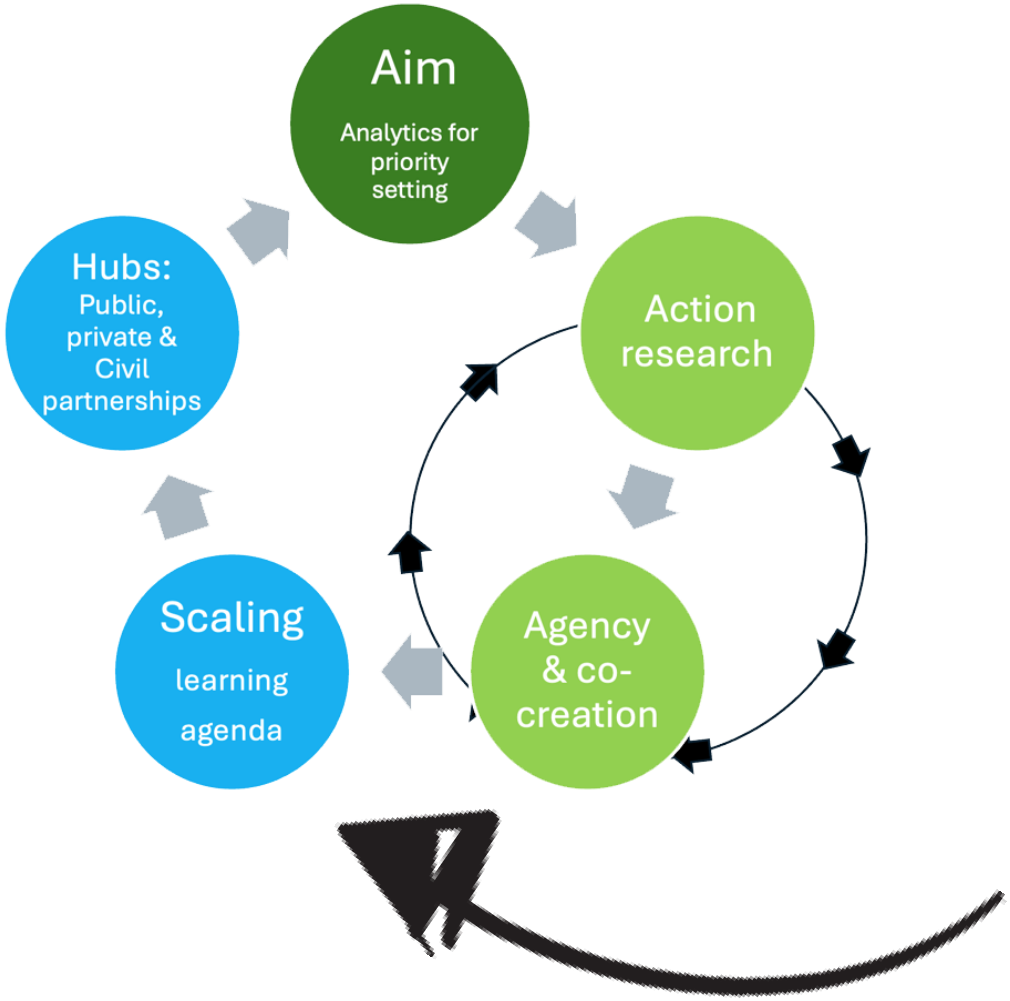
SCALING – A learning agenda:



