

# Applying innovation system concept in agricultural research for development: A learning module



# Applying innovation system concept in agricultural research for development

## A learning module

Prepared by:

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Supported through:

Improving Productivity and Market Success (IPMS) of Ethiopian farmers project  
International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia

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# Preface

Sustained agricultural growth requires, among others, increased availability of technologies, farm inputs and services on the one hand, and sustained demand for the agricultural outputs on the other. This demands that contemporary thinking of agricultural development look beyond production into the chain of activities and interventions required up to consumption. This calls for the involvement of all relevant actors, individuals and organizations, in the process. In turn this requires a different framework and institutional arrangement to conduct research for development. To be effective, the emerging concepts such as Innovation Systems Perspective (ISP), value chain analysis, Integrated Agricultural Research for Development (AR4D) and impact orientation need to be integrated into the agricultural research process. The R&D system should think in terms of contributing to innovation.

The Improving Productivity & Market Success of Ethiopian Farmers (IPMS) project is fully cognizant of this reality and is exploring options for transformation of the subsistence Ethiopian agriculture. In line with this, the project is attempting to employ the innovation system framework as a possible option to realize this espoused goal.

In this context, it becomes necessary to create the capacity to apply the innovation system perspective in agricultural research for development. This learning module on **Applying innovation system concept in agricultural research for development** has been prepared to serve as a tool in achieving the objective of strengthening the capacity of project staff and other researchers and actors who are believed to have a key role to play in ushering in market-led agricultural transformation. This includes national, regional, international and private sector agricultural researchers, university lecturers, and others engaged in bio-physical as well as social science research.

This module is expected to have multiple uses. One, a source material for trainings that could be organized at different levels, and two, as reference document to upgrade the knowledge of staff of partner organizations about innovation systems approach and applications. The design of the learning module includes guidance notes for potential trainers including learning purpose and objectives for each session; description of the session structure (including methods, techniques, time allocation to each activity); power point presentations, presentation text, exercise handouts, worksheets, and additional reading material. There are also evaluation forms and recommended bibliography for use by future facilitators.

The module has been prepared in the style of a source book and it assumes that the reader is familiar with the concepts, procedures and tools used in participatory research approaches. Users can pick and choose the sessions/idea/tools/concepts that are most relevant and appropriate in specific contexts and for specific purposes. This is work in progress. The module is being continually refined and updated, based on application of the concept and tools in the project and elsewhere and, lessons learned in the process. Case studies will be prepared to supplement this module. Therefore, IPMS would like to encourage users of this learning module to actively provide feedback, including suggestions on how it can be improved.

Dirk Hoekstra  
Project manager, IPMS



# Acknowledgments

This learning module is prepared as part of the capacity building activities in the IPMS project to help fulfill its objectives related to building and strengthening existing institutional capacity so that the agricultural research is transformed to respond to emerging development challenges and opportunities and is designed to have more impact, using a combination of innovation systems perspective and value chain approaches. This is of critical importance to support the transformation of the subsistence agricultural sector to a more market-oriented one.

We wish to express our gratitude to Dr Carlos Sere, Director General of ILRI; Dr John McDermott, Deputy Director General of ILRI; and Dr Dirk Hoekstra, Project manager, IPMS, for their support and interest shown in the development of this module.

This learning module would not have been produced without financial support provided by the Canadian International Development Agency (CIDA). The authors would like to thank CIDA for the same.

This learning workshop was refined based on the feedback received from the previous participants of similar training workshops conducted in 2006 and 2007. The authors would like to appreciate their contribution.

It is our hope that this learning module to which so many people have contributed is widely available and useful.

The authors

## Learning approach

This learning module provides trainers with the information, specific activities and materials they need to effectively plan and deliver a learning program on **applying innovation system concept in agricultural research for development**.

The learning module is organized to foster participatory learning and hence takes into consideration the principles of adult and experiential learning. As a result all sessions are planned to include a short presentation by the trainer not exceeding 30 to 45 minutes followed by an exercise session to help participants relate the presentation (the new knowledge) with what they already know and reflect on possible opportunities and challenges for its application. In doing so, the module encourages participation and provides hands-on, problem-solving experiences and exercises.

The whole module is divided into nine sessions. Each session is self-contained but logically flows from the preceding session. Therefore, at the outset of each session, the trainer should try to highlight the link between the current, previous and following sessions.

The module also has an evaluation session to be held at the end of the workshop to get feedback from participants that would help in refinement of the module.

## How to prepare for a session

Before starting the session the trainer should read the facilitators guide of each session and make sure that the materials and handouts required for running the session are in place.

Furthermore, it is required to ensure that the training hall is well organized and has enough space for the plenary and group sessions.

## Targets of this learning module

This module is aimed primarily at researchers in the agricultural innovation system. These include, researchers in national, regional and international research institutes, university and college lecturers, students and, private sector research agencies who are concerned and working towards enhancing agricultural innovation.

# Tentative workshop schedule

Day 1	Day 2	Day 3	Day 4
9:00 – 10:00	8:30 – 10:00	8:30 – 10:00	8:30 – 9:30
Session 1: Welcome and introduction to the workshop	Session 4: Steps in project cycle and modifications needed in the design and implementation of R&D (Presentation)	Session 6: Partnerships and networks (Presentation and exercise 6)	Session 8: Managing innovation (Presentation and exercise 8)
			9:30 – 10:00
			Session 9: Institutionalization of ISP (Presentation and exercise 9)
<b>Tea/coffee break</b>	<b>Tea/coffee break</b>	<b>Tea/coffee break</b>	<b>Tea/coffee break</b>
10:30-13:00	10:30 – 11:15	10:30 – 11:15	10:30 – 13:00
Session 2: Challenges of R&D systems and changing paradigms (Presentation and exercise 2)	Session 5: Tools for innovation systems understanding and analysis  11:15 – 13:00 Sessions 4 & 5 combined exercise	Session 6 (continued)  11:15 – 13:00 Session 7: M&E and impact assessment (Presentation and exercise 7)	Session 9 (continued)
<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>	<b>Lunch</b>
14:00 – 15:30	14:00 – 15:30	14:00-15:30	14:00 – 15:00
Session 3: Evolution of ISP and key concepts (Presentation and exercise 3)	Sessions 4 & 5 combined exercise (continued)	Session 7 (continued)	Clearing the parking lot
			15:00 – 15:30
			Workshop evaluation and wrap-up
<b>Tea/coffee break</b>	<b>Tea/coffee break</b>	<b>Tea/coffee break</b>	
15:50 – 16:45	15:50 – 16:45	15:50 – 16:45	
Session 3 (continued)	Sessions 4 & 5 combined exercise (cont'd)	Session 7 (continued)	

# Registration form

Last name			First name		
Function in this training	<input type="checkbox"/> Participant <input type="checkbox"/> Facilitator/presenter <input type="checkbox"/> Organizer <input type="checkbox"/> Observer <input type="checkbox"/> Other _____		Title	<input type="checkbox"/> Dr. <input type="checkbox"/> Mr. <input type="checkbox"/> Mrs. <input type="checkbox"/> Miss <input type="checkbox"/> Eng. <input type="checkbox"/> Other _____	
				Sex	<input type="checkbox"/> M <input type="checkbox"/> F
Degree	<input type="checkbox"/> Ph.D <input type="checkbox"/> M.Sc <input type="checkbox"/> B.Sc <input type="checkbox"/> Other				
Position (Type)	<input type="checkbox"/> Policymaker <input type="checkbox"/> Senior manager <input type="checkbox"/> Middle manager <input type="checkbox"/> Researcher		Position (Describe)		
	Organization	_____		Department	
_____					
Name of your immediate supervisor					
Organization address					
Telephone no./			Fax no.		
E-mail					

# Trainer's guide

## Session 1 Welcome and introduction to the workshop

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Purpose	The purpose of this session is to share with participants the goals of the workshop and provide an insight into its structure and organization. This session will also provide an opportunity for the participants to get to know each other and share their expectations from the training workshop.
Objectives	At the end of this session participants will be able to: Describe the background, objectives, and expected outputs of the four day workshop List their expectations Get to know each other
Resources	Flipcharts Copies of handouts 1.1 & 1.2 for each participant Computer and LCD projector
Time needed	One hour

