Agricultural technologies and their role in providing agro ecosystem services in selected sites of Kenya

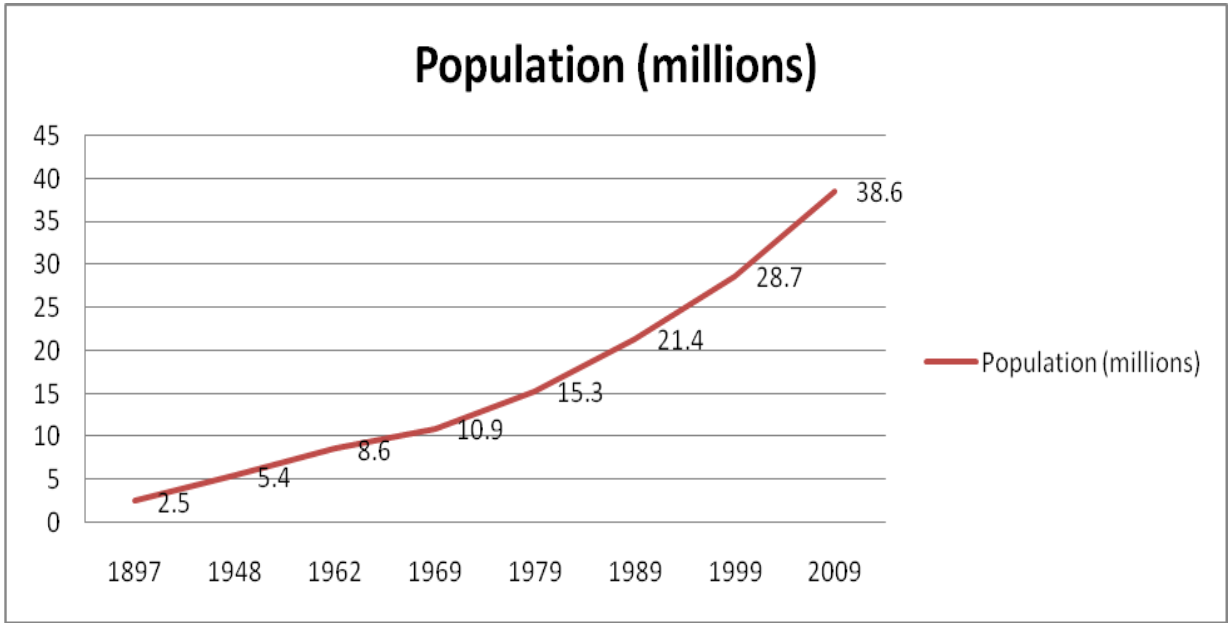
Dr. Immaculate Maina

Kenya Agricultural Research Institute (KARI)

Outline of the presentation

- Background
- Broad research issues
- Study sites
- The theoretical framework/Approach
- Case studies: Agriculture technologies and ecosystems services
- Lessons Learnt
- Conclusion

