Agricultural Innovation Systems: Lessons from CTA

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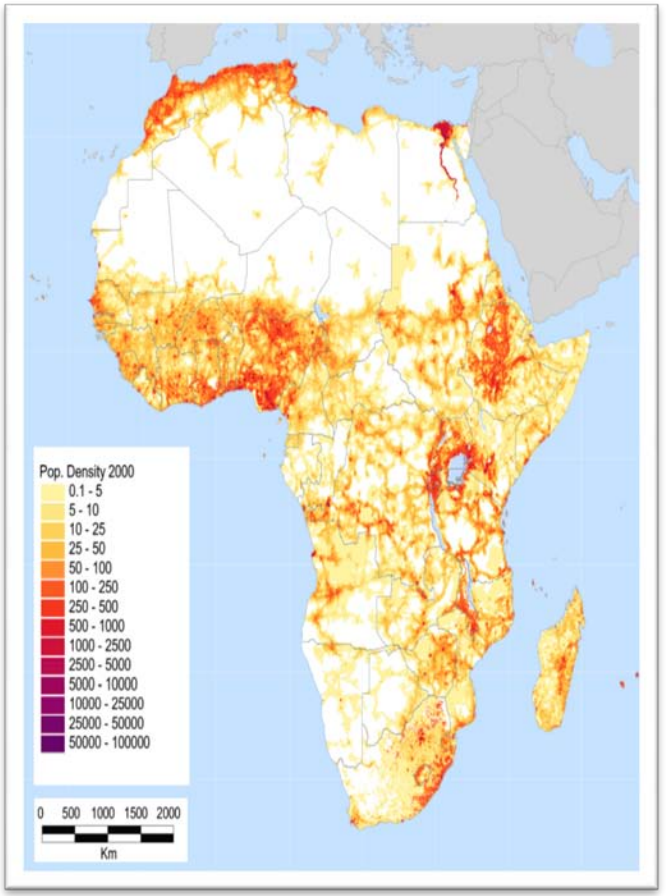
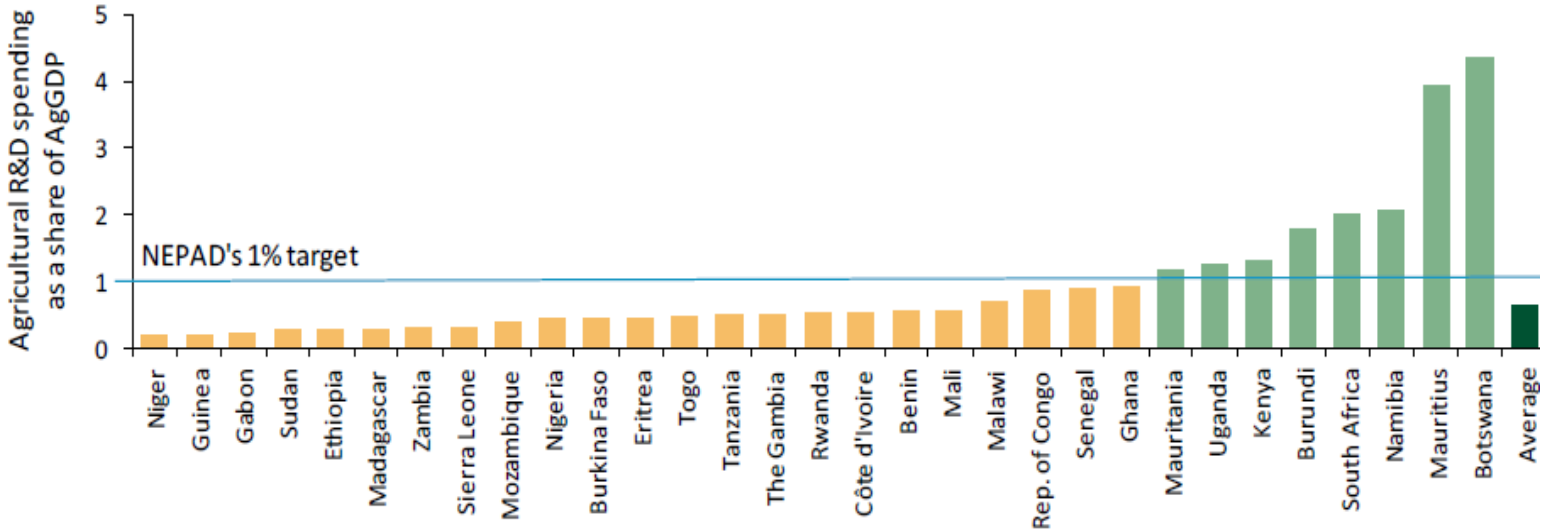
Africa : Second most populous continent