### Session structure

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Activity		Time required	Remark
Presentation	Distribute handout 1.1 before you start your presentation Give an introductory presentation about the workshop goals, objectives, duration and learning procedure Make sure that participants are clear about what is presented	15 minutes	
Exercise	Distribute handout 1.2 for exercise 1 on 'Getting to know each other' Ask a volunteer to read the exercise Ask participants to complete the form and share it with the audience Give feedback on the listed expectations	40 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

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# Session 1: Presentation slides

Slide 1

Applying innovation system concept in agricultural research for development:

A training workshop

ILRI  
INTERNATIONAL INSTITUTE FOR  
IMPROVED AGRICULTURAL  
SYSTEMS

IPMS  
ETHIOPIA

Canadian International Development Agency

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Slide 2

Purpose of the workshop

- To strengthen the capacity of researchers in the understanding of innovation systems perspective and its application in agricultural R for D for enhanced impact

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IMPROVED AGRICULTURAL  
SYSTEMS

IPMS  
ETHIOPIA

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Slide 3

Objectives

- To discuss the evolution of Innovation Systems Perspective (ISP) and to clarify key concepts
- To demonstrate the application of the ISP in project planning, implementation and evaluation
- To understand the implications of applying the ISP in Agricultural Research for Development and Research Management
- To provide necessary skills and tools to analyse innovation processes

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Slide 4

## Expected outputs

- Better understanding of ISP and its application in agricultural research for development
- Acquired skills to apply the various concepts in project/intervention planning, implementation and, research management
- Acquired skills to identify and analyse innovation processes



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Slide 5

## Session 1

Welcome  
and  
introduction to the workshop



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Slide 6

## Objectives of session 1

- Describe the background, objectives, and expected outputs of the four day workshop
- Identify participants' expectations
- Getting to know each other



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# Exercise 1. 'Getting to know each other' (Individual and pair exercise)

## Phase 1 Individual exercise (10 minutes)

1. Complete the form in handout 1.3. The form helps you to introduce yourself and inform the facilitators about your expectations from the workshop. Be ready to exchange this with your neighbour and sharing with the audience

## Phase 2. Working in pairs (10 minutes)

2. Form a pair with the participant sitting next to you and exchange the completed forms with each other. Take some time to read and make sure that it is legible to you. Clarify any unclear statements and be prepared to read it to the audience.



## Phase 3. Plenary (20 minutes)

3. The facilitator invites each participant to read the exchanged forms to the audience (10 minutes)
4. When it is over the facilitator reflects on the exceptions and gives feed back to the group ( 5 minutes)
5. The facilitator asks feedback on this exercise and closes the session (5 minutes)



# Exercise 1 Worksheet

Name: _____
Organization: _____
Area of work: _____
List your three major expectations from this workshop:

# Trainer's guide

## Session 2 Challenges of research for development systems and changing paradigms

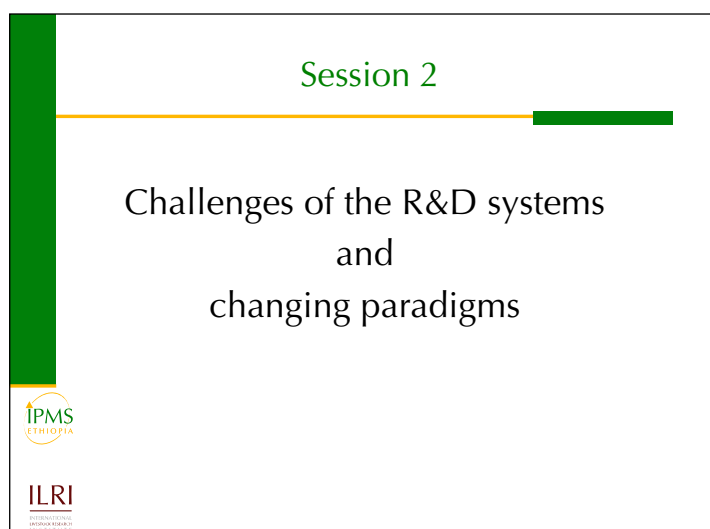
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Purpose	The purpose of this session is to set the stage to create a common understanding on the current challenges of R for D and changing paradigms.	
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"><li>• Identify and describe the challenges of Agriculture Research for Development Systems;</li><li>• List and explain the changing paradigms in Research for Development.</li></ul>	
Resources	<ul style="list-style-type: none"><li>• Markers</li><li>• Cards</li><li>• Push button pins</li><li>• Soft board</li><li>• Copies of handouts 2.1, 2.2, 2.3 and 2.4 for each participant</li><li>• Computer and LCD projector</li><li>• Flip chart</li></ul>	
Time needed	Two hours and thirty minutes	
Session structure		
Activity	Time required	Remark
Presentation	Distribute handout 2.1 (presentation slides) before you start your presentation. Give a presentation on challenges of research and development systems and changing paradigms Allow some time for discussion to make sure that participants understand what is presented. Distribute handout 2.2. (presentation text) to supplement your presentation.	50 minutes
Exercise	Distribute handouts 2.3 and 2.4 for exercise 2 on Setting the scene: Reflecting on contemporary scenario of agricultural research for development Ask a volunteer to read the exercise Ask participants to answer the questions in the exercise individually and then in group Remind them the time allotted to the exercise Invite them to present in plenary	1 hour 35 minutes
Transition	Make closing remarks and transit to the next session	5 minutes

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## Session 2: Presentation slides



Slide 1



Session 2

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Challenges of the R&D systems  
and  
changing paradigms

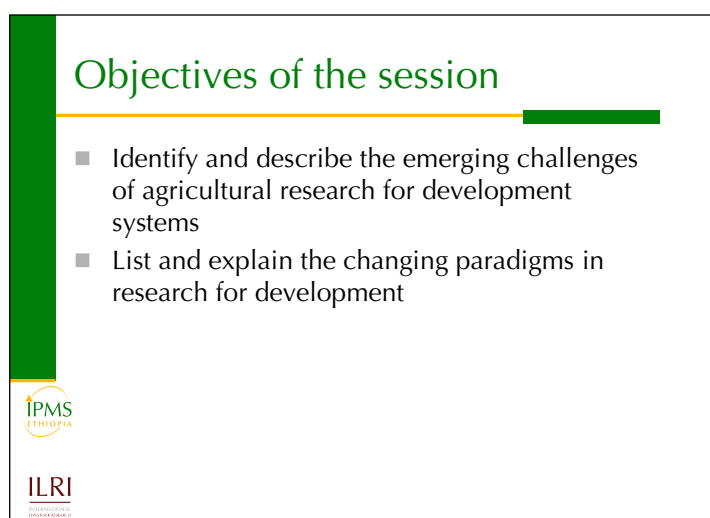
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Slide 2



Objectives of the session

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- Identify and describe the emerging challenges of agricultural research for development systems
- List and explain the changing paradigms in research for development

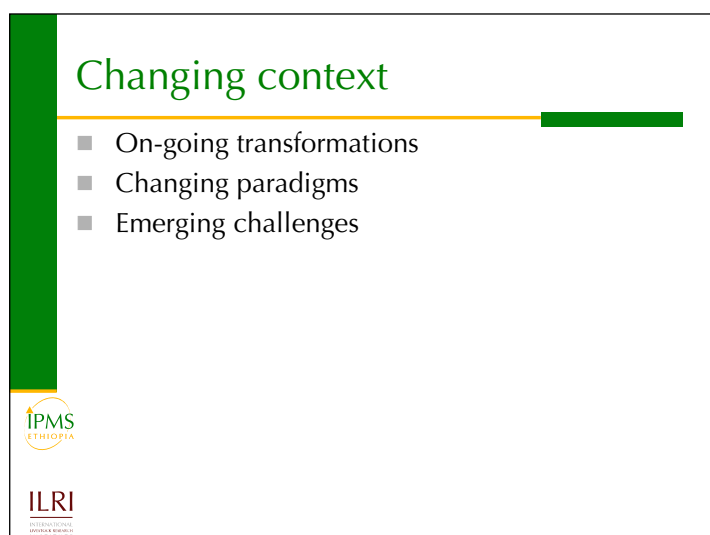

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Slide 3



Changing context

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- On-going transformations
- Changing paradigms
- Emerging challenges