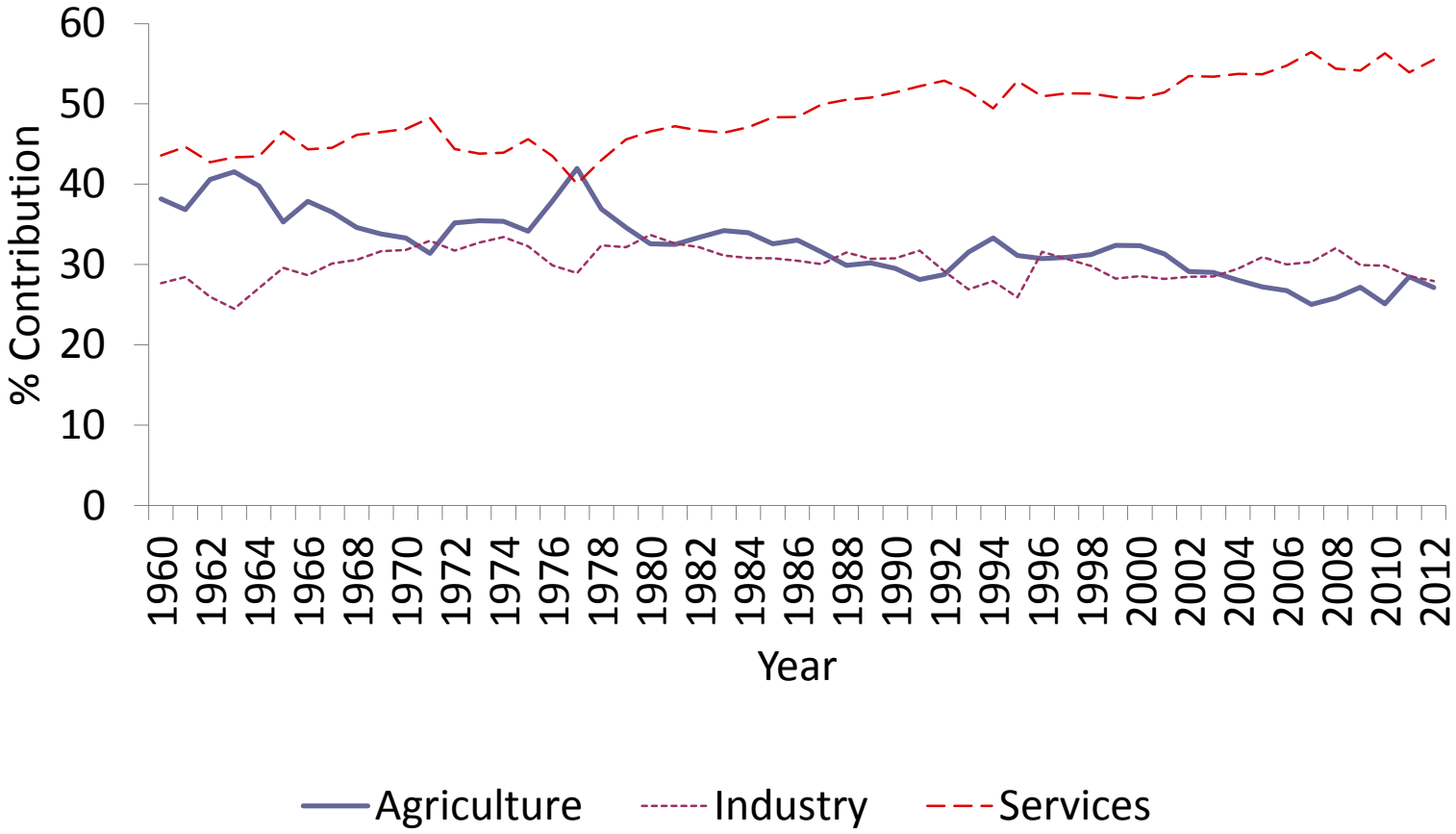
Development challenge: High population growth and high food insecurity levels