- 1.03 billion (+1.2 billion by 2050)
- 218 million live in extreme poverty
- 52% female; 20% aged15-24
- Agriculture (10 - 36% of GDP)
- Agriculture labour force (29 – 84%)
- Agriculture as % total imports (12- 25%)
- Agriculture as % total exports (4 - 58%)
- Annual imports US$ 24 billion
- 79% Arable land remain uncultivated
- Value addition - low



R&D Investment in Sub-Saharan Africa Scenario

Figure 2. Agricultural R&D intensity ratios (spending/AgGDP), 2008



Source: Beintema and Stads (2011).

Just 8 countries of 31 countries for which data is available met the 1% of total GDP national R&D investment target put forward by NEPAD.

African Universities Ranking

- Africa's top university is 324th
- Most significant barrier to innovation in Africa is lack of qualified people

Name of University	Country	African Ranking	World Ranking
University of Cape Town	South Africa	1	324
University of Pretoria	South Africa	2	507
Stellenbosch University	South Africa	3	540
Makerere University	Uganda	10	1,256
University of Johannesburg	South Africa	12	1,395
Kwame Nkrumah University of Science & Technology	Ghana	13	1,559
University of Nairobi	Kenya	26	2,452
University of Ibadan	Nigeria	41	3,499
Université de Ouagadougou	Burkina Faso	63	4,984

Source: Webometric, world university ranking http://www.webometrics.info/top100_continent.asp?cont=africa

Enrolment in African Universities

Gender balance is still an issue in tertiary institutions in Africa

Country	Total Number Enrolled in Tertiary education	Number in Agriculture related field	Percentage of Female enrolled in tertiary education	Percentage of female enrolled in Agriculture related fields
Botswana	10950	112	49.8%	14.3%
Burkina Faso	33459	321	30.9%	21.8%
Burundi	17061	392	30.6%	15.1%
Kenya	102798	6969	37.5%	27.4%
Cameroon	120198	696	41.8%	NA
South Africa	741380	13452	55.1%	43.3%

Realities of Small holder Farmers (SHF)

Do we fully understand?

- Fragmented holdings, land grabbing, encroachment on traditional natural resource reserves (pastoralists)
- Environmental degradation – poverty, population pressure, property rights
- Regionalization & globalization of markets, competition in local markets, stringent regulatory regimes (**food quality** & **food safety** e.g. GAP, Fairtrade, organic standards), increasing **contractualization** of farming
- Protectionist agricultural policies in developed countries & unpredictable world market prices for commodities e.g. cocoa, coffee & energy – unstable market prices
- Limited access to capital, knowledge, technologies; little / limited education (n.b high % female engagement)
- Fragile states, armed conflict, poor governance

Operating in a local, national, global context

Realities of Small holder Farmers

Case of Farmers in East Africa

African Regional Intellectual Property Organisation (ARIPO), proposed a draft regional harmonised policy and legal framework on **plant variety protection**. This will make it ***mandatory for small-scale farmers*** in East Africa to **buy all their seeds from multinational firms** and *stop using seeds from past harvests*.