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Slide 4

## Reform agenda within the R&D arena

- Redefinition of role of government in agricultural R&D
- Decentralization/privatization of agricultural R&D activities
- Broader and active stakeholder participation— pluralism in service provision, networks and partnerships
- New funding arrangements
  - Separation of financing from service provision and research execution
  - Changing the funding base to competitive funding
- Orientation of R&D to be more outward looking, client oriented and impact driven
- Embracing Systems perspectives



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Slide 5

## Exogenous trends contributing to the reform process

- Changes in the political and socio-economic context
- Changes in the market context
- Changes in the demand for R&D services
- Changes in research technologies, methodologies and approaches
- Changes in the institutional context



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Slide 6

## Paradigm shifts in agricultural R&D

- Approaches for technology development
- Organizational analysis



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Slide 7

## Paradigm shifts in agricultural R&D

- Traditional linear model for research and extension
- Farming systems perspective (OFR/FSP)
- Participation/participatory research methods
- Action research
- Rural livelihoods
- IAR4D
- Agri-food systems/value chain
- Positive deviance



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Slide 8

## Paradigm shifts in agricultural R&D (cont'd)

- Knowledge development, dissemination and use continuum
- Doubly Green Revolution
- Rainbow Revolution



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Slide 9

## Paradigm shifts in agricultural R&D (cont'd)

- NARS (loose conglomerate of agencies and actors involved in ag. research)
- AKIS (R,E,T in one system; knowledge triangle)
- Innovation systems perspective
- Knowledge quadrangle — participatory innovations, information, knowledge and education quadrangle with ICT playing a critical role



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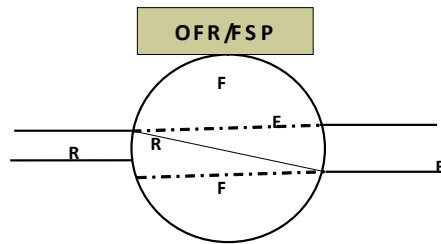
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Slide 10

## OFR and participatory research methods



Slide 11

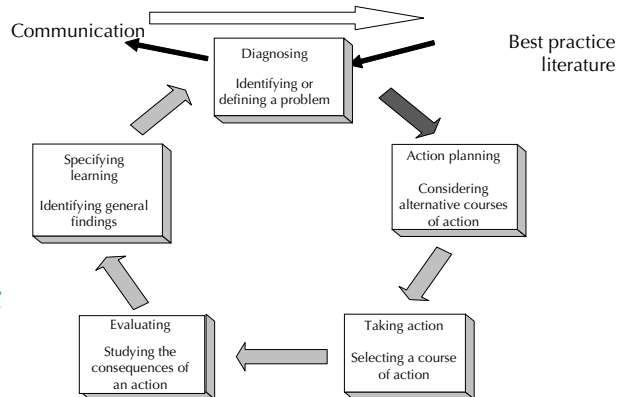
## Action research

- Philosophy — learning by doing
- Ideas are borrowed, tested and adapted to local circumstances
- Attributes
  - Turning people involved in the process into researchers
  - Always connected to social action
  - Takes place in real world situation
  - Action research is typically cyclical



Slide 12

## Action research cycle



Slide 13

## Rural livelihoods

- Poverty is multidimensional — income, vulnerability, lack of voice etc.
- Poor have some assets, used for multiple livelihood strategies and outcomes
- They often manage a portfolio of part time activities
- Poor are deprived of entitlement, and have inadequate knowledge and power to claim them



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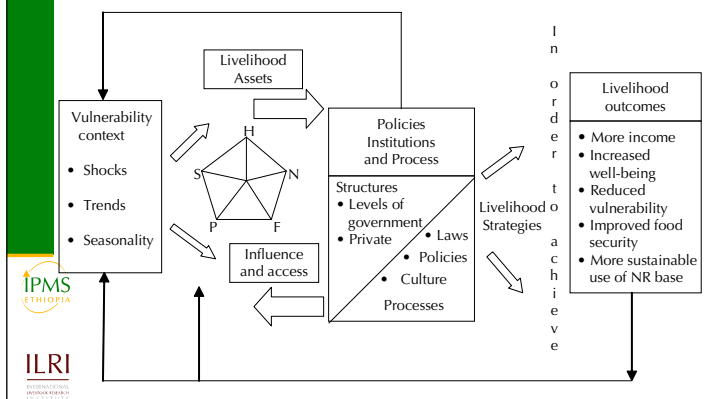
Slide 14

## Sustainable livelihoods framework

Sustainable livelihoods framework

F = Financial Capital  
H = Human Capital  
N = Natural Capital

P = Physical Capital  
S = Social Capital



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Slide 15

## Implications

- R for D strategies have to be placed in the context of rights and livelihood aspirations of the poor
- Production and protection strategies have to complement each other
- To be beneficial, research and extension efforts should be geared broadly towards livelihood contexts than crop and/or livestock production contexts



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Slide 16

## IAR4D

- A new approach to help research contribute more effectively and efficiently to poverty reduction and sustainable NR use
- To mainstream a new way of doing business that ensures that research does not only lead to knowledge and publications, but also and most of all contributes to change and innovation for the betterment of people, while also preserving the natural resource base for future generations



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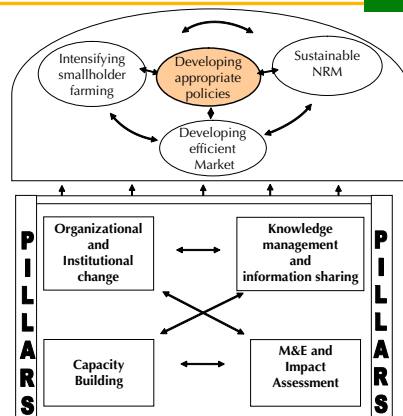
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Slide 17

## The 4 pillars of ARD



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Slide 18

## Major thrusts of IAR4D approach

- Set of principles for conducting research for development
- New research agenda that addresses interaction between NRM, production systems and agricultural markets and policies
- Institutional change for new partnerships involving all stakeholders in the agricultural innovation system



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Slide 19

## Doubly Green Revolution

- A revolution which is more productive and green
- Aims to be equitable, sustainable, and environmentally friendly
- Knowledge intensive methods to promote agricultural and rural development
- Focus on both high risk marginal and remote environment as well as high potential areas



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Slide 20

## Rainbow Revolution

- Based on:
  - Combination of science and policy with community empowerment and NRM
  - Healthy crops and environmentally sound and profitable small holder farming systems (green)
  - Diversity of farming systems that reflects African realities and institutions



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Slide 21

## Rainbow Revolution (cont'd)

- Key components
  - Agriculture
  - Nutrition
  - Politics
  - Markets
  - Ecosystem regeneration and
  - Policies



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Slide 22

## Rainbow Revolution (cont'd)

- Action needed to
  - Increase productivity of food insecure farmers
  - Improve nutrition of the chronically hungry
  - Reduce vulnerability through productive safety nets
  - Increase income and market access
  - Restore degraded agro-ecosystems



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Slide 23

## System concept at organizational level



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graph TD; NARIs[National Agricultural Research Institutes (NARIs)] --> NAREs[National Agricultural Research and Extension (NAREs)]; NAREs --> NARS[National Agricultural Research Systems (NARS)]; NARS --> TDT[Technology Development and Transfer System (TDT)]; TDT --> ATS[Agricultural Technology System (ATS)]; ATS --> AKIS[Agricultural Knowledge and Information Systems (AKIS)]; AKIS --> AIS[Agricultural Innovation System (AIS)];
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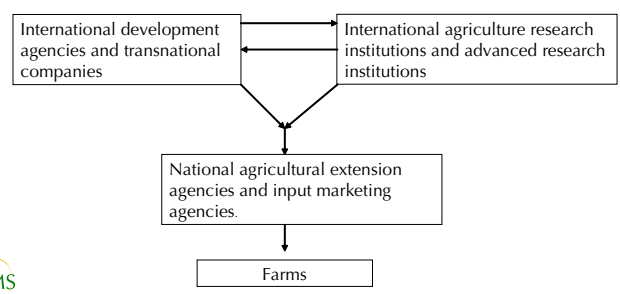
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Slide 24