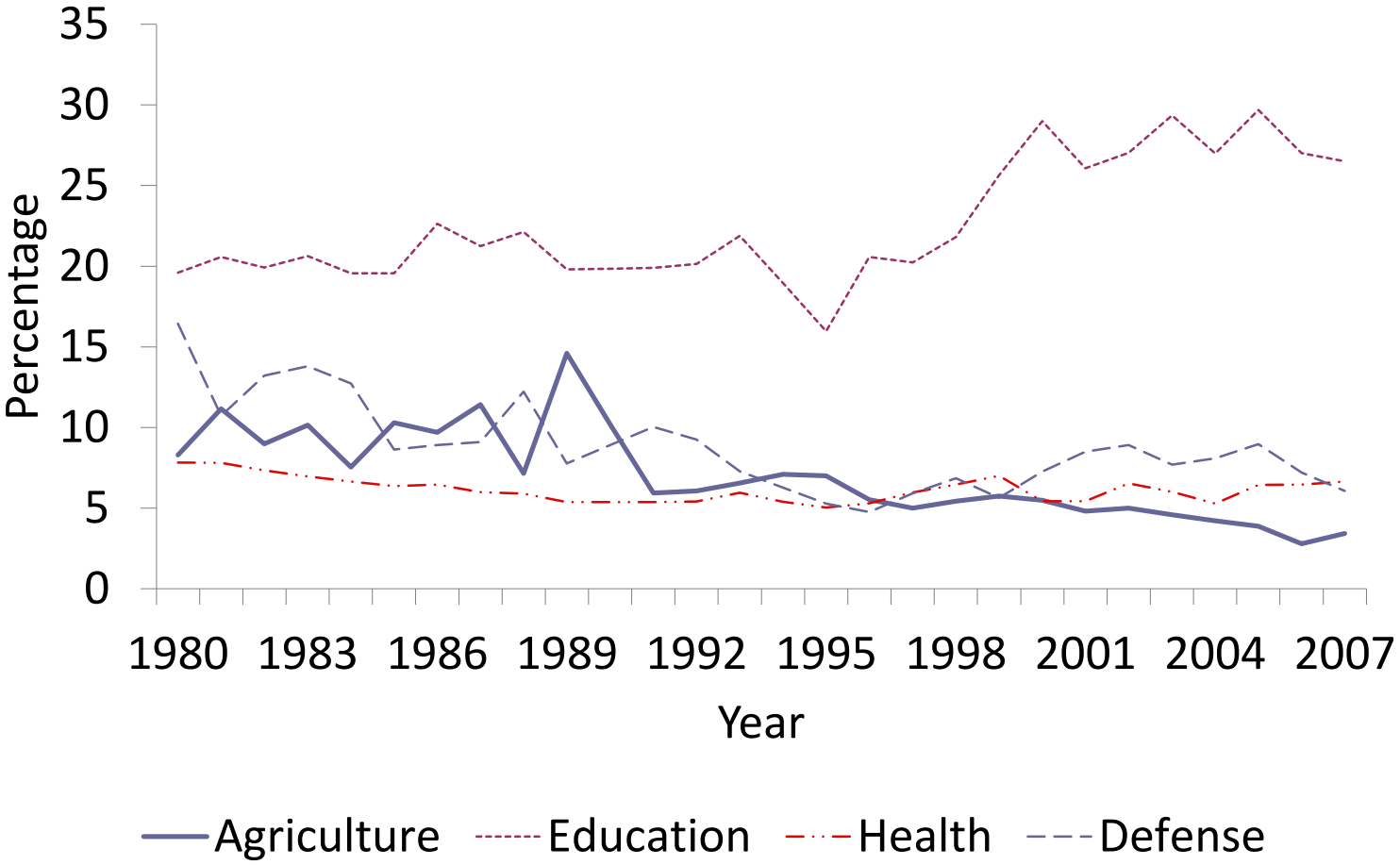
- In Kenya, smallholders are the main food producers but paradoxically, they are also the most food insecure

- Small holder food production requires strategies and practices that enable farmers to adapt and be more resilient

Declining trend in contribution of Agriculture to GDP – trapped populations



Declining public expenditure on agriculture in Kenya



Key research questions / Focus

a. **How can agricultural "best-bet innovations and technologies" be harnessed to reach the "hardest to reach?"**

- The focus: To enhance adaptation of pro-poor agri-food system innovations to improve food security

