‘Strengthening agricultural innovation capacity of developing economies using the AIS framework: *A review of Literature*

By Vera Florida Mugittu (PhD),

ANNUAL RESEARCH WORKSHOP,
October 27th, 2017

Science, Technology and Innovation Research Organization (STIPRO)

1. Why are we still here?

Even after 50 years of independence, Poverty is still high,

Agriculture is still the major employer but uncompetitive and with **low capacity for growth** (AGRA 2013),

Most farming is still small farming (by 80%)

Poor small producers who use low technologies to produce very little for the market still dominate the sector (Collier & Dercon, 2009)

Still known for its **failure to respond** to broad economic reforms and over 50 years of agricultural aid (Eicher, 2013).

A **disconnect** still exists between production and markets making it risky, unprofitable (high transaction costs) hence **less attractive for investment in innovation**.

Thomas and Slater (2006) said:

”In the current fast-changing multifunctional agricultural sector, innovation is a central strategy to achieve economic, social and environmental goals. Many countries are attempting to reform and evolve their agricultural innovation support arrangements to develop flexible and responsive capacities to achieve these goals.

This is particularly urgent in developing countries as agriculture remains a central element of their economies and innovation is a key to the sustainable agricultural growth

2. The focus of the presentation

Through a review of literature I will:

- Clarify the need to focus on innovation capacities to improve agricultural performance,
- Describe the Agricultural Innovation Systems (AIS) and the role of actors (institutions) in strengthening innovation capabilities in agriculture through interaction, learning and knowledge exchange,
- Explain how the AIS framework can be used to analyze/plan to develop agricultural innovation capacities.

3. Definitions

- **Innovation capability** is the ability to absorb, adapt and transform a given technology into specific operational, managerial and transactional routines that can lead a firm to **innovate** (i.e. to Schumpet- erian profits). By doing so, a firm can perpetuate itself overtime (Nisula and Kianto, 2013).
- **Innovation culture** is the work environment that leaders cultivate in order to nurture unorthodox thinking and its application. Workplaces that foster a **culture** of **innovation** generally subscribe to the belief that **innovation** is not the province of top leadership but can come from anyone in the organization (Nisula and Kianto, 2013).

Organization's capability

- Ability to use resources **for learning and innovation** and, achieve competitiveness (Sirmon et al., 2011).
- Ability to organize a working environment that **motivates and enables utilization of skills** and knowledge for continuously improving work practices.
- Capabilities **for orchestrating and managing resources** (Penrose, 1959; Sirmon et al., 2007; Sirmon et al., 2011).
- Ability **to change and modify resources and routines in a flexible and agile manner** to sustain competitiveness (Nisula and Kianto, 2013)

4. Agricultural innovation capacity

Tackling agriculture to increase performance needs new capacities and tools because:

a) Agricultural development depends on **how knowledge is generated and applied**.

b) **Investments in knowledge**—especially in the form of science and technology promotes sustainable and equitable agricultural development at the national level.

c) **The context for agriculture is changing rapidly**, sometimes radically, calling for continuous learning and adapting.

5. Why examine agricultural innovation capacity?

1. **Markets, not production, increasingly drive agricultural development.**
2. The production, trade, and consumption environment for agriculture and agricultural products is growing more dynamic and evolving in unpredictable ways.
3. Knowledge, information, and technology increasingly are generated, diffused, and applied through the private sector.
4. Exponential growth in information and communications technology has transformed the ability to take advantage of knowledge developed in other places or for other purposes.
5. The knowledge structure of the agricultural sector in many countries is changing markedly.
6. **Agricultural development increasingly takes place in a globalized setting.**

Moreover,

- Production is increasingly integrated in value chains with forward and backward linkages.
- Urban markets cause supply chains to grow longer (hence require other logistics & market requirements).
- Commodities pass through several agents before reaching the consumer & more value is added.
- New /niche markets may appear (e.g. animal feed market).
- A wider range of inputs must now be used judiciously to arrive at sustainable production systems.
- Each of the links in these “production-to-consumption” systems provides new opportunities for innovation.

Furthermore;

- *diversification into new crops, products, and markets, and*
- *adding value to serve new markets better is increasing. (Bhargouti et al. 2004).*

- The resulting large number of products **makes it impossible to develop national research programs for each one**.