## Technology development and transfer system



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graph TD; A[International development agencies and transnational companies] <--> B[International agriculture research institutions and advanced research institutions]; A --> C[National agricultural extension agencies and input marketing agencies.]; B --> C; C --> D[Farms];
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Adapted and modified from Thrupp et al. (2000)



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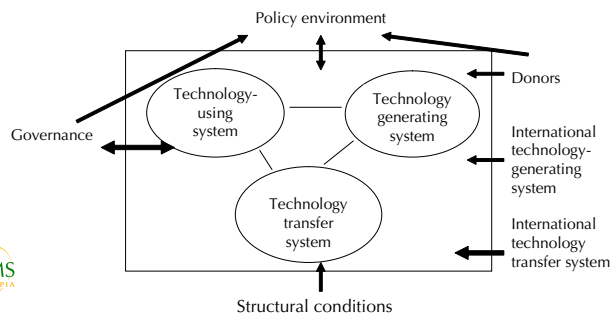
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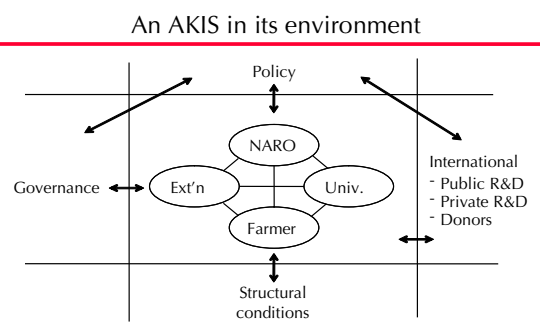
Slide 25

## Agricultural Technology System (ATS)



Slide 26

## Agricultural Knowledge and Information System (AKIS)



Slide 27

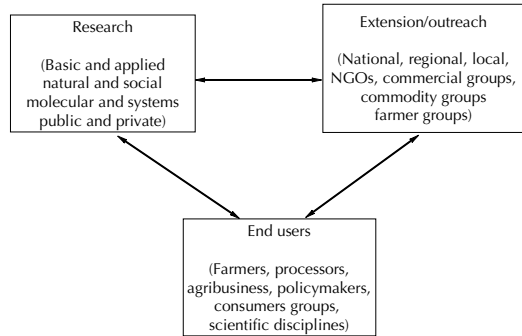
## Innovation system

- An innovation system is
  - a group of organizations and individuals involved in the generation, diffusion, adoption and use of new knowledge and
  - the context and institutions that govern the way these interactions and processes take place
- Not a theory, but an organizing principle
- Can be defined at different levels
- It is an analytical construct



Slide 28

## Synthesis/triangular (supply and demand) model for commercialization of knowledge



Source: Adapted and modified from Lacy (2001).

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Slide 29

## Value chain/commodity chain/ agri-food chain

- A value chain describes the full range of activities which are required to bring about a product or service from design through the different phases of production, delivery to final consumers, and final disposal after use
- From 'hoe – fingers'
- From 'plough – fork'



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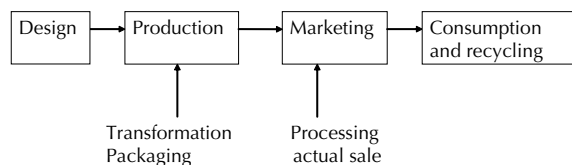
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Slide 30

## A simple value chain has four basic links



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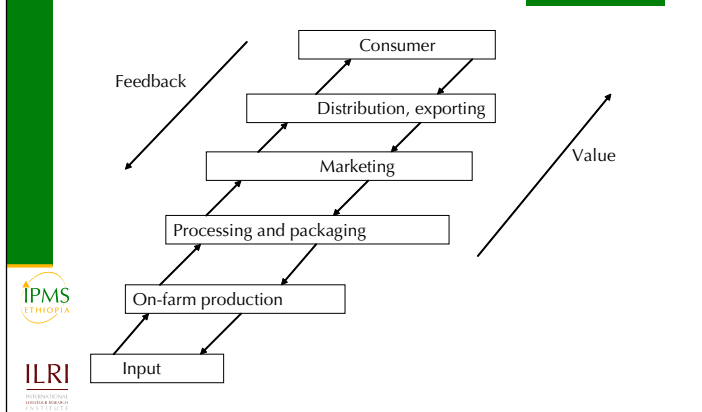
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Slide 31

## Agricultural food chain: value adding



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Slide 32

## Why is value chain analysis important?

- Value chain analysis plays a key role in understanding the need and scope for systematic competitiveness — growing division of labour, global dispersion of production of components
- Efficiency in production is only a necessary condition for successfully penetrating regional and global markets
- Entry into the various markets: national, regional, and global requires an understanding of dynamic factors within the whole value chain
- Commercialization of smallholder production system and market orientation
- To reap the maximum benefit it is important to understand the nature, structure, and the dynamics of the value chain



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## Value chain analysis (cont'd)

- In the real world, value chains may be much more complex
- Intermediate producers may feed into a number of value chains, e.g. the forestry, timber



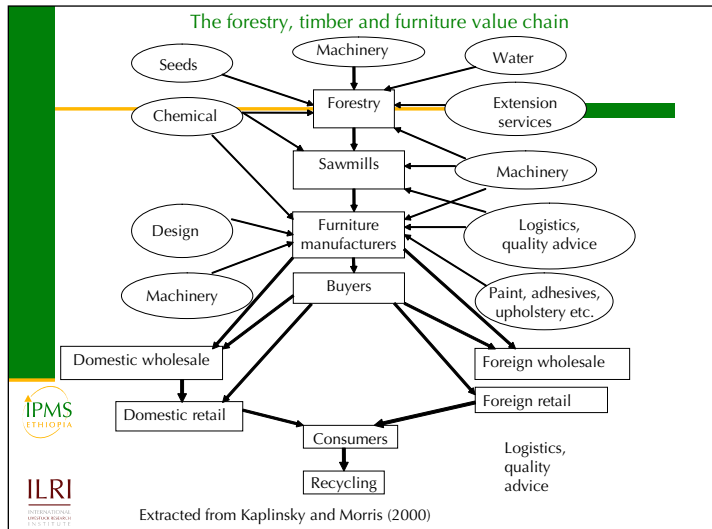
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Slide 34




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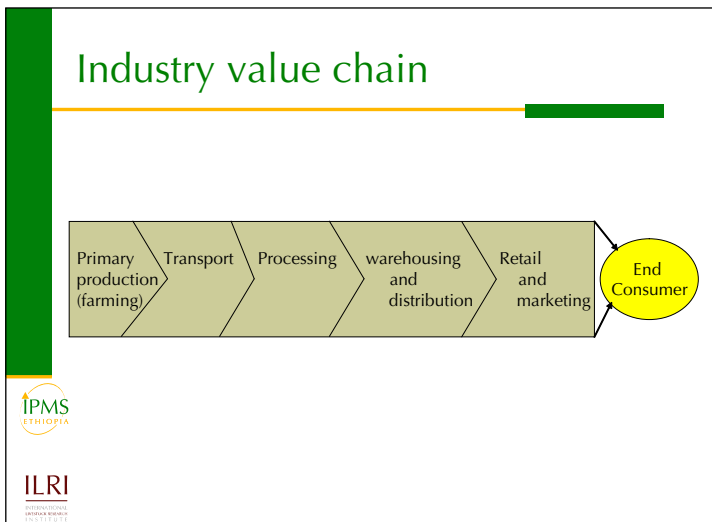


