Complex agricultural problems and innovative approaches to their solutions

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Who is in the room?
Please pick the category that best describes your primary affiliation

A. Government / Extension
B. NGOs / Civil Society
C. Research
D. Other
Who is in the room?
Please describe your exposure to innovation platforms (IPs)

A. Innovation what? Never heard of it...
B. I heard of it but not really sure what they are
C. I’ve worked with IPs before and have a basic understanding of the concept
D. I’ve used IPs extensively and have a strong grasp of the topic
Objectives of the module

The core objectives of the module include:

- To identify and examine the main features and characteristics of complex agricultural problems
- To explore innovative solutions to address complex agricultural problems
- To examine the circumstances under which innovative solutions emerge
Complex agricultural problems defined

- In one way or another, agriculture is integral to the physical and economic survival of every human being.
- Agricultural problems are multidimensional and multilevel involving many actors.
- The causes of agricultural problems are also complex.
Complex agricultural problems

• Agricultural sustainability is a must if we want to be able to produce food for the generations ahead

• Agricultural sustainability is complex and needs to cover the whole food chain, from production to consumption

• Contemporary agriculture = managing land in ways that conflict with the healthy functioning of ecosystems (level fields, reductions of biodiversity, no rest period, use of toxic chemicals, etc.) Yet agriculture depends on the healthy functioning of ecosystems (Hollander, 2004)
Complex agricultural problems

The Status of the Agricultural Production Base; characterized by disconnects, both the in developed and developing world:

• Disconnects between agriculture and the environment;
• Disconnects between producers and consumers or land and cities;
• Disconnects between policies and expectations. (Peter, 2012)
Disconnects between agriculture and the environment

- Human activities have significantly disturbed water, carbon and nitrogen cycles and so are impacting global climate change, which in turn is and will impact agricultural productivity and challenge sustainability.
- Contemporary farming methods have degraded soil leading to massive fertilizer use. (Peter .2012)
Climate Extremes

- Heat Wave
- Dryness
- Heavy Rain
- Hurricanes
- Cold Wave

Natural Hazard

- Drought
- Flood
- Storm Surge
- Wind
- Freeze

Natural Disasters

- Agriculture: Crops, Livestock, Forests
- Water: Irrigation, Urban, Industrial
- Ecosystems, Environment
- Coastal Ecosystem
- Damage to Crops

Sectoral Impacts

- Loss of productivity
- Food security
- Competition, Quality, Efficiency
- Destruction of Biodiversity

Quality of Life

- Loss of life and Property
- Saline intrusion, Beach erosion, Water contamination, Power disruption

Sectoral Impacts

- Agriculture: Crops, Livestock, Forests
- Water: Irrigation, Urban, Industrial
- Ecosystems, Environment
- Coastal Ecosystem
- Damage to Crops
The Challenge: Sustainable Agriculture in a Changing Climate
Disconnects between producers and consumers

- Perpetual low prices that consumers are generally willing to pay for food (making farming a precarious business), is now compounded by a crisis of trust amongst consumers, fueled by food scares (Mad Cow, Bird Flu) and a sense that many supermarket foods are low on nutritional value, high on price. (Peter, 2012)
Disconnects between policies and expectations.

- Almost every country in the world cherishes its agricultural roots, in song, picture and mythology.
- But this valuation is rarely translated into policy to support the family farms that are central to an agricultural community. (Peter. 2012)
What makes agricultural problems so complex?

A. Technologies used in agriculture are more sophisticated than ever before

B. Problems tend to be multidimensional, multilevel and involve multiple actors

C. Most problems are linked with climate change which has brought about complex changes in agricultural ecosystems

D. Each problem requires multidisciplinary research to discover a solution
Which of these situations do **NOT** represent a 'disconnect' in the Agricultural Production Base?

A. Degraded soils requiring high levels of fertilizer inputs

B. Distrust between consumers and producers of agricultural produce

C. Strong cultural roots in a country's agricultural heritage

D. Saline intrusion and beach erosion resulting from unprecedented frequencies of storm surges
When we say that complex agricultural problems are 'multidimensional' do we mean...

A. They require input at national, regional, local and sometime global level.

B. They demand the involvement of multiple actors to achieve resolution.

C. They involve a range of agricultural products.

D. They are an interplay of biophysical, technical, socio-cultural, economic and political factors.
Explaining complex agricultural problems, and examining and designing and applying remedies will not be fruitful if these dimensions, levels and stakeholder needs and interests are examined and addressed separately.
Factors Behind complexity

- The principal reasons that make agricultural problems complex can be grouped under four main categories.