- **Thus new approaches to support innovation in these knowledge-intensive activities become necessary** (World Bank, 2006

6. The innovation systems (IS) concept

Central to this reform and evolution process is:

*"the shift **from a linear approach** to innovation in which public sector agricultural research and extension delivers new technology in a pipeline configuration,*

to

***a systems approach** in which innovation is the result of a process of networking, **interactive learning** and negotiation among a **heterogeneous set of actors** "*

(Leeuwis, 2004; World Bank, 2006; Rolling, 2009)

The IS approach recognizes that:

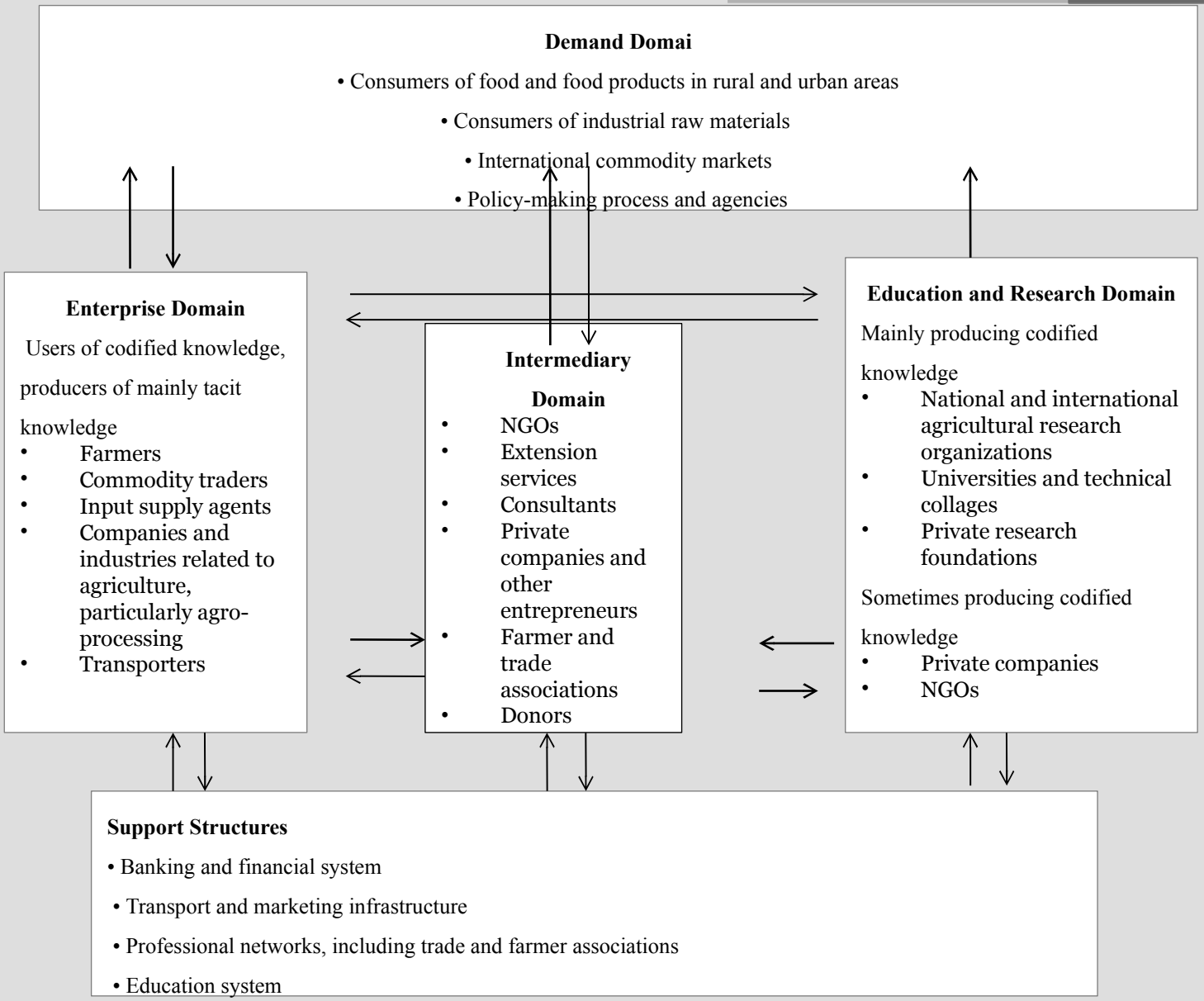
"agricultural innovation is not just about adopting new technologies; it also requires a balance amongst ***new technical practices*** *and* ***alternative ways of organizing****, for example, markets, labour, land tenure and distribution of benefits"*

(Dormon et al., 2007; Adjei-Nsiah et al., 2008).