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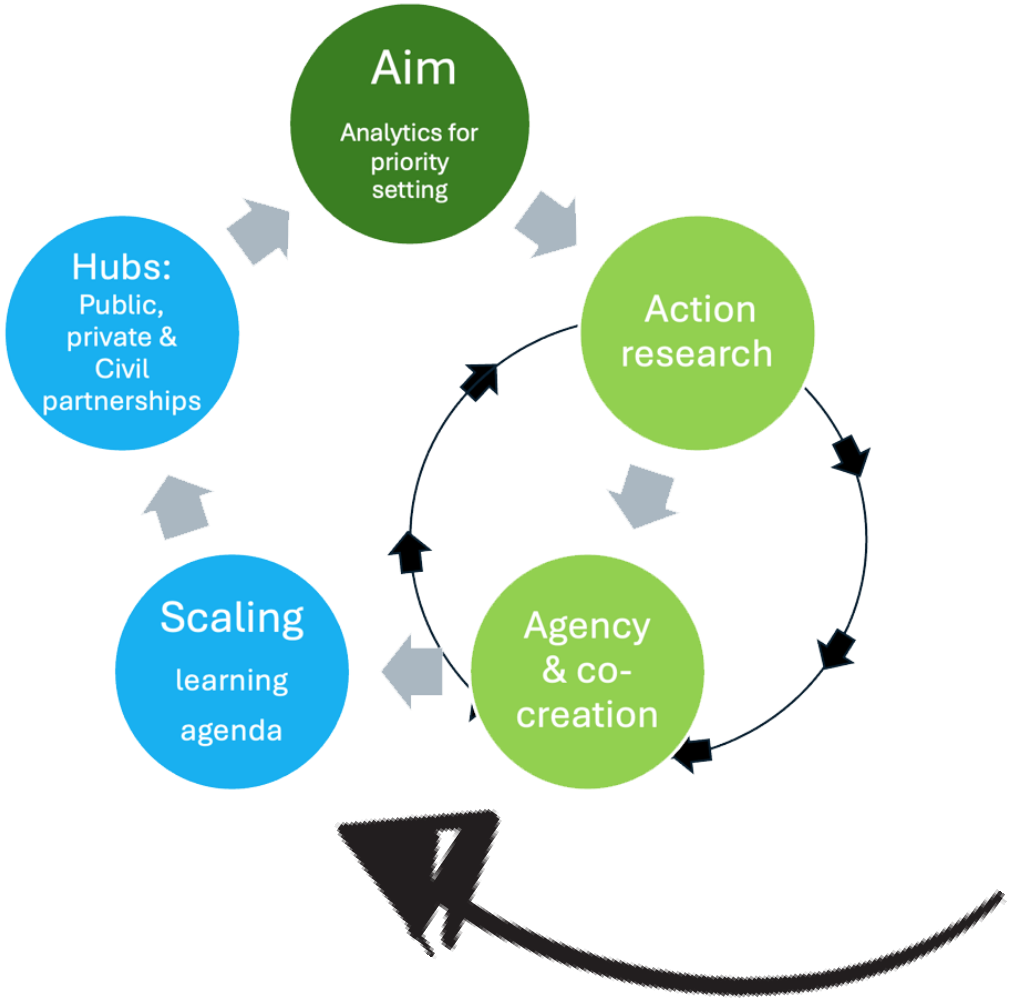