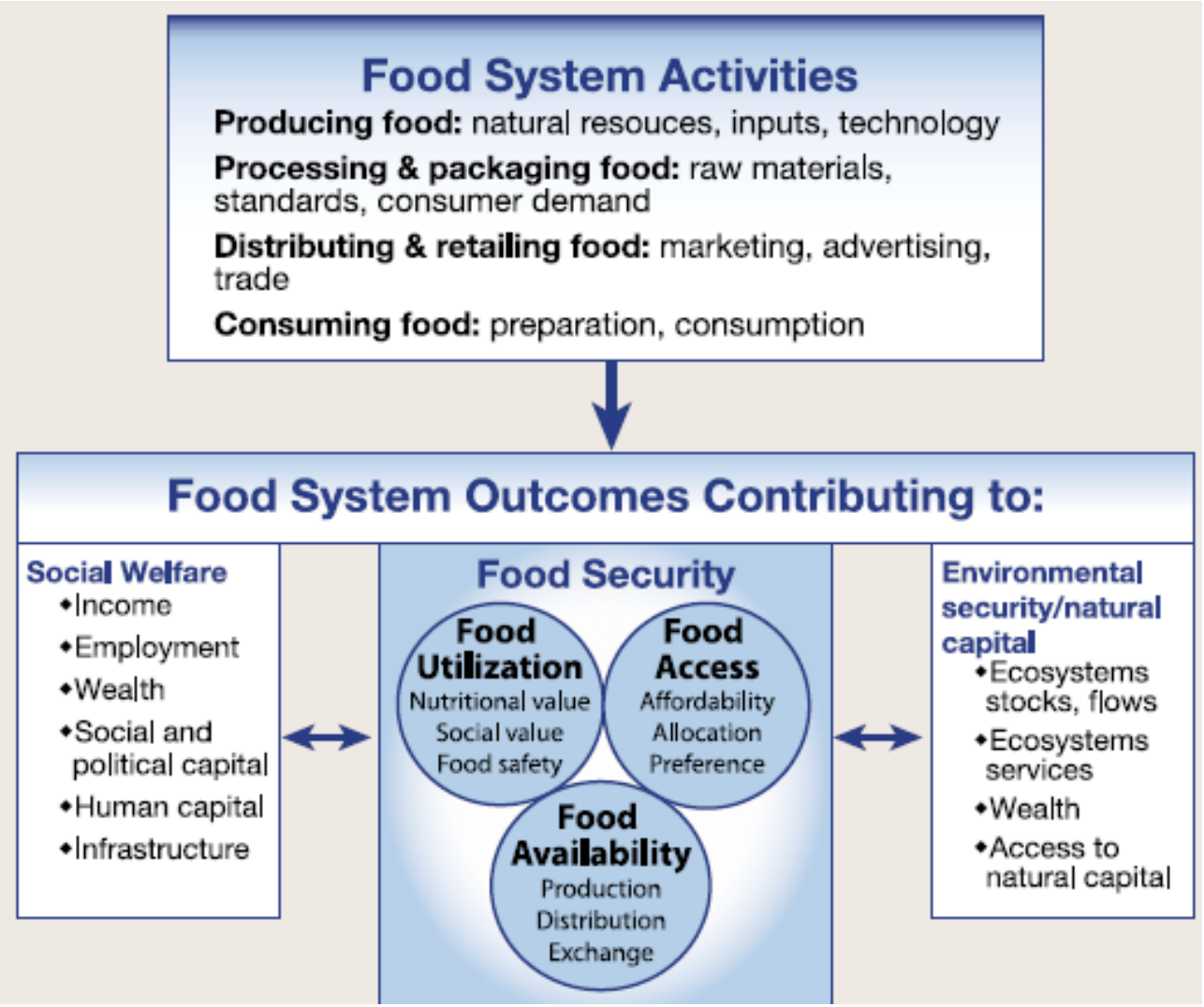
b. **Which factors influence successful inclusion of smallholder farmers in value chains?**

- The focus: Development of pro-poor agro-enterprise value chains for sustainable rural livelihoods

Study sites

- Mbeere South Sub-County
- Imenti South Sub-County
- Kirinyaga West Sub-County
- Nyandarua North Sub-County
- Naivasha Sub-County
- Malindi Sub-County
- Trans Mara Sub-County

Agri-Food Systems Approach - Multidisciplinary (and Trans-disciplinary)



Agriculture technologies and agro-ecosystem services: Case studies

Case study I: Integrated soil fertility management

- Soil nutrient losses in Kenya are extensive; fertilizer and manure application on smallholder farms is low

- Integrated systems yielded positive ecosystem services in the form of on-farm nutrient replenishment and higher crop yields.