- The IS concept offers exciting opportunities for:
  - ✓ *understanding how the sector can make better use of new knowledge, and*
  - ✓ *designing alternative interventions that go beyond research system investments (World Bank, 2006)*.
- It offers a holistic explanation of how knowledge is produced, diffused, and used; and it emphasizes the actors and processes important in agricultural development.
- The IS concept emphasizes adaptive tendencies as a central element of innovation capacity.

7. The Agricultural Innovation System (AIS)

- **An AIS** can be defined as a network of Actors + Institutions and policies affecting their behavior and performance in agriculture sector (Hall, 2009)
- The concept embraces not only the **science suppliers** but the totality and **interaction of actors** involved in agricultural innovation.
- *It extends beyond the creation of knowledge to encompass the factors affecting demand for and use of knowledge in novel and useful ways.*



Source: Adapted from Arnold and Bell 2001: 292. Cited in (Rajalahti, Janssen, and Pehu 2008, p.4)

The evolution of systems thinking and its application in agriculture

Framework for Technology Development

- Cropping Systems
- Farming Systems
- Household Production system
- Farming Systems Research (FSR) Focus on Research
- FSR and Extension (FSR/E) Focus on Research and Extension
- Farming System Approach (FSA) Focus on R + E and Training
- Farming Systems Development (FSD) Focus on R+E+T+ Institutions
- Various participatory approaches
- Agricultural Research for Development (AR4D)

Framework for Organizational Analysis

NARIs-Focus on generation of knowledge (Public Sector Research Institutes only)

National Systems Framework

- National Agricultural Research Systems (NARS)
- National Agricultural Extension Systems (NAEs)
- Focus on generation of knowledge

Agricultural knowledge and Information Systems (AKIS)

- Focus on knowledge generation

Source: Anandajayasekeram et al. 2005

A shift from NARIs to Agricultural Innovation Systems (AISs)

In this shift:

- the **goal** of the system is broadened from research and technology to agricultural innovation,
- the number of **actors**/organisations considered as key players becomes larger and all inclusive,
- partnerships, linkages and **interactions** become more central,
- operational **mechanisms** change from transfer of technology to interactive learning.
- nature of **capacity** strengthening moves from focusing on developing infrastructure and human resource to
  - ✓ strengthening interactions and communication between actors,
  - ✓ institutional development and change to support interaction, learning and innovation, and
  - ✓ Creating an enabling environment.

Going beyond the supply of knowledge:

- Beyond researchers, extension agents and farmers, an AIS consists of all types of:
  - ✓ *Public (Policy makers, regulators, etc.),*
  - ✓ *Private (Input suppliers, processors, banks, etc.), and*
  - ✓ *civil society actors (NGOs, farmer organizations.*
- For specific innovation processes, flexible and dynamic innovation networks are formed from the network of actors in the national AIS or across different national AIS. These networks have been referred to as:
  - ✓ *innovation coalitions (by Biggs and Smith. 1998),*
  - ✓ *multistakeholder platforms (by Rolling, 1994),*
  - ✓ *innovation configurations (by Engel, 1995), or as*
  - ✓ *public-private partnerships (PPPs) (Spielman and Von Grebmer, 2006; Hartwich & Tola, 2007; Hall, 2006).*

8. The Role of institutions in AIS

- Besides stressing the involvement of many actors and effective interactions amongst these,
- the AIS approach recognizes the influential role of institutions *(i.e., laws, regulations, attitudes, habits, practices, incentives)* in shaping how actors interact (Hall et al., 2001; World Bank, 2006).

- Although there is much emphasis on knowledge creation, exchange and use in the above definition of AIS, innovation systems need to fulfil several other functions that are essential for innovation. These functions include:
  - ✓*fostering entrepreneurial drive and activity,*
  - ✓*vision development,*
  - ✓*resource mobilisation (e.g., capital),*
  - ✓*market formation,*
  - ✓*building legitimacy for change, and*
  - ✓*overcoming resistance to change by means of advocacy and lobbying (Hekkert et al., 2007).*

9. For the AIS to function and enhance innovation capacity…

the literature emphasizes:

- ✓ *the need to come to shared visions,*
- ✓ *have well-established linkages and information flows amongst different public and private actors,*
- ✓ *conducive institutional incentives that enhance cooperation,*
- ✓ *adequate market, l*
- ✓ *egislative and policy environments and*
- ✓ *well-developed human capital* (Hall et al., 2001; Biggs, 2007; Spielman et al., 2008).