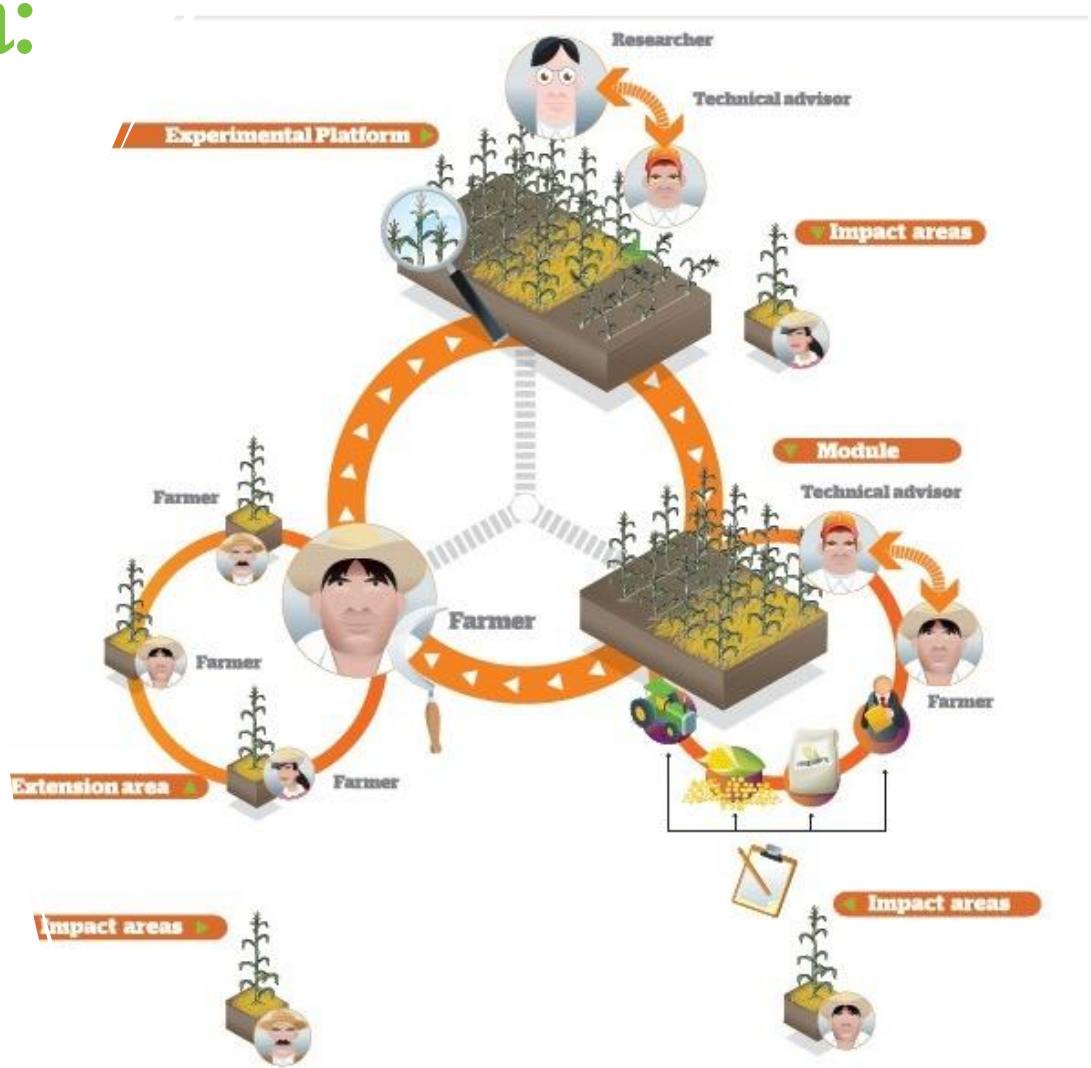
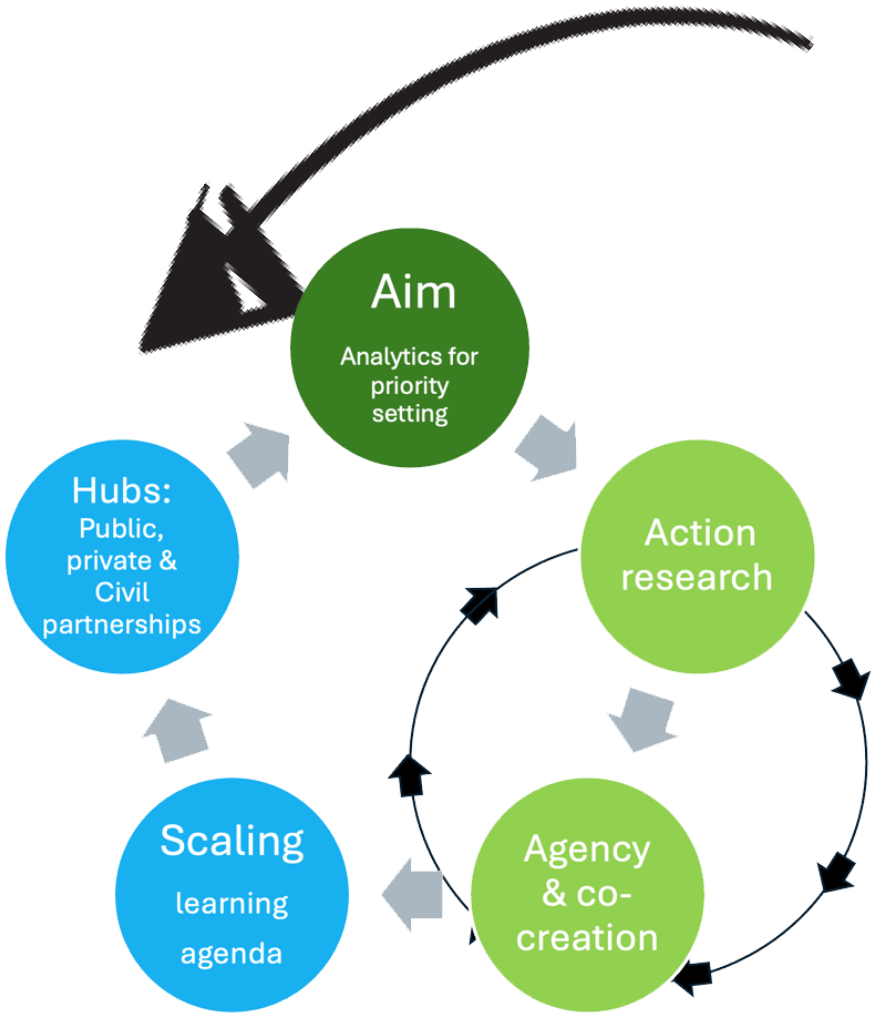