- **Soil fertility amendment options**
  - 40 Kg P /ha + 40Kg N /ha
  - 40 Kg P /ha + 20 Kg N /ha
  - 40 Kg P /ha + 40Kg N /ha + Manure 5 t/ha
  - **40 Kg P /ha + 20 Kg N /ha + Manure 2.5 t/ha (Best option)**
  - Manure 5t/ha

Case study II: Water management in rain fed systems

- **Water harvesting techniques for higher crop yields**

  - Tied Ridges (Better yields)
  - Contour furrows

Case study III: Promoting "orphan crops" or traditional crops of high value

- Small holder food production requires strategies and practices that enable farmers to adapt and be more resilient
  - Food insecurity is often seen as failure of maize and other major crops to respond to localized concerns and vulnerabilities
  - With climate change – maize is often failing, returns are low; farmers need alternatives to maize
  - ➢ Locally important, underutilized crops provide good alternatives for enhanced nutrition, higher productivity, biological integrity and climate adaptability while maintaining diversity

Pulses	Root & tubers	Edible oil crops	Cereal crops
Dry Beans (7.13)	Sweet-potato (7.33)	Oil palm (5.82)	Finger-millet (6.84)
Pigeon-pea (6.39)	Cassava (6.70)	Soybean (5.75)	Sorghum (5.93)
Cowpea (6.33)	Potato (6.68)	Safflower (5.55)	Maize (5.64)
Dolichos (7.13)	Arrow roots (5.68)	Sunflower (5.23)	Wheat (5.24)
Chickpea (6.08)	Yams (4.59)	Sesame (4.59)	Pearl Millet (5.24)
Grams (5.88)		Canola (.4.30)	Rice (5.02)
Bambara nuts (4.42)			Proso Millet (4.75)
			Foxtail Millet (4.12)

Case study III: Promoting "orphan crops" or traditional crops of high value ....provides opportunities for improved nutrition

- Nutritional status of children under five
  - High malnutrition rates – Stunting (32%); wasting (7.9%) and underweight (22%)
  - Highest stunting levels in children 18-28 months – poor weaning and complimentary feeding regimes

- Infant and young children feeding practices
  - Low dietary diversity – mainly cereals and low levels of legumes
  - Suspected micronutrient deficiencies

➢ Opportunity exists in traditional crops of high value +Skills in food preparation + Nutrition education

Case study IV: Lessening the impacts of disease or pest outbreak (Example of passion fruit)

Brown spot

Fusarium wilt and dieback

Woodiness virus

Stink bugs damage

Mites damage

Thrips

Case study IV: Lessening the impacts of disease or pest outbreak in passion fruit.....

- Providing skills in agronomic practices reduced severity and spread

Case study V: Development of pro-poor and inclusive value chains for improved household incomes and wealth


Beekeeping


Indigenous chicken

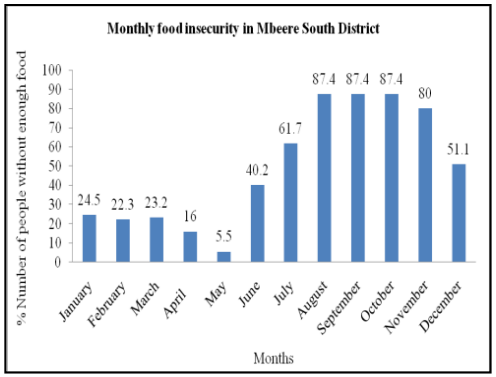

Banana

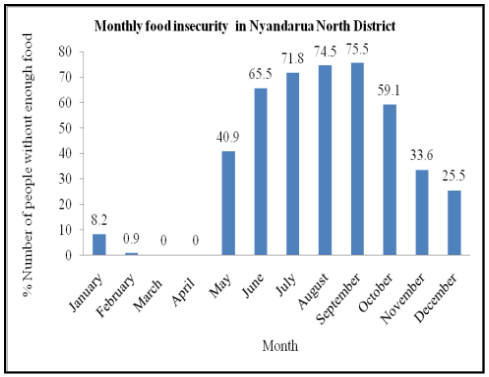

Passion fruits

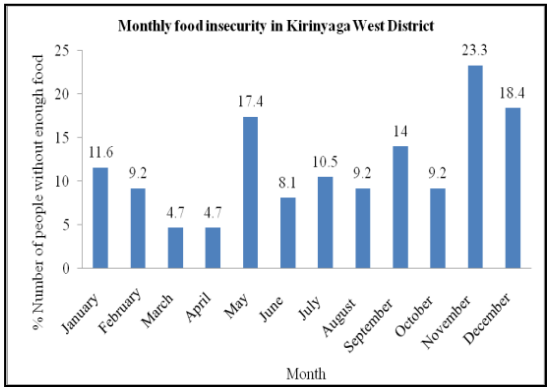
Lessons learnt

Lesson I: Providing agro-ecosystem services ….. requires appreciation of demographic and socio-economic dynamics