- However, creating and fostering effective linkages amongst heterogeneous sets of actors is often hindered by different technological, social, economic and cultural divides (Hall, 2006; Pant and Hambly-Odame, 2006; Gijsbers, 2009).
- Such divides may be caused, for example, by:
  - ✓ *different incentive systems for public and private actors,*
  - ✓ *differences between local indigenous knowledge systems and formal scientific knowledge systems,*
  - ✓ *social differences that cause exclusion of certain actors, and*
  - ✓ *ideological differences amongst different NGOs.*

- The World Bank (2006) study on AIS found that, even when there were strong market incentives for private actors to collaborate for innovation, linkage formation was still extremely limited.
- *This suggests that public policy should play a role in promoting these linkages, but it is not clear how this should be achieved in practice.*
- The AIS approach has proves its value as a comprehensive framework for analyzing strengths and weaknesses in AIS,
- *However, there is still a critical role of intermediary organizations to broker knowledge between and among institutions in an AIS; and foster interactions* (Howells, 2006; Hartwich et al., 2007)

10. Understanding Barriers to interaction and learning

- **Organizational thinness:** i.e. *'scarcity of relevant actors'* (key organisations, firms and institutions) which possess resources that can facilitate innovation activities (Todtling and Trippl, 2005)

- **Fragmentation:** i.e. situation where *'relevant firms exists but do not interact'* (Kaufmann and Wegner, 2005).

11. Using the IS concept to strengthen agricultural innovation capacity

These following insights are used to develop a framework for using the IS concept to:

- ✓*diagnose the strengths and weaknesses of existing innovation capacity; and*
- ✓*guide investments and interventions to strengthen this capacity.*

1. ***Focus on innovation rather than production:*** In contrast to most economic frameworks, which focus on production or output, the focus here is on innovation.

Innovation is understood to be neither research nor science and technology, but rather the application of knowledge (of all types) in the production of goods and services to achieve desired social or economic outcomes.

2. ***Improve interaction and learning:*** Innovation is an interactive process through which knowledge acquisition and learning take place. This process often requires quite extensive linkages with different knowledge sources.
   - ✓ *These **sources** may be scientific and technical, but equally they can be a source of other forms of knowledge, both tacit and codified.*
   - ✓ ***Patterns** of interaction between different knowledge sources form a central component of an organization's or sector's capacity to innovate.*
   - ✓ *Strengthening the **intensity** of interaction to promote the process of innovation is very vital.*

3. ***Build linkages for accessing knowledge and learning:*** The relationships that sustain the acquisition of knowledge and permit interactive learning are critical and can take many forms. They can be:
   - ✓ *partnerships,*
   - ✓ *commercial transactions,*

4. ***New actors and new roles*:** The innovation systems concept recognizes that:
   - ✓ *there is an important role for a broad spectrum of actors outside government;*
   - ✓ *the actors' relative importance changes during the innovation process;*
   - ✓ *as circumstances change and actors learn, roles can evolve; and*
   - ✓ *actors can play multiple roles (Hall 2004, Mytelka 2004).*

5. ***Attitudes and practices determine the propensity to innovate:*** The common attitudes, routines, practices, rules, or laws that regulate the relationships and interactions between individuals and groups largely determine the propensity of actors and organizations to innovate (Edquist 1997).
   - ✓ *Some organizations have a tradition of interacting with other organizations; others tend to work in isolation.*
   - ✓ *Some have a tradition of sharing information with collaborators and competitors,*
   - ✓ *of learning and upgrading, whereas others are more conservative in this respect.*
   - ✓ *Some resist risk-taking; others do not.*

6. ***Interaction of behavioral patterns and innovation triggers*:** Attitudes and practices also determine how organizations respond to innovation triggers such as changing policies, markets, and technology.
   - ✓ *Such attitudes vary across organizations and across countries and regions,*
   - ✓ *Actors in different sectors or countries may not respond in the same ways to the same set of innovation triggers.*
   - ✓ *Interventions that seek to develop the capacity for innovation must give particular attention to ingrained attitudes and practices and the way these are likely to interact with and skew the outcome of interventions (Engel and Solomon 1997).*