"MasAgro" in Mexico *Govaerts et al., 2023*

HUBS – Public, private and civil society partnerships



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Research infrastructure needs: Data systems

Triangulate data:

- Learning landscapes
  - Participatory action research linked to long-term experiments

Open data:

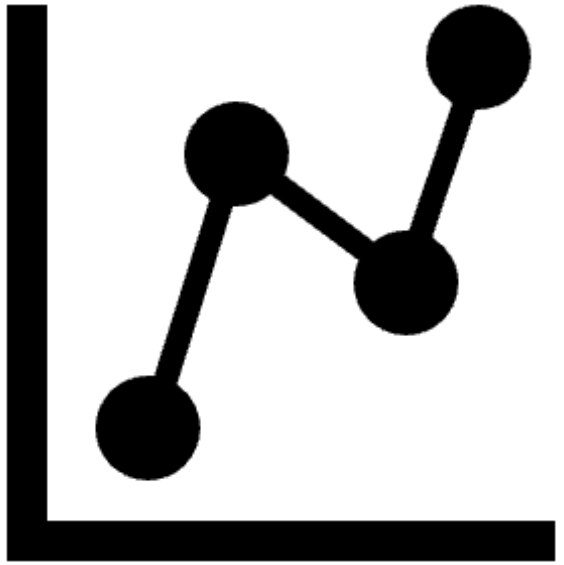
Open protocols: Publish SOPs

Open data: Soil properties LandPKS, handhelds & NDVI handheld sensors

Open science:

Synthesis through simulation models, AI, Bayesian analysis, positive deviation

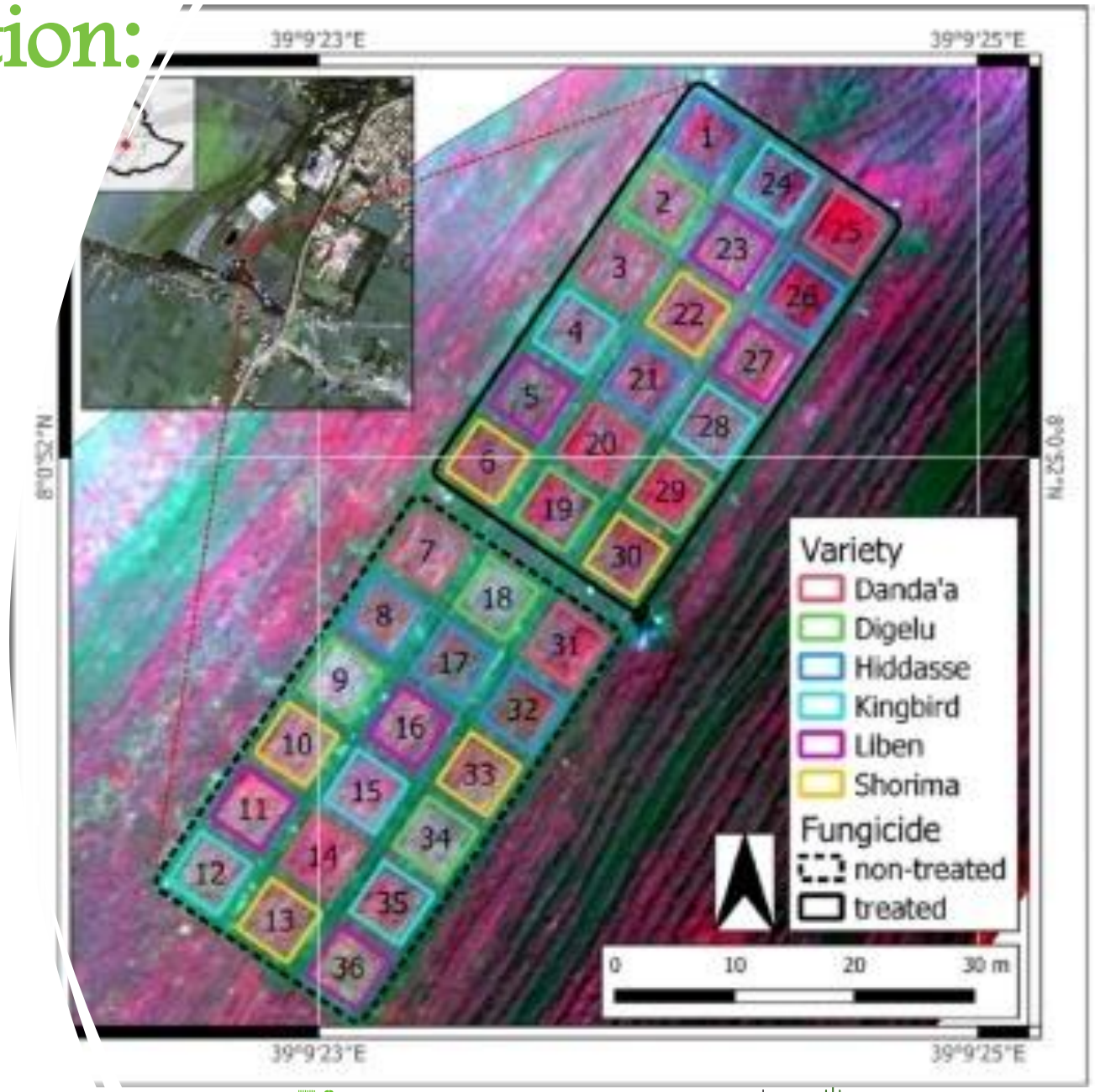
Publish open access, dataverse, mini-papers, etc