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Slide 35




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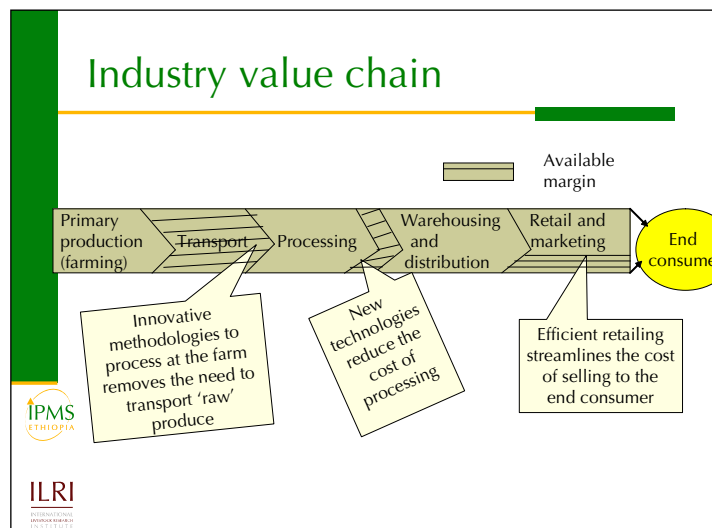


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Slide 36




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Slide 37

## Positive Deviance (PD)

- 'Deviance' refers to departure from the 'norm'
- PD is the departure from the norm which results in positive outcomes
- Leads to solutions that are cost effective, internally sustainable, owned and managed by community



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## Positive Deviance (cont'd)

- Positively deviating individuals have exactly the same resources as their non-PD neighbours
- Identify and amplify PD — use PDs as change agents.
- Discover original local answers to problems and give everyone access to the secrets



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Slide 39

## Implications for R for D

The complexity of the development challenge requires an innovation system perspective, hence the,

- Need for multi-stakeholder partnerships and
- Research and development teams of a multi-disciplinary nature
- R for D is about the integration of technological, organizational, institutional and policy options



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## Implications for R for D (cont'd)

- The development is a process which will require learning by and between individuals; team, as well as between stakeholders: interactive, social and institutional learning
- Outcomes are expected to go beyond mere productivity and efficiency in the producer-to consumer chain but combined with need for improvement in the rural livelihoods
- Systemic rather than linear approaches: for knowledge generation and up-take, and up-scaling of innovation




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## Key features of paradigm shifts in R&D

Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Driving motive	Efficiency: maximize productivity and profit/return to limited resources; competitiveness	Productivity, achieving food and nutritional security, poverty alleviation, ecological sustainability and equity
Mode	Blue print, supply push	Process, demand/end user driven
Goals	Pre-set; closed	Evolving, open
Planning and action	Top-down	Bottom-up




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Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Assumed causes of problems	Lack of knowledge, farmers are irrational	Political-economic roots of problems neglect of ecology and farmers' needs (farmers' knowledge), poor understanding of the production system, poor linkages and partnerships
Assumption and key features	Crop /commodity specific monoculture, uniformity/homogeneity, reductionism, simplification of system, efficiency focus on limited variable (land, labour, capital)	Agro-ecosystems, polycultures, multiple and high value crops and resources in system, diversity/heterogeneity, holistic view of productivity and resource management




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Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Institutional relations and actors/interaction of professionals with people	<ul style="list-style-type: none"> <li>■ Top-down (linear) technology development and transfer model</li> <li>■ Research to extension (or private sector) to farmers</li> <li>■ Instructing, motivating</li> <li>■ Centralized</li> </ul>	Interactive systematic model, collaboration and networks horizontal relations (farmer to farmer); agricultural innovation systems, pluralism (research, extension, NGOs, education, civil societies, CBOs, private sectors); decentralized
Main beneficiaries and locus of control of technology	Private sector, formal institutions	Public interests, communities and farmers (especially the poor), women and children, vulnerable groups




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Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Focus	<ul style="list-style-type: none"> <li>■ Single technologies (seeds, agro chemical, biotechnology)</li> <li>■ production technologies</li> </ul>	<ul style="list-style-type: none"> <li>■ Agro-ecological principles, institutional innovations, ITK, empowerment and capacity strengthening.</li> <li>■ Innovation</li> </ul>
Main types of research/analytical assumptions	Unidisciplinary, reductionist, scientists or private sector generate knowledge, mainly done in laboratories and research stations	Multi disciplinary, farmers are researchers and innovators, on-farm , participatory, in communities, systems, holistic.




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Slide 45

Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Common view of farmers	Passive audience/ partners, irrational seen as conservative, ignorant and beneficiaries	<ul style="list-style-type: none"> <li>■ Active, rational, key partners in the innovation process with valuable knowledge</li> <li>■ Farmers are active in adopting new research findings to improve productivity</li> <li>■ Partners and actors</li> </ul>
Skills required	Specialization in technology, biological/ agronomic sciences, business/finances, bio-technology	Biological systems management, social and institutional relations, people/partnering skills, facilitating skills




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Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R for D
Policy arena	<ul style="list-style-type: none"> <li>■ Political agencies form rules, close connection with private sector</li> <li>■ Policies considered as external</li> </ul>	<ul style="list-style-type: none"> <li>■ Public (community) actively involved in setting agenda and decisions</li> <li>■ Link to environmental /social/ food interests</li> <li>■ Includes policy related constraints in analysis and interventions</li> </ul>




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## Emerging challenges

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- Emerging food and energy crisis
- Greater concern for the environment
- Climate change
- Trade, market liberalization and emerging agri-food systems
- Emerging diseases
- Growing need for inter-sectoral linkages
- Changing expectations from science, technology and innovation




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## Emerging challenges (cont'd)

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- Underinvestment in agriculture and agricultural research
- Technological advances in biotechnology and ICT
- Globalization of private agricultural research and innovation
- Meeting commitments and targets
- Global financial crisis




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Slide 49

## Main messages

- Approach to research is changing
- What constitutes R for D systems (organizations and institutions) has changed
- Emerging challenges require R for D systems to be dynamic



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Slide 50

*Thank you!*



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# Challenges of research and development systems and changing paradigms

## 1 Introduction

In a rapidly changing world, food and agricultural innovation systems in developing countries are facing new and increasingly complex challenges. Fighting poverty; ensuring food and nutrition security while protecting the environment still remains as a major challenge facing the global development practitioners today. To ensure that the global changes benefit smallholder farmers, food insecure households, and other vulnerable groups, new mechanisms to foster the development and diffusion of innovation are needed to strengthen the ways in which information, knowledge, and technology are researched, developed and disseminated.

The scientific theory of inquiry and key steps in experimentation and discovery have not changed since its exposition in the 19th century, nor will it change. What keeps on changing is rather, the environment in which discovery and innovation occurs and the stakeholders involved in these stages. And this environment influences the organization and social process of discovery and innovation. The Research and Development (R&D) community responds to the changing needs and emerging challenges by coming up with innovative tools and approaches. Since the introduction of technology transfer model, the R&D arena in sub-Saharan Africa has seen a number of paradigm shifts. In this section an attempt is made to briefly describe these concepts so that the R&D practitioners can comprehensively internalize the desirable features of these concepts in designing the future policies, strategies and programs.

Over the years, the R&D system has been testing, adapting and adopting a number of concepts and procedures to make it relevant, effective and efficient. Some of these concepts include: farming systems approach; participatory research methods; National Agricultural Research Institutes (NARIs); National Systems Framework (NSF) including National Agricultural Research Systems (NARS), National Agricultural Extension System (NAES), National Agricultural Education and Training System (NAETS); Agricultural Knowledge and Information Systems (AKIS); Agricultural Innovation Systems (AIS); rural livelihoods; agri-food chain/value chain; knowledge quadrangle; action research; Integrated Agricultural Research for Development (IAR4D); Doubly Green Revolution and Rainbow Revolution; and Positive Deviance. These concepts are briefly discussed in this chapter in order to understand the contemporary perspectives with respect to agricultural R&D systems.