- Dependent population outweighs the productive population
- Many households experience a long hunger gap
- Sale of food crops is a major source of household income
- Small land size is available for under cultivation



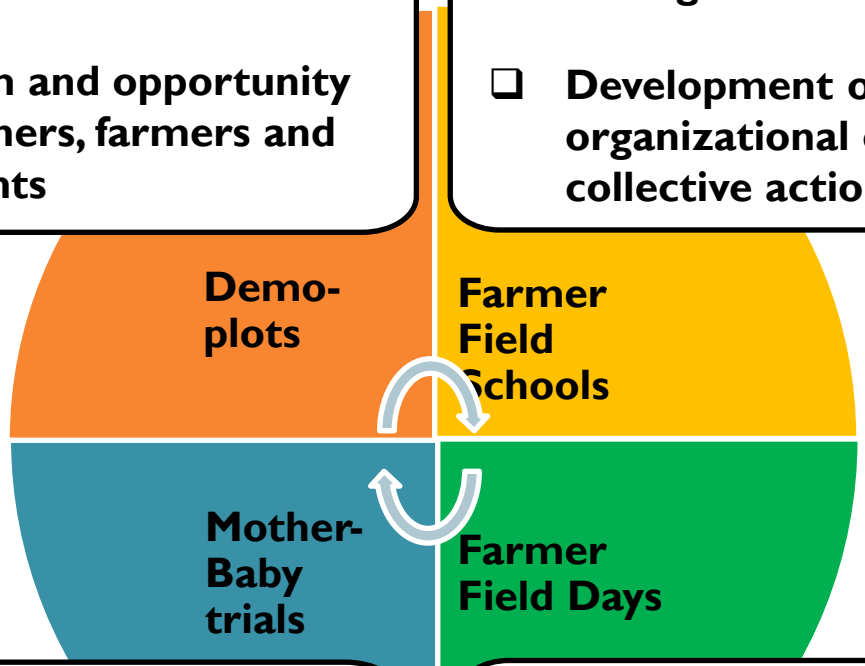




Lesson II: Providing agro-ecosystem services….. requires multiple strategies

- Access to technical information
- Shared problem and opportunity among researchers, farmers and extensions agents

- Shared creativity and learning through iterative reflection
- Development of local organizational capacity for collective action