7. ***The role of policies:*** Policy support of innovation is not the outcome of a single policy but of a set of policies that work together to shape innovative behavior.
   - ✓ *be sensitive to a wide range of policies that affect innovation and seek ways of coordinating them.*
   - ✓ *Because policies and attitudes and practices interact, effective policies will take account of existing behavioral patterns (Mytelka 2000).*
   - ✓ *For example, rent-seeking behavior.*
   - ✓ *Policies to promote innovation must therefore be attuned to specific contexts.*

8. ***Inclusion of stakeholders and the demand side:*** The innovation systems concept recognizes the importance of the inclusion of stakeholders and the development of behavioral patterns that make organizations and policies sensitive to stakeholders' agendas or demands (Engel 1997).
   - ✓ *Stakeholders' demands are important signals that can shape the focus and direction of innovation processes.*
   - ✓ *They are not articulated by the market alone but can be expressed through a number of other channels, such as collaborative relationships between users and producers of knowledge, or mutual participation in organizational governance (for example, board membership).*

- ***Learning and capacity building:*** Attitudes and practices critical to innovation are themselves learned behaviors that shape approaches and arrangements and are continuously changing in both incremental and radical ways.
  - ✓*These changes include institutional innovations that emerge through scientists' experimentation and learning, such as farmer field schools or participatory plant breeding.*
  - ✓*Alternatively, a company may start using research to gain an edge over its competitors.*
  - ✓*Learning to discover that partnering is a key strategy for responding rapidly to emerging market opportunities.*
  - ✓*The new ways of working that result from learning enhance the ability of organizations and sectors to access and use knowledge more effectively and therefore to innovate.*
  - ✓*The capability to learn to work in new ways and to incrementally build new competencies is an important part of innovation capacity at the organization and sector or systems level*.

9. ***Changing to cope with change:*** Successful IS reconfigure linkages or networks of partners when faced with external shocks (Mytelka and Farinelli 2003).
   - ✓*A new pest problem may require new alliances between scientific disciplines;*
   - ✓*a new technology, could require partnerships between the public and private sector;*
   - ✓*changing trade rules and competitive pressure in international markets could require new alliances between local companies and between those companies and research organizations.*
   - ✓*It is thus impossible to be prescriptive about the types of networks, linkages, and partnerships that, for example, agricultural research organizations will need in the future, because the nature of future shocks and triggers is unknown and to a large extent unknowable.*
   - ✓*One way of dealing with this uncertainty, however, is to develop attitudes that encourage dynamic and rapid responses to changing circumstances—by building self-confidence and trust, fostering preparedness for change, and stimulating creativity.*

1. ***Coping with "sticky" information:*** Previous insights emphasize that innovation can be based on different kinds of knowledge possessed by different actors: local, context-specific knowledge (which farmers and other users of technology typically possess) and generic knowledge (which scientists and other producers of technology typically possess).

- *In an ideal innovation system, flow of information is often constrained because information is embodied in different actors who are not networked or coordinated. Hence information does not flow easily; it is "sticky."*

- *One must therefore overcome this asymmetry by discovering how to bring those possessing locally specific knowledge (farmers or local entrepreneurs) closer to those possessing generic knowledge (researchers or actors with access to large-scale product development, market placement, or financing technologies).*

- Ways of dealing with this asymmetry include:
  - ✓ *Encouraging user innovation. For example, as the capacity of the private sector grows, the private sector will undertake a greater proportion of innovation, because it possesses the fundamental advantage of knowing the market.*
  - ✓ *Developing innovation platforms for learning, sharing, communicating, and innovating. The structure of public research systems must adapt to permit a more open, thorough, and multifaceted dialogue with other key actors identified in the innovation system analysis.*
  - ✓ *Investing in public research and advisory systems. Such investment must be based on careful identification of knowledge demands and joint strategic planning with the multiple stakeholders of the system.*

12 Conclusion

- Developing agricultural innovation capability is inevitable given the role of agriculture in poverty alleviation and the current market dynamics
- There is a need to assess capacity gaps at the individual actor/organization level as well as at the system level
- Building agric innovation capacities must be approached in a holistic manner using the AIS framework where all actors are involved
- Innovation capacity requires continuous learning and exchange of knowledge among different actors through interactions
- Building innovation capacity requires effective knowledge management and brokerage

Thank you