## 2 The reform agenda and changing paradigms within the R&D arena

The policy and institutional context in which agricultural research and innovation occurs have changed dramatically. Rapid changes continue to take place in the structure and authority of governments, the global economy, the structure of the farming sector, and in the global and local food industries and retail businesses. The institutional landscape is also changing dramatically. The 'third parties' (such as civil society, farmer organizations and NGOs) are increasingly playing important role in agricultural R&D. Cross-sectoral linkages between agricultural and other sectors (such as water, health, energy and education) are becoming increasingly important. The agricultural sector is expected to play a significant role in poverty alleviation, and food and nutrition security, while protecting the environment. With reduced funding support the agricultural R&D system is now forced to raise questions on their

continuing relevance, approaches, accountability and impact. As a result, the research and support services can no longer be separated from the broader development questions.

Since independence in most African countries research and extension managers have been forced to grapple simultaneously with five complex transitions which will ultimately influence the productivity and sustainability of the R&D system. These are: the managerial transition from colonial to local research and extension administrators; scientific transition from expatriate to indigenous scientists; financial transition from dependence on financial support from colonial governments and large scale farmers to mobilizing support from national governments, donors and beneficiaries; political transition from commercial farms to smallholders to private research and extension; and new forms of public-private-civil society research extension partnerships.

In sub-Saharan Africa the public sector agricultural R&D system has been characterized by built up of research personnel, declining levels of resources per researchers and growing reliance on donor funds, none of which appears sustainable. Today most NARIs in the region are constrained by recruitment freezes or lack of finance to hire new staff or retain existing staff (inadequate support, low pay); budget highly committed to staff salaries and benefits, i.e. existing establishment costs; due to budgetary constraints focus on short term activities, geographical areas and limited number of commodities; and lack of strong national or rural development policies in favour of resource poor smallholders and sustainability.

Recent studies (Biggs and Smith 1998; Hall and Nahdy 1999; Ashby et al. 2000; Chema et al. 2003; Paterson et al. 2003) showed that many organizations, especially publicly funded agencies dealing with agricultural R&D in developing countries are facing a crisis of confidence among key stakeholders due to: lack of strategic planning that indicates future directions; inward looking attitudes; poor participation and co-operation of end-users in research activities; inadequate monitoring and evaluation systems; top-heavy, bureaucratic procedures; insufficient resources for effective implementation of priority research; lack of effective external linkages; and lack of performance evaluation and innovation culture.

This crisis has been found to result in organizational inefficiencies, lack of adequate stakeholder participation and responsiveness, decreasing investor confidence, inadequate staff motivation and low moral, limited research and service outputs, limited uptake and utilization of research findings and a 'brain-drain' from the public sector. As a result of the Structural Adjustment Programs in many countries in SSA, at present the three core institutions in the agricultural knowledge triangle—research—extension and higher education—have been down-sized and restructured and new private institutions are now in stiff competition with public counterparts.

Recent developments in the context of agricultural R&D present certain challenges to agricultural research and innovation in developing countries. These developments include:

- Confronting new priorities in a rapidly changing world (e.g. stronger demand for competitive and quality-conscious agriculture) and adapting to changes within a more complex innovation systems framework where there are a greater number of actors and linkages to consider;
- Redefining the role of government in agricultural research and service provision and defining the role of the private sector, civil society, and end users;
- Strengthening the demand side of agricultural research and services to ensure that these programs are more responsive and accountable to end users;

- Developing a clear understanding of the institutional structures needed at the national, regional, and subregional levels for agricultural research and service provision and of whether, and how this understanding would imply changes in the current structures present at national, regional, and global levels;
- Developing a clear understanding of the institutional structures needed at every level for agricultural education within the emerging food and agricultural innovation systems;
- Ensuring stakeholder participation and developing local, regional, and global partnerships and alliances;
- Facilitating development of innovative funding instruments that make public institutions more sustainable, reduce donor dependence, and enhance co-financing by end users and others;
- Assisting in developing mechanisms through which internal and external support for food and agricultural innovation systems in developing countries are better coordinated; and
- Strengthening system linkages and coordination, including linkages between agricultural research policy and wider policies for science and technology (IFPRI–ISNAR 2005).

The reform agenda within the R&D arena includes: redefinition of government role in agricultural R&D, decentralization/privatization of agricultural R&D activities, broader and active stakeholder participation—pluralism in service provision, networks and partnerships, orientation of R&D to be more outward looking, client oriented, and impact driven, and embracing ‘systems’ perspectives. Within the reform agenda, the new funding arrangements in the R&D arena include: separation of financing from service provision and research execution and changing the funding base to competitive funding.

Different exogenous trends contributing to the reform process are identified as changes in the political, socio-economic, market, and institutional context together with changes in the demand for R&D services, research technologies, methodologies, and approaches. Managing this complex environment requires a range of skills and tactical planning and shifts in paradigms.

Given the sweeping reforms that are taking place, the R&D systems are facing a transition period in which they will need to restructure themselves, confront new demands, and adjust to new political, scientific, institutional and economic environment. Some of the key emerging concepts and perspectives within the agricultural R&D system are discussed in the following sections.

Agricultural research and technology development is undergoing a paradigm shift in which the environment under which agricultural research and extension systems are operating is affecting their organizational structure, management style, and field operations. Basic trends of these environmental changes are based on multiple partnerships, multilevel participation, and the enlargement of the scene from national to supra-national levels. Under these circumstances, traditional agricultural research and agricultural extension policies are going obsolete with regard to the new options (SDR 2005).

A shift was needed from a single commodity and monodisciplinary base to a farming system and a multidisciplinary based approach together with a change from a top–down extension model to a participatory approach to technology assessment and adoption.

Since independence, a number of paradigm shifts have occurred within the R&D arena. The paradigm shifts included changes in both research approaches and approaches to organizational analysis. Changes in approaches in agricultural research include farming systems perspective, participatory research methods (including action research), rural livelihoods, Integrated Agricultural Research for Development (IARD4D), Agri-Food systems/Value chain, and Positive Deviance Approach. Changes

in approaches to organizational analysis include National Agricultural Research Systems (NARS), Knowledge and Information System (AKIS), Innovation Systems Perspective. These various concepts are discussed in the following two subsections.

## 2.1 Research approaches

### 2.1.1 Farming systems perspective (OFR/FSP)

The concept farming systems perspective (FSP) implies 'seeing things from the farmers' view-point. It means that researchers should use a FSP even when working on a single commodity and/or discipline problem. FSP means that researchers should be sensitive to farming systems interactions, understand how the farming systems operate, and use this understanding in designing and evaluating the new technologies offered to them. The concept has grown from farm boundaries to household system to livelihood systems.

Since small farmers are managing the farm household with multiple objectives and multiple enterprises, but with limited resources, the interaction between the various components is very critical in decision-making. Interactions may occur between the various components crop–crop, crop–livestock, farm–household as well as on-farm–off-farm activities as they compete for the same resources. Interactions may also arise from the farmers objectives and his/her attitude towards risk. In addition, these interactions may occur over space (e.g. inter-cropping), over time (e.g. liming, green manuring), and over time and space (e.g. relay cropping).

The interactions are important to identify the trade-offs and compromises in the system while identifying and prioritizing problems in order to understand the process of resource allocation. They are important in identifying the indirect costs and benefits during technology assessment. The research may concentrate on key enterprises while taking into account the interactions with other elements, including resource competition, complementarity, and participatory processes, together with meeting multiple objectives of the farm household. The explicit recognition of the importance of interactions in the farming system is defined as the 'farming systems perspective'.

### 2.1.2 Participation/participatory research methods<sup>1</sup>

The participatory paradigm is based on the premises that the non-adoption of technologies is not due to ignorance of the farmers but due to deficiencies in the technology and the process that generated it, especially inadequate participation in all stages of the process by those intended to benefit. It has been argued (Chambers 1993) that much of the earlier farming systems work could be seen as an extension of ToT, where outside professionals obtained information from farmers, analysed it and decided what would be good for the farmers, and what experiments should be designed and executed. In contrast, in the new participatory approaches analysis, choice and experimentations are conducted with and by farmers themselves, with outside professionals providing catalytic, facilitating, and supportive role. The salient feature of the new approach is the reversal of learning; where researcher and extension workers are learning from farmers putting emphasis on people rather than 'things', to decentralize, to empower participants, to value and work on what matters to participants (subjective perspective), and to learn from the beneficiaries rather than to teach them. Location and roles are also reversed, with farms and farmers as central instead of stations, laboratories, and scientists. In this new paradigm farmers

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1. The various tools and approaches are discussed in session five of this module.

analyse, choose, experiment and evaluate, while outsiders convene, catalyse, advice, search, supply, and provide support and consultancy.