The farmers' groups fault the process and the **negative impact** its adoption would have on small-scale farmers, food security and on agricultural biodiversity. The draft policy will give powers to ARIPO regional offices to grant and administer breeders' rights on behalf of all the contracting states. It also paves the way for **the African Union (AU)** to start discussions on the *cultivation, import and export of genetically modified crops* in Africa at the next AU summit to be held in January 2013. (IP Watch 5/11/2012)

Global Challenges require

Interconnected thinking & Strategic Response (s)

- **New knowledge / competencies** - rapid advances in science, engineering and technology e.g. biotechnology, nanotechnology, ICTs

- **Investments –** in research (monitor environmental changes, for new product development, improving technologies & systems, in tapping new markets/ technologies

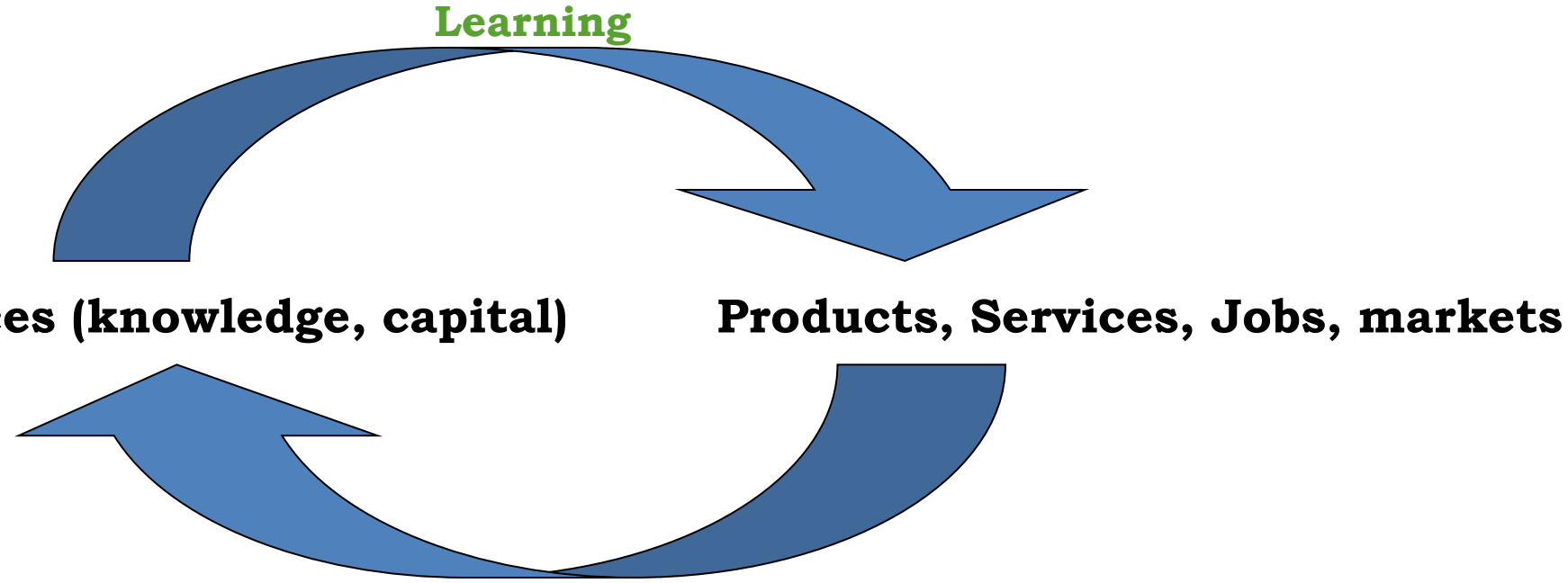
- **Innovation** in all spheres of endeavour – policy, products, processes, finance, markets, institutions, research (e.g. Collaboration), higher education

  - **Grounded in local context**
  - **Embedded in national systems**
  - **Inter-disciplinary / inter-sectoral**