  1. Complex agricultural problems are an interplay of biophysical, technical, socio-cultural, economic, institutional and political factors.

  2. They have different implications across different levels and they are intertwined in interactions across different levels (for instance global, national, subnational).

  3. They are characterized by the involvement of a multitude of actors and stakeholders. For instance, farmers, politicians, private sector, NGO and academicians may all be involved in identifying remedies to such problems.

  4. The development of the problem and the efficiency and effectiveness of different types of proposed solutions is uncertain and unpredictable.
Factors Behind complexity

Multi-dimensional

- Interaction of biophysical, technological, socio-cultural, economic, institutional and political dimensions.
- For instance leaving import taxes on steel without putting taxation on imported agricultural equipment and machines (institutional dimension) will hurt producers of locally adapted agricultural equipment such as no-till planters. This has implications for effective soil conservation for sustainable crop management (biophysical dimension).
Climate change and food security

- Rainfall patterns
- Temperature
- Reduced yield/income
- Drought resistant varieties
- Kyoto protocol
- Carbon credits
- Cropping calendar
- Who is responsible?
- Who pays?
Factors Behind complexity

Multi-stakeholder

• Actors comprise anybody who is associated directly or indirectly with a problem, or with the possible remedies to a problem.
• Stakeholders are those actors that can affect or be affected by actions, policies and objectives and have a vested interest in addressing the problem and whose participation in finding solutions is seen as a major success factor.
• Stakeholder involvement can provide understanding of the various dimensions of the problem and the kinds of solutions that are both technically feasible and socio-culturally and economically acceptable.
Complex agricultural problems

Multi-level interactions

- International
- Regional
- National
- Subnational
- Community
- Farm
- Plot

Exploring solutions requires interventions across different levels
Climate change and food security

Intergovernmental Panel on Climate Change (IPCC) – awareness of and structural allocation of resources to CC

SADC Climate Change Adaptation Strategy – impact of CC on water availability for amongst others agriculture

Kenya National Climate Change Response Strategy – urban pollution/ clean energy/ deforestation/ desertification

Farmer climate change mitigation and adaptation strategies (e.g. rain water harvesting)
Factors Behind complexity

Multi-stakeholder partnerships do not only bring key stakeholders together to discuss policy issues, build consensus and implement solutions. They also:

- Foster the sharing of skills and innovation.
- Promote inclusivity and equity
- Promote grassroots mobilization and participation.
- Help to develop trust among groups that are usually suspicious and hostile towards each other.

Source APC, 2007
Complex agricultural problems

Multi-stakeholder
- Policymakers
- Civil society
- Development
- Donors
- Farmers
- Private sector
- Consultants
- Researchers

None of these stakeholders can solve the complex problem on their own.
Factors Behind complexity

Efficacy of solutions Uncertain and Unpredictable

- The development of the problem through time
- Type of solutions and their (undesired) impacts
- Stakeholder interactions
- Phases in e.g. policy processes
- Disorder and catastrophes
Climate change and food security

- How will climate change develop over time?
- What type of climate change adaptation and mitigation strategies will be effective?
- Will different types of stakeholder continue to work together?
Need for agricultural innovations

Solution strategies with attention for:

• Integrated analysis of problem dimensions, design integrated solutions

• Interactions between multiple levels

• Needs and interest of different stakeholder groups (including gender, age, ethnic groups)

• Flexibility and adaptive capacity to respond to uncertain and unpredictable context
How innovations emerge?

http://www.youtube.com/watch?feature=player_detailpage&v=NugRZGDbPFU
How innovations emerge?

• Spaces for creativity
• Where ideas of different people can mingle
• Connectivity, borrow from each other, combine perspectives
• Finding the missing piece
• Such processes take time
• “The whole is bigger than the sum of its parts”
An Agricultural Innovation System (AIS) is a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behavior and performance.’ (World Bank, 2009)

It is a cooperative arrangement putting together several organizations working toward technological, managerial, organizational, and institutional change in agriculture.