In the literature, a distinction is made between 'participation' and 'participatory'. The term participatory development has sometimes been defined as involving users and communities in all stages of the development process (Narayan 1993). On the one hand, participation has been defined by one author as 'voluntary or other forms of contributions by rural people to pre-determined programs or project' (Oakley et al. 1991). Activities, such as participation in a survey, serving as key informant, or participation in an experiment which is researcher managed could be described as participation. On the other hand, a participatory project has been described as one initiated and 'owned' by beneficiaries (Cummings 1995). Thus, participatory programs contribute to empowerment of the individuals and communities involved in the program. In practice, therefore, there is little to be gained from such distinctions between participating and participatory in practical fieldwork. Participation can be considered as a product (end) as well as a process (means). As a product, the act of participation is an objective in itself, and is one of the indicators of success as it refers to the empowerment of individuals and communities in terms of acquiring skills, knowledge and experience, leading to greater self-reliance. However, when viewed as a process, participation refers to the action used to achieve a stated objective, i.e. cooperation and collaboration which helps to ensure sustainability of program/project/development.

The popularity of participatory approaches is based on the assumption that they eliminate the weaknesses of the traditional 'top-down' approach to research and development. Many different types of participation exist, and can be classified according to the degree of initiative and involvement of beneficiaries. These include:

- Functional participation—to get something useful accomplished;
- Empowering participation—to give the community a greater decision-making role;
- Capacity building participation—to enhance the skills of the community;
- Contractual participation—to provide specific services;
- Consultative participation—to get information;
- Collaborative participation—work as partners;
- Collegial participation—strengthen farmers research;
- Passive participation—where most decisions are made by outsiders; mostly one way communication between outsiders and local people;
- Active participation—where there is two way communication; people get an opportunity to interact with outsiders;
- Participation by subscription—where the local people are given an opportunity to subscribe to the project and in turn receive some benefits from the project; and
- Participation based on local request—demand driven approach where planned activities respond to the needs expressed by local people.

### 2.1.3 Action research

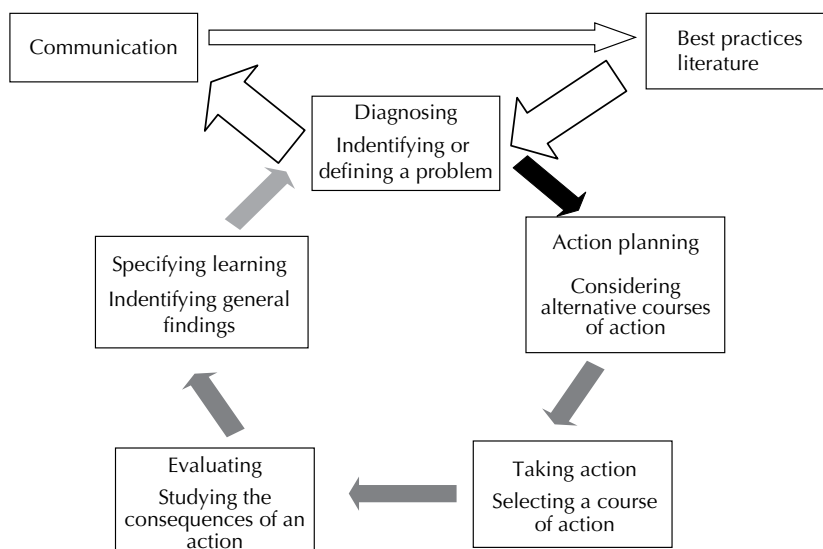
Action research is a research philosophy/approach that specifically focuses on 'learning by doing', where ideas and concepts are borrowed from other places and are tested and adapted to local circumstances. Action research (also known as participatory research, collaborative inquiry, emancipatory research, action learning and contextual action research), is essentially a process by which reform practitioners attempt to study their problems systematically (scientifically) in order to guide, correct, and evaluate their decisions and actions (Lewin 1958; Huizer 1979; Fernandez and Tandon 1981; Huizer 1983; Carr and Kemmis 1986; Sohng 1995).



Several attributes separate action research from other types of research. First, it focuses on turning the people involved in the reform process into researchers on the principle that people learn best, and more willingly apply what they have learned, when they do it themselves. Second, action research is always connected to social action. It understands itself as a concrete and practical expression of the aspiration to change the social (economic, political etc.) world for the better through improving shared social practices, understandings of these social practices, and the shared situations in which these practices are carried out. It is always critical—it is about relentlessly trying to understand and improve the way things are in relation to how they could be better. It is also critical in the sense that it is catalytic: it aims at creating a form of collaborative learning by doing, in which groups of participants set out to learn from change in a process of making changes, studying the process and consequences of these changes, and trying again. It aims to help people understand themselves as the agents, as well as the products of history (Lewin 1958; Huizer 1979; Fernandez and Tandon 1981; Huizer 1983; Carr and Kemmis 1986; Sohng 1995).

Action research takes place in real-world situations, and aims to solve real problems with researchers often acknowledging their bias—challenges the concept of ‘objectivity’. It is committed to spreading involvement and participation in the research process. It not only offers ways in which people can improve their socio-economic and political conditions through research on the ‘here and now’, but also in relation to wider socio-economic and political structures and processes—as people whose interconnections constitute the wider webs of interaction which structure social life in discourses, in work, and in the organizational and interpersonal relationships in which relations of power are exercised (Sohng 1995).

Action research typically involves an intervention methodology. As its eventual function is to bring about future change, in the short term, its key function is to involve those who are most affected by the expected change in a way that secures their commitment. Action research is typically cyclic. Carr and Kemmis (1986) conceived of each action research cycle as comprising planning, action, observation and reflection, whilst Susman (1983) distinguished five phases of action research as shown in Figure 1.



Source: Adapted from Susman (1983).

**Figure 1.** Action research cycle.

Firstly, a problem is identified and data is collected for detailed diagnosis. This is followed by a collective postulation of several possible solutions, from which a single plan of action emerges and

is implemented. At this point the best practices literature constitutes a useful input into this research cycle, by providing promising, alternative courses of action. Data on the results of the intervention are collected and analysed, and the findings are interpreted in light of how successful the action has been. At this point, the problem is re-assessed and the process begins another cycle. This process continues until the problem is solved.

Action research is used in real situations, rather than in contrived, experimental studies, since its primary focus is on solving real problems. It can, however, be used by social scientists for preliminary or pilot research, especially when the situation is too ambiguous to frame a precise research question. Mostly, in accordance with its principles, it is chosen when circumstances require flexibility, the involvement of the people in the research, or change must take place quickly or holistically. It is often the case that those who apply this approach are practitioners who wish to improve understanding of their practice, social change activists trying to mount an action campaign, or, more likely, academics who have been invited into an organization (or other domain) by decision-makers aware of a problem requiring action research, but lacking the requisite methodological knowledge to deal with it.

Action research not only enables the delivery of the research objectives but also builds the necessary capacity to institutionalize learned approaches and methods program. One of the criticisms on action research is that practitioners often get so much involved in the action that they forget their research function. Another problem is that what is being learned through action research (i.e. the experience) is often not recorded—there is no tangible output. Moreover, when action-research practitioners write it down, few scientific journals are prepared to publish it because it is not up to ‘orthodox’ scientific standards. At the end of each study, action research will leave behind applicable knowledge among management practitioners and systematically documented lessons learned that are applicable in similar conditions elsewhere. Ultimately, as these case study results are systematically tested under similar and even dissimilar conditions, the cumulative results will form a wealth of knowledge.