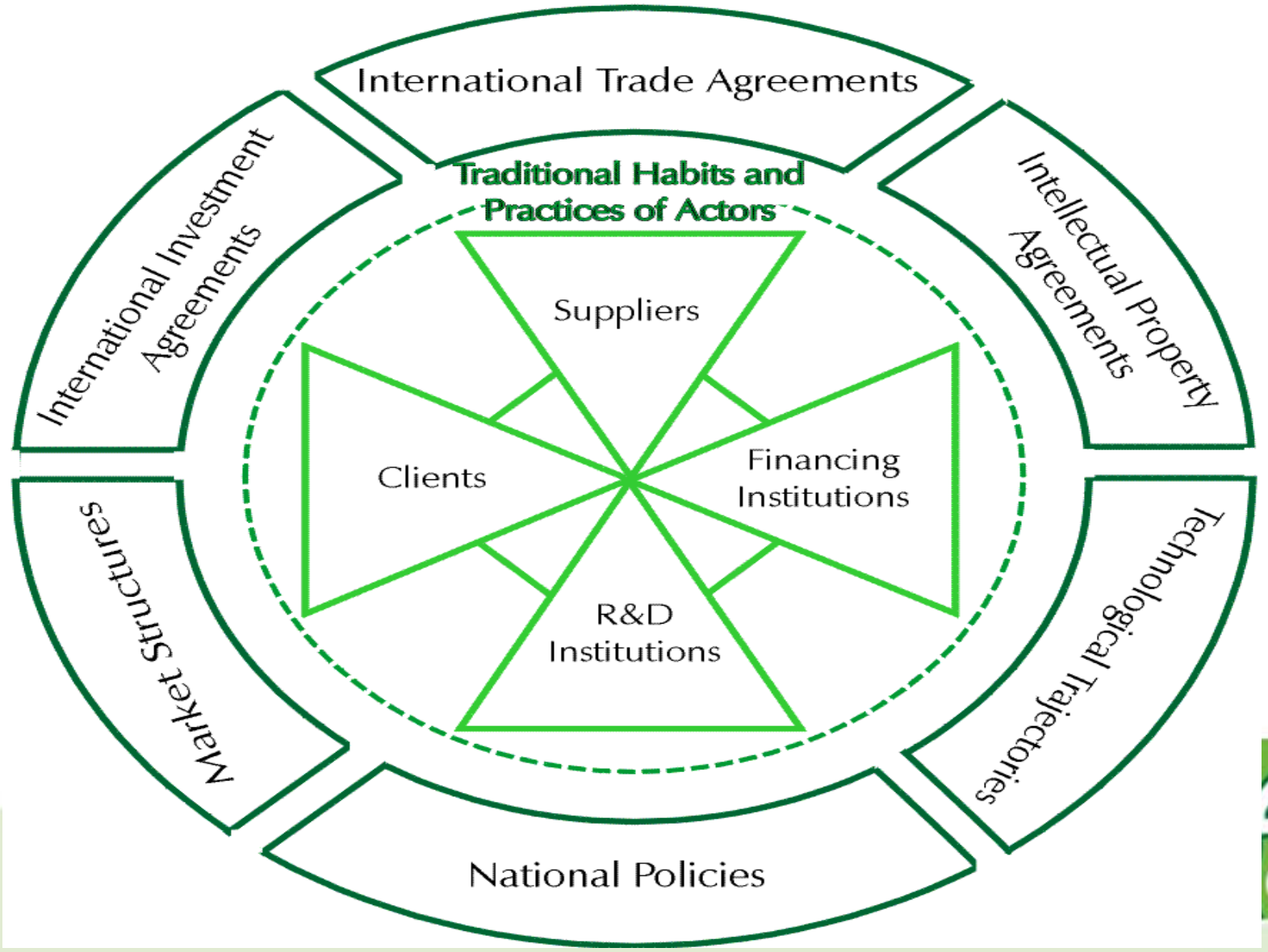
What is Innovation?

An Interactive process (continuous & systemic)

Creating, using and exploiting ideas, knowledge (scientific, tacit, traditional/indigenous), technologies & markets



Innovation Systems



Innovation Systems

Defined

An innovation system (IS) consists of a **network of actors** who *demand, create, diffuse and use* **knowledge** within an institutional and economic framework. The system actors include individuals and enterprises, commodity and industry associations, standard setting bodies, research and development organizations, universities, education and vocational training centres and banking and financial service providers among others.

The ***innovation systems approach (ISA)*** is considered a **valuable tool** in understanding the dynamics and trends of economic development and for informing innovation policy.