A new infrastructure in action: Ethiopia

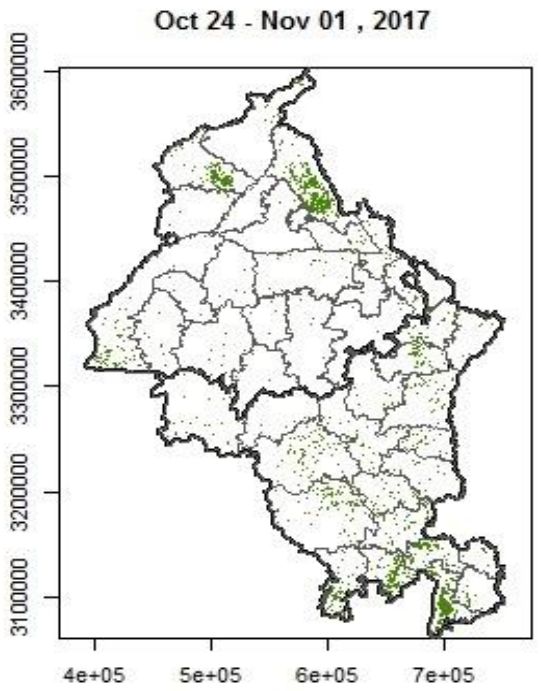
- **Evidence based agile systems:** Remote sensed data predicts rust disease progression in wheat
- **Wheat yield protected:** Warnings reach farmers, government extension and private sector ICT ‘Lersha’ promote a learning agenda on rust tolerant varieties and judicious fungicides, IPM
- **Society benefit:** Improved understanding of disease-plant-farmer decision making, nutritional gains