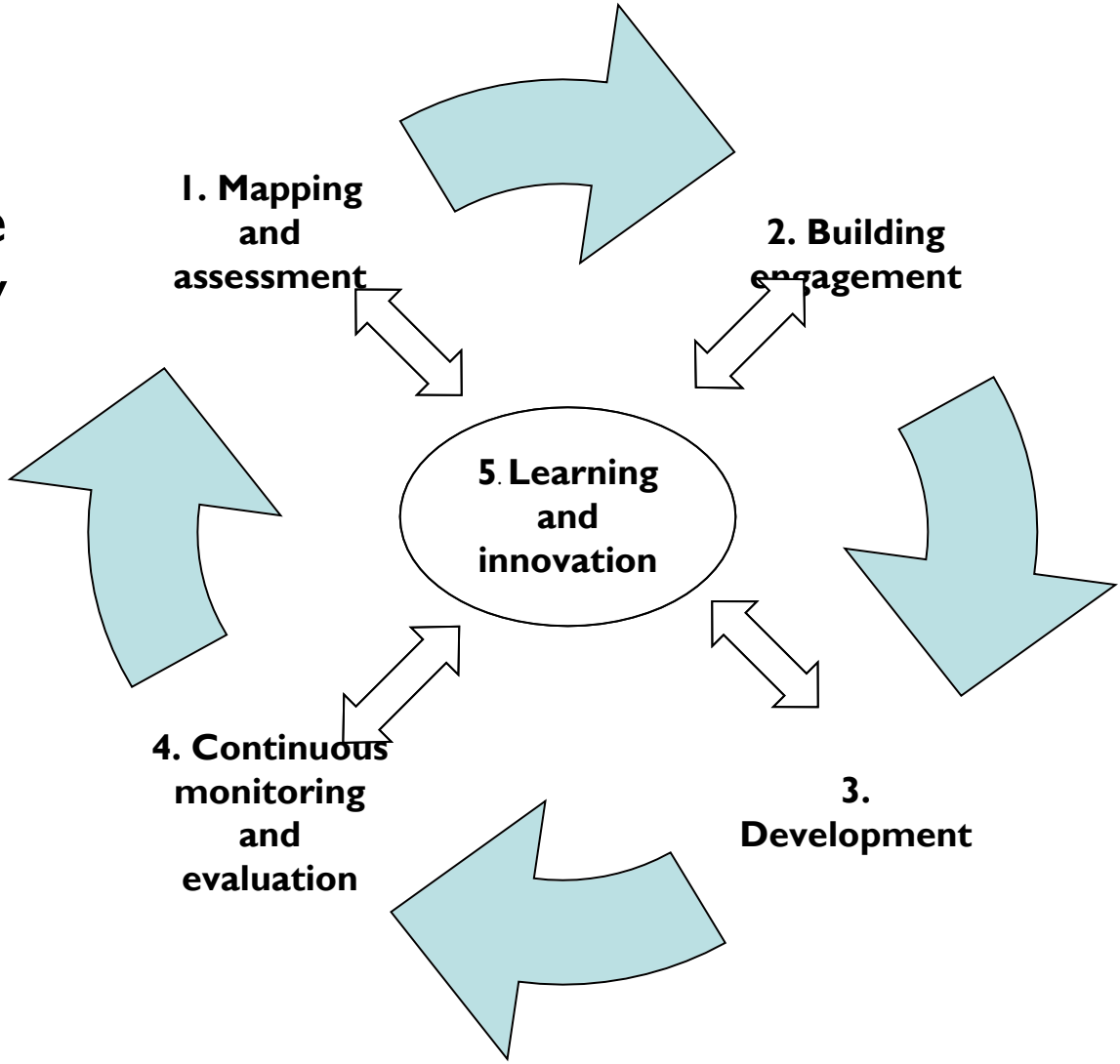


- Effective research design
- Effective cross-disciplinary learning

- Scaling-up and scaling out
- Facilitation and negotiation at different levels

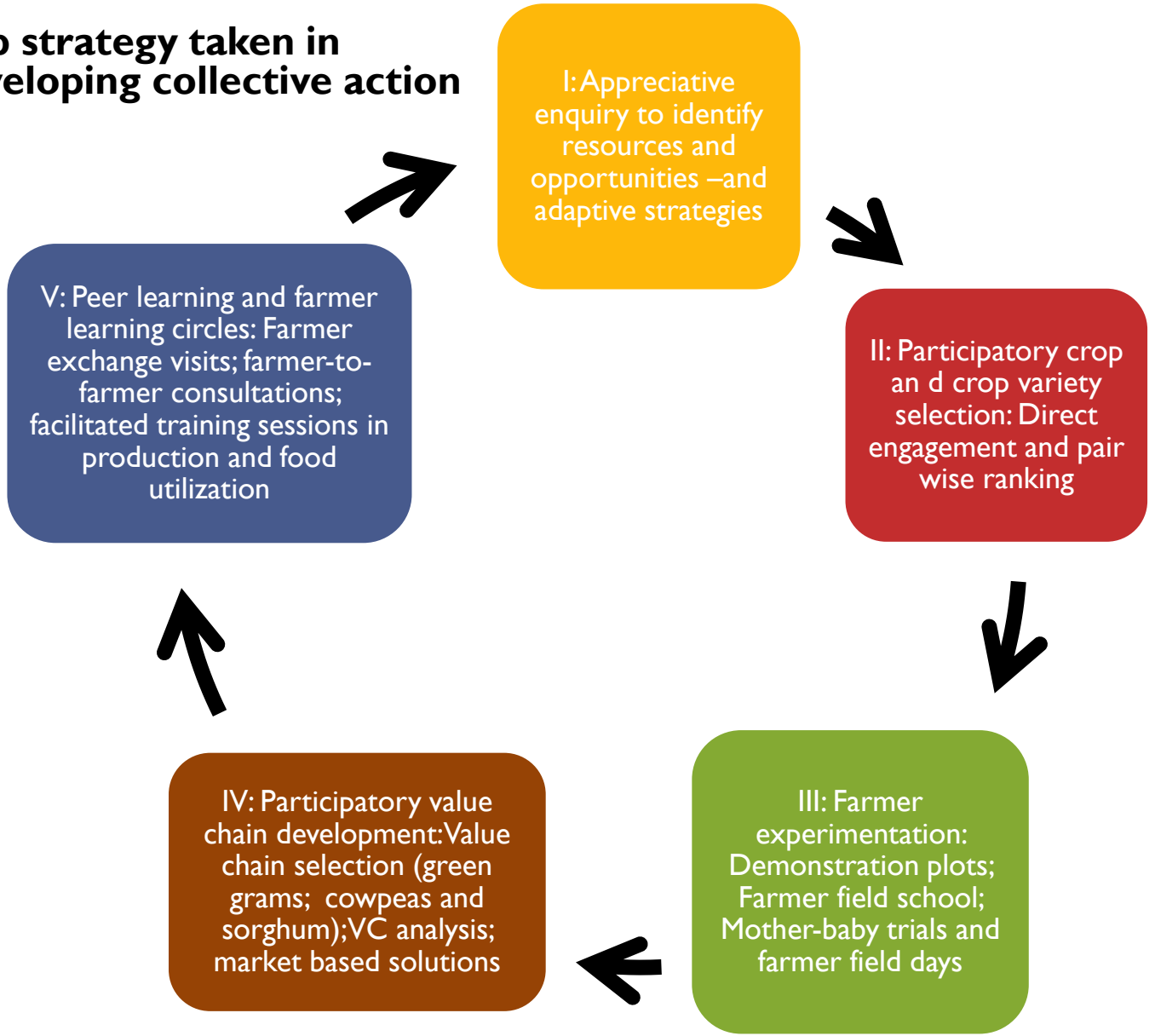
Lesson III: Providing agro-ecosystem services ….. Requires building and managing multi-stakeholder partnerships

- Engage in interventions that seek to coordinate the complimentary and synergistic efforts of various players
- The emphasis is how best to leverage such synergy for greater impact



Lesson IV: Providing agro-ecosystem services ….. requires collective action among smallholders

5-Step strategy taken in developing collective action



Lesson V: Providing agro-ecosystem services ….. requires gender considerations

The Gender Parity Index (GPI) and WEAI – This reflects the percentage of women who are as empowered as their spouses. The score ranges from 0-1. The closer the GPI is to 1 the more the gender parity.

	Malindi	**Naivasha**
% of women without gender parity (H_GPI)	0.527273	0.462963
Weighted inadequacy count (ci_average)	0.249296	0.161599
Average empowerment gap (GPI)	0.868553	0.925186
WEAI	**0.738**	**0.831**

Conclusion

- In Kenya, implementation of agricultural technologies to deliver ecosystem services occurs within complex agro-ecological systems and diverse socio-ecological systems which are important for smallholder agricultural production to achieve multi-functionality from agricultural landscapes.

Acknowledgements

- Director Kenya Agricultural Research Institute (KARI) for supporting this project
- KARI research team
- Funding from the International Development Research Cooperation (IDRC) through IDRC Grant Number 105790-003 and Ford Foundation Grant Number 1120 1956
- The contribution of the extension staff, local administration, the field enumerators, private sector actors and the farmers who participated is also highly appreciated

THANK YOU FOR YOUR ATTENTION