The national system of innovation (NSI) concept is used for comparing the economic performance of developed countries (OECD, 1997; Freeman, 2002) and is considered relevant for developing countries (Lundvall et al., 2002; Feinson, 2003; Spielman, 2006).

IS cannot be **created** or **developed** (Edquist, 1997).

Agricultural Innovation Systems in ACP Countries

CTA's Approach to capacity building

- 2003 – Sensitization of key decision makers on IS and its relevance to agricultural development to gain buy-in
- 2004 - Initial training of 6 ACP experts on understanding innovation processes and applying the innovation systems approach to analyzing the ACP agricultural, science, technology and innovation (ASTI) system
- 2004 – 2007 Development of TOT manual, conducting regional ASTI System TOT workshops & incorporating ACP experts in the training
- 2004 – 2008 Support for national case studies (>20) – led by ACP experts
- 2008 - Piloting the development of ASTI system performance indicators
- **Since** 2010 – **reflecting**

Lessons from CTA Experience

Consensus on key issues

- Innovation emerges from multiple interactions within an institutional **context** (social, political, economic)
- Innovation is an **iterative**, evolving process with **complex feedback loops** – social actors create value from knowledge
- Innovation can be *social, technological, political, organizational* etc.
- Innovation is not only of economic significance, can have environmental as well as social impact. Does not only emerge from R&D but from farmers, traders, processors
- Innovation is spurred by a range of drivers and triggers
- **A systems approach** is needed to understand processes and address the factors that drive/trigger/hinder innovation in a coherent & concerted manner

Lessons from CTA Experience

Innovation Triggers & Drivers

Triggers	Drivers
• Demand • Market opportunities and constraints • Needs • Challenges • Competition • **Crises** (food, energy and water shortages, climate change, epidemic diseases)	• Political will, enabling policies • Adequate resources and infrastructure • Leadership and facilitation, sector development champions • Stakeholder linkages and interaction • Private sector involvement • Common vision, partnerships, alliances • Shared learning leading to “buy in” • Education • Technologies • Credit

Lessons from CTA Experience

Factors that Hinder Innovation

Linkages
- Lack of linkages among stakeholders
- Lack of organisation of producers / private sector
- Lack of private sector engagement

Policy and bureaucracy
- No clear and appropriate policy directions
- Lack of political support and policies
- Lack of specific policies (e.g. on biotechnology, etc.)
- Failure to implement conducive policies

Capacity & infrastructure
- Insufficient capacity, skills
- Lack of infrastructure
- Lack of capacity for interactive learning

Behaviour
- Power differences
- Lack of trust
- Ownerships

Market
- Markets (poor, unavailability)
- Adverse market conditions

Culture
- Failure to exploit informal rules and overcome cultural issues (e.g. gender)
- Paradigm and knowledge systems differences among actors

Resources
- Not enough resources allocated to agriculture

Lessons from CTA experience

Boundary Issues

Not fixed. System is open. Actors move in and out. Context changes (e.g. Policy, regulations etc). Has implications for analysis & evaluation of performance.

Malerba (2002) defines a sectoral system as *a set of new and established products for specific uses and the set of agents carrying out market and non-market interactions for the creation, production and sale of those products*. In studying sectoral systems, focus should be on the specific knowledge base, demand, technologies, and input as well as the innovative capacity of the actors as it impacts on system performance. ***Innovative capacity is linked to competencies, behaviour, habits and practices of the actors and the nature and quality of the linkages and interactions between and among them.*** The competencies include the ability to *carry out routine search for new knowledge, change the direction of search, utilize research results created elsewhere and stimulate the emergence of new knowledge*.

Competencies needed for innovation cannot simply be acquired or imitated by rote *(Mytelka, 2003)*.

Lessons from CTA Case Studies

Assumptions & Methodology

That **little innovation** was occurring in the ACP agricultural sector and the ISA was useful for studying the strengths and weaknesses in the ASTI system;

There was a **disconnect** between the S&T community and policymakers;

A structured approach was needed for analyzing ACP ASTI systems for which a case study approach was appropriate;

- ***Reviewing the historical background of the sector & the policy environment, mapping the key actors and assessing their competencies, habits & practices, analyzing system performance linked to key functions***

Results would **generate policy relevant information** and lessons that will contribute to enhancing innovation for improving ACP agricultural performance and sustaining rural livelihoods.