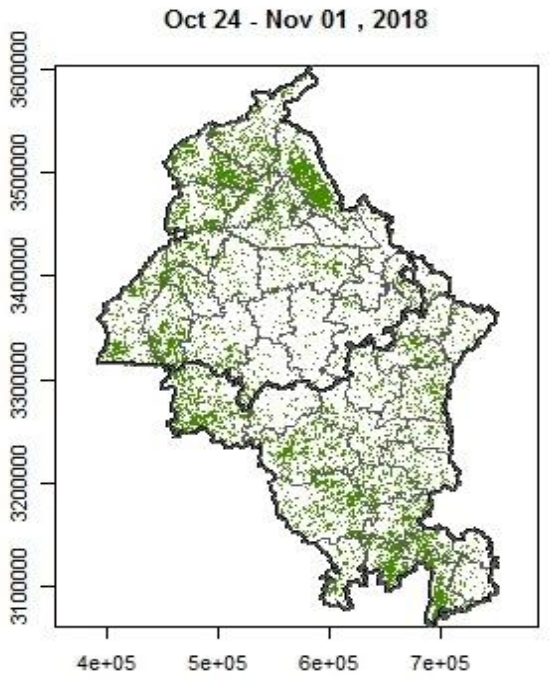
New infrastructure buffers agriculture

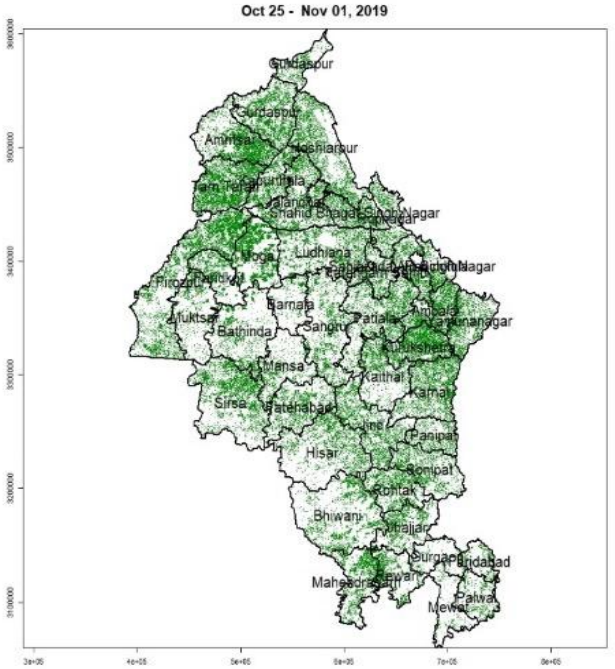


A new infrastructure in action: India

- **Evidence based agile systems:** On-farm assessments, analysis, action research on CA
- **Wheat yield protected:** Adapted varieties, CA, early sowing and diversification with mungbean/vegetables promote reduced residue burning and earlier harvest, escape heat waves







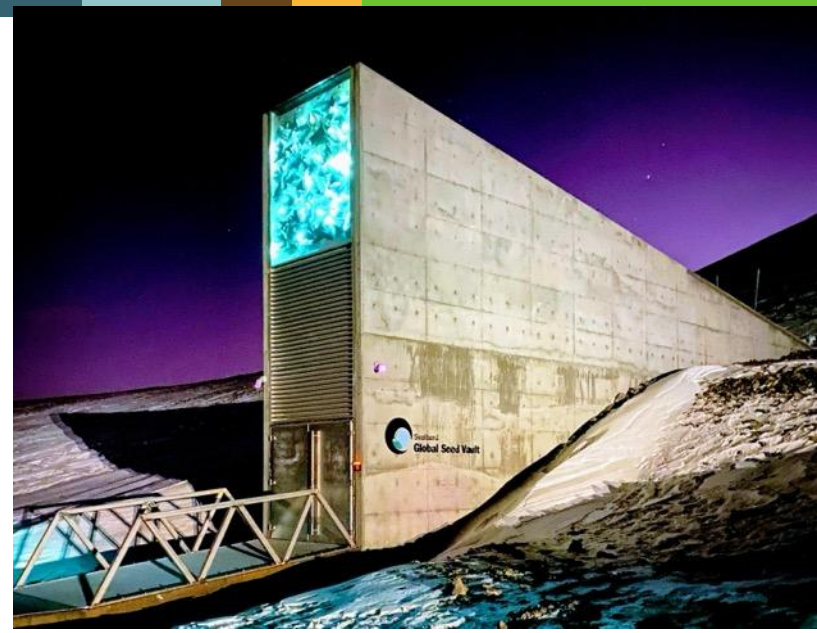
A new infrastructure in action: India

- **Beating the heat**
- **Society benefit:** Improved air quality, soil health, water savings, higher wheat yields and diversified farming for nutritional gains.
- >600,000 ha of wheat are now sown earlier, substantial adoption of conservation agriculture

Agile systems science at scale

How do we build this new infrastructure?

- People
- Place
- Process



Svalbard's Global Seed Vault