Source World Bank, 2009
Define agricultural innovation

- Technology, practice or product handling that will bring increased yield and income to the farmer.
- Modern/ improved or superior production technique used to improve production or quality and quantity required at a given time.
- Novel idea, process, tool, or solution to facilitate healthy and sustainable agriculture that is tailored to a specific context.
Define agricultural innovation

• Combined hardware (technologies – e.g. seeds) and software (social-organisational – e.g. seed systems) to enhance development and business objectives, change for the better

• Tool that can guide analysis of complex agricultural problems, and the identification of entry points that enhance the innovation capacity of the agricultural system in which the complex agricultural problem is embedded.
Emergence of agricultural innovation

- No detailed blueprint exists for making agricultural innovation happen at a given time, in a given place, for a given result.
- Actors in an agricultural innovation system (AIS) innovate not in isolation, but through interacting with other actors.
- Valuable insights are gained from working with all kinds of groups to develop and achieve shared objectives.

Source (World bank, 2006)
## Agricultural Innovation Systems

<table>
<thead>
<tr>
<th>Purpose</th>
<th>National agricultural research systems (NARSs)</th>
<th>Agricultural knowledge and information systems (AKISs)</th>
<th>Agricultural innovation systems (AISs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roles of farmers</td>
<td>Planning capacity for agricultural research, technology development, and technology transfer</td>
<td>Strengthening communication and knowledge delivery services</td>
<td>Strengthening the capacity to innovate</td>
</tr>
<tr>
<td>Actors</td>
<td>Agriculture research organizations, universities, extension services, and farmers</td>
<td>Agriculture research organizations, universities, extension services, farmers, NGOs, etc</td>
<td>Potentially all actors in the public and private sectors involved in the creation, diffusion, adaptation, and use of all types of knowledge</td>
</tr>
</tbody>
</table>

(Source ASTI, 2011)
# Agricultural Innovation Systems

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<tr>
<td><strong>Outcome</strong></td>
<td>Technology invention and technology transfer</td>
<td>▪ Technology adoption and innovation in agricultural production</td>
<td>▪ Combinations of technical and institutional innovations</td>
</tr>
<tr>
<td><strong>Organizing principle</strong></td>
<td>Use of science to create inventions</td>
<td>Accessing agricultural knowledge</td>
<td>New uses of knowledge for social and economic change</td>
</tr>
</tbody>
</table>

(Source ASTI, 2011)
Agricultural Innovation Systems

<table>
<thead>
<tr>
<th></th>
<th>Technology Transfer (TT)</th>
<th>Farming Systems Analysis (FSR)</th>
<th>Agricultural Knowledge and Information Systems (AKIS)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Intended outcomes</td>
<td>Technology adoption and uptake</td>
<td>Adapt technologies to farming systems</td>
<td>Joint development of technologies</td>
<td>Capacities to co-innovate, learn and change</td>
</tr>
<tr>
<td>Key intervention approach</td>
<td>Technology dissemination through extension and mass media</td>
<td>Surveys, typologies, modelling of impact</td>
<td>Participatory research, Farmer Field Schools</td>
<td>Establish, implement and support multi-stakeholder platforms</td>
</tr>
<tr>
<td>Weaknesses</td>
<td>Disregards farmer involvement and adoption context</td>
<td>Focus on field and farm level</td>
<td>Local orientation, costly, scaling up and scaling out</td>
<td>Lacks empirical evidence, system’s boundaries are difficult to define</td>
</tr>
</tbody>
</table>
Barriers to Agricultural innovation

Barriers include:

- Adverse market conditions
- Culture
- Knowledge deficiencies and Capacity
- Policy and Bureaucracy
- Linkages
- Attitude and behavior
- Infrastructure
- Lack of incentives
Farmers do not need a package of practices but a basket of choices!

- Farmers have always been innovative – innovation is not something external actors ‘bring’ to communities.
- From the 70s until now there is a steady move in the way researchers work with farmers from
  - Production system approach to farming system
  - From farming system to farmers first and participatory approaches
  - From participatory to a broader knowledge system (Agricultural knowledge and information system - AKIS) approach
  - From AKIS to innovation

Each step acknowledged the complexity and non linear nature of the attempted change and introduced new factors (socio economic, cultural, institutional and political) to understanding the drivers of change.

(Source: FAO, 2014 and Sims et al. 2012)
More information

This module is associated with an elearning module on ‘Understanding, Facilitating and Monitoring Agricultural Innovation Platforms’ available at: http://learning.ilri.org/course/detail/24
Thank You

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