Lessons from CTA Case Studies

Countries	Commodity for Diversification	Export Commodity under threat	Commodity for Food Security
Cameroon		Cocoa	Cassava
The Gambia	NERICA rice		
Ghana			Plantain, fisheries
Grenada		Nutmeg	
Jamaica	Ginger & Mango	Sugar	
Kenya	Floriculture		
Malawi			Maize, fisheries
Papua New Guinea	Rice		Banana
Senegal			Rice, fisheries
St. Vincent & The Grenadines		Banana	
Tanzania & Uganda			Banana
Samoa & Tuvalu	Noni *(Morinda citrifolia)*		

Lessons from CTA Case Studies

The Policy environment

- Most countries had relevant policies and legislation in place e.g. Kenya's Seeds & Plant Varieties Act – planter breeders' rights for persons discovering new varieties;
- IPR policies were under consideration or non-existent;
- Major **problems were in implementation** – insufficient resources, lack of credit, changing policies mid-stream e.g Papua New Guinea – 1998 (10 year programme for improving domestic production); 2001 (20% reduction in imports); 2002 (focus on small holder production, increasing access to high quality seeds & credit and investing in small rice mills) - not implemented because of **lack of funds**;
- Domestic environment for innovation was considered inadequate.

Lessons from CTA Case Studies

Environment for Innovation

Infrastructure	PNG – Rice	Jamaica - ginger	Grenada - nutmeg	Tanzania - banana	Malawi - maize
Government incentives for innovation	Weak	Weak	Weak	Weak	Average
Scientific / skilled manpower	Weak	Average	Weak	Weak	Average
Competence of local universities	Weak	Weak	Weak	Weak	Average
Competence of R&D org	Average	Average	Weak	Very Weak	Weak
Intellectual Property Rights	Weak	Weak	Weak	Very Weak	Weak
Venture Capital	Very Weak	Weak	Weak	Very Weak	Weak
Quality of ICT services	Weak	Strong	Average	Weak	Weak
State of Power	Average	Strong	Average	Weak	Weak
State of water supply	Average	Average	Average	Weak	Weak

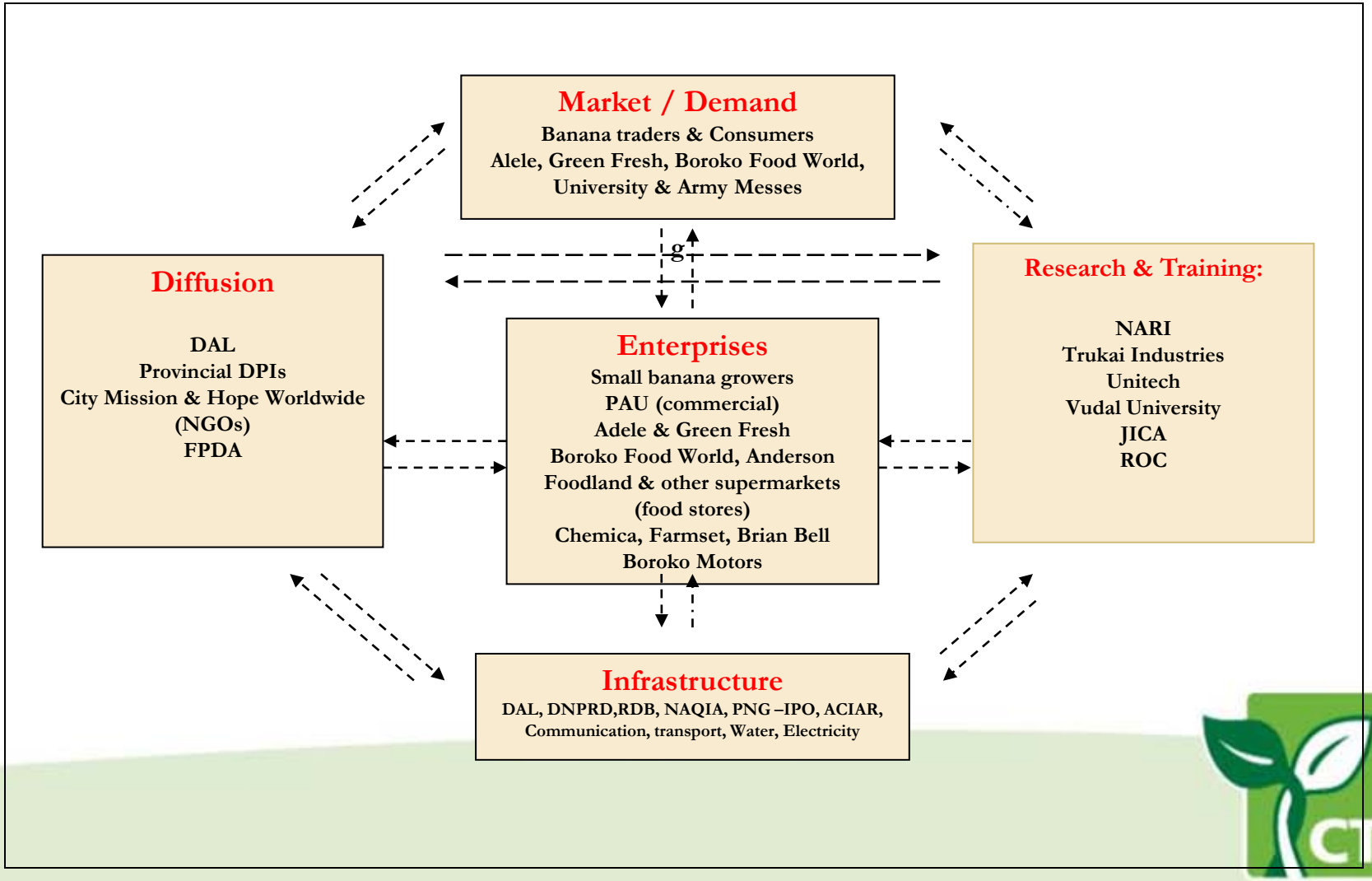
Lessons from CTA Case Studies

Linkages among actors

Actor Linkage Intensity	Jamaica – Ginger & mango	Cameroon – cassava & cocoa	Senegal - rice
Public research - enterprise	**Weak**	**Average**	**Average - strong**
Public research – extension/diffusion	**Average**	**Average**	**Average - strong**
University – enterprise/farms	**Weak**	**Weak - Average**	**None - Weak**
National – international research	**Weak - Average**	**Strong**	**Strong**
Extension / diffusion – Enterprise	**Average**	**Average**	**Average - strong**
Enterprise – enterprise/ Farmer - farmer	**Strong**	**Strong**	**Very strong**

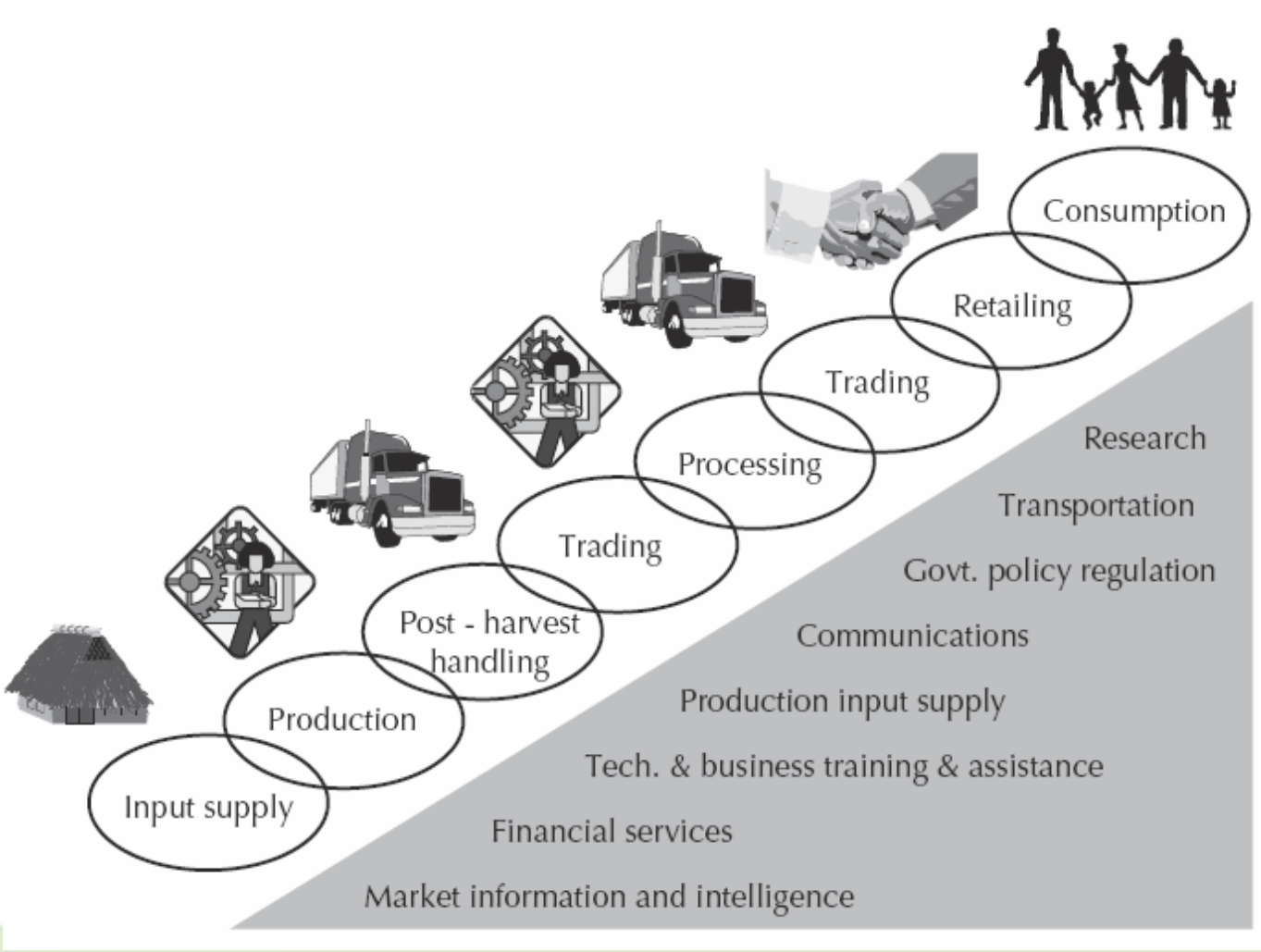
Lessons from CTA Case Studies

Banana Innovation System PNG



Making a difference for SHFarmers

VCD, IAR4D, IPs, AKIS, Farmer Innovations



My perspective - These are only some of the possible responses

Conclusions

We know the answers

- Realities of smallholder farming will remain unresolved unless purposeful action is taken
- IS thinking and approach allows policymakers and other actors to shape the future of agricultural development that benefits shf
- Developing competencies of shf & other actors will help
  - Role of science & engineering cannot be dismissed;
  - Role of endogenous research & higher education capacity should not be undervalued
  - Farmers must be valued as allies in the finding solutions - fight against hunger and poverty, environmental degradation, etc

Conclusions

Some additional thoughts

- IS & **ISA are relevant but not well understood**
- **Policymakers need to be exposed to innovation systems thinking & its application including success stories e.g Uruguay & OECD countries**
- **Researchers need to continue to probe but remain grounded in reality:**
  - **Policies that support / hinder including science, trade & education policies – national, regional & international level;**
  - **Funding sources for research and development;**
  - **Competencies of actors**
  - **Access to as well as role of technology – mechanization, ICTs (e.g. mobile phones), biotechnology etc**

Innovation systems are grounded in local, national, global contexts

Recommendations – for improving SH realities

- ✓Enhance the policy & institutional framework
- ✓Invest in research & tertiary education
- ✓Improve science & technology infrastructure
- ✓Develop human resources
- ✓Facilitate access to information, financing and markets
- ✓Create opportunities

Innovation is essential 4 Development