#### 2.1.4 Rural livelihoods<sup>2</sup>

Poverty is multidimensional (beyond income, to include vulnerability and lack of voice), that the poor have assets on which they can draw (and which they can build up); they use these to pursue multiple livelihood strategies and outcomes, often by managing a portfolio of part-time activities (though multi-locational households are becoming common). The poor generally have limited entitlements, are commonly deprived of those they do have, and have inadequate information, knowledge and power to claim them.

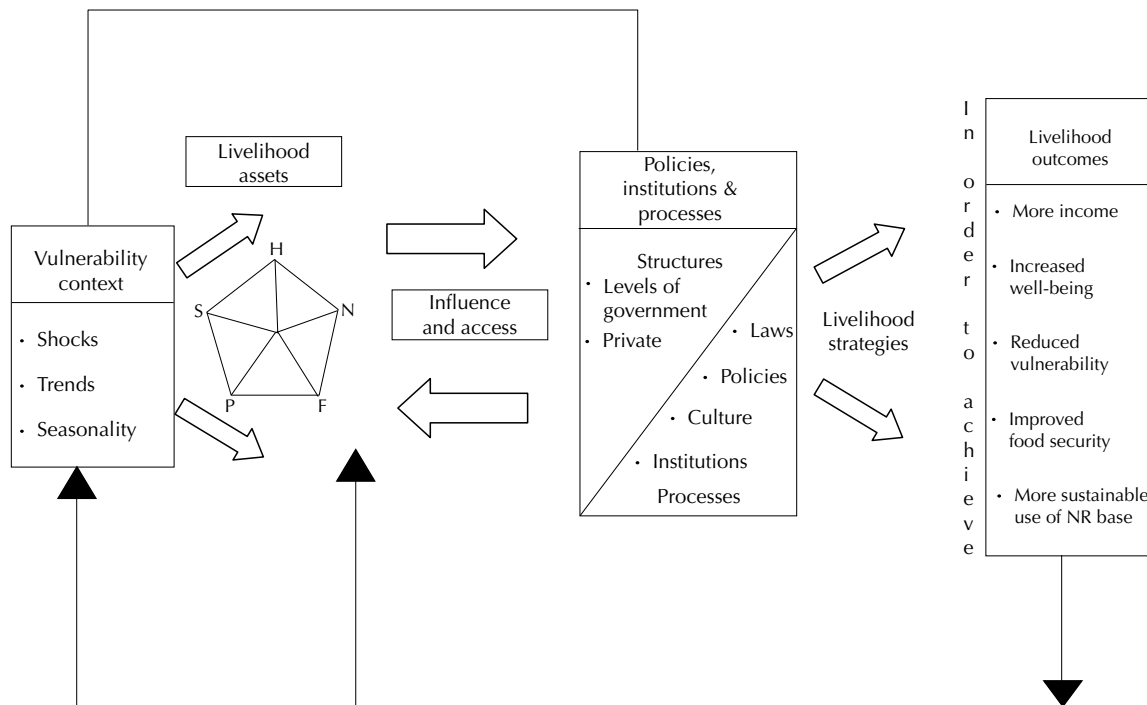
The sustainable livelihoods (SL) framework argues that the poor have assets and choices; development is not merely about increasing income, but about broadening livelihood-related choices. In its broadest conception, the purpose of extension is to help in broadening choice. It is clear that the very poorest are unable to engage in production and even if they do; they are producers, consumers and labourers at the same time. Hence, they cannot be helped by agricultural extension directly. Here social policy will take on a more important role, incorporating livelihood extension and safety nets.

Sustainable livelihood approaches identify the current livelihood strategies and objectives of the poor, in the context of vulnerability, the influence of policies, institutions and processes, and current levels of access to assets and entitlements. According to Christoplos et al. (2001) poor producers face high

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2. This section is heavily drawn from Christoplos et al. (2001).

transaction costs due to limited information and weak infrastructure to access markets, new quality standards which may be unattainable, and growing instability as major purchasers (such as supermarkets) shift bulk purchases from one country (or continent) to another in response to short-term market fluctuations. These stress that the poor draw on a range of assets, which they either own or can access, in order to achieve a range of livelihood outcomes (going beyond income to include greater wellbeing, increased voice and reduced vulnerability). To do so, they pursue a range of livelihood strategies, often managing a 'portfolio' of part-time activities, and changing the composition of the portfolio in response to emerging needs, opportunities or constraints. Part of the outcome of these strategies (such as higher income) will be consumed; part may be re-invested back to replenish or strengthen their livelihood assets, and part may be used to reduce vulnerability. The types of strategy they can pursue are influenced by policies, and by formal and informal institutions and processes. Of crucial importance to the poor is access, not only to assets (and low *ownership* of assets is clearly an underlying feature of poverty), but also to the benefits provided under, for instance, government programs. Such benefits can be either production-oriented (e.g. subsidies, credit, training) or protection-oriented (e.g. pensions, access to health facilities). Figure 2 depicts the sustainable livelihood framework.



F = Financial capital      P = Physical capital  
H = Human capital        S = Social capital  
N = Natural capital

Source: Christoplos et al. (2001).

**Figure 2.** Sustainable livelihoods framework.

Four further aspects of poverty are:

- The high transaction costs faced by the poor in production and trade: these impact disproportionately on the poor due to access problems caused by weak infrastructure, poor organization and adverse local power relations; appropriately focused extension involves providing more complete knowledge of alternatives and likely outcomes.
- The high risk facing the poor of breaking out of traditional patterns of production and associated social systems, which may provide some social protection, but are often deeply exploitative;

again, although extension cannot directly provide a solution to such dilemmas, it can help by promoting greater awareness of the potential returns and risks associated with alternatives.

- The high priority given by the poor to protecting themselves against vulnerability—evident in, for instance, the ‘defensive’ ways they use for social protection purposes some of the microfinance intended for productive activities. This may place limits on the extent to which they are prepared to engage in the types of productive activity that extension usually promotes. Furthermore, the poor do not progress on a simple linear path from vulnerability to accumulation: those apparently accumulating in one season might well be barely coping in the next.
- The limited impact that production-focused interventions can have on the destitute, and the need to supplement these by safety nets, especially where the poor—such as those chronically sick, the old, and those caring for large numbers of dependents—are unable to sell their labour, as well as where chronic conflict, HIV/AIDS and other factors have led to systemic collapse. They urge an approach to extension which is not concerned merely with agricultural production advice, or agricultural inputs. Rather, they suggest, first, that agricultural and rural development strategies have to be located in the context of the rights and livelihood aspirations of the poor; second, that production and protection strategies have to complement each other; and, third, that an extension approach which is geared broadly to livelihood contexts rather than narrowly to crop or livestock production contexts is more likely to be of benefit to the poor.

### 2.1.5 Integrated agricultural research for development (IAR4D)<sup>3</sup>

In the contemporary context research is not merely intended to develop and promote technologies to farmers but also empower farmers to better understand and respond to changing circumstances as they emerge. Farm enterprises and commodity production are no longer viewed in isolation of one another rather they are seen as interacting with natural resources management, markets and policies. Collaboration is no longer approached in a top-down manner through assigned tasks instead partnerships are forged and have recognized the importance of participation and interaction balanced with individual needs and goals.

The agricultural research for development takes a systems approach that goes beyond integrated natural resources management to encompass the domains of policies and markets and the effects that these have on the productivity, profitability, and sustainability of agriculture. The four pillars of agricultural research for development and their important interactions are presented in Figure 3. The procedure recognizes that the general approach to rural transformation involves intensification of subsistence oriented smallholder farming systems, better management of natural resources while intensifying their use, developing more efficient markets and enabling policies.

Agricultural research for development requires additional mechanisms to foster integration of these four dimensions and a new way of doing research and development. Therefore the support pillars of agricultural research for development include:

- Promotion of organizational and institutional change to enable cross-disciplinary research and development and multi-institutional collaboration
- Capacity building of the various stakeholders (farmers, scientists, and other relevant stakeholders)
- Information and knowledge management and
- Continuous monitoring and evaluation and systematic approach to impact assessment.

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3. The link to resources of the leading institute on ARD, <http://www.icra-edu.org/page.cfm?pageid=ardapproach>.

The agricultural research for development in fact utilizes the various participatory methods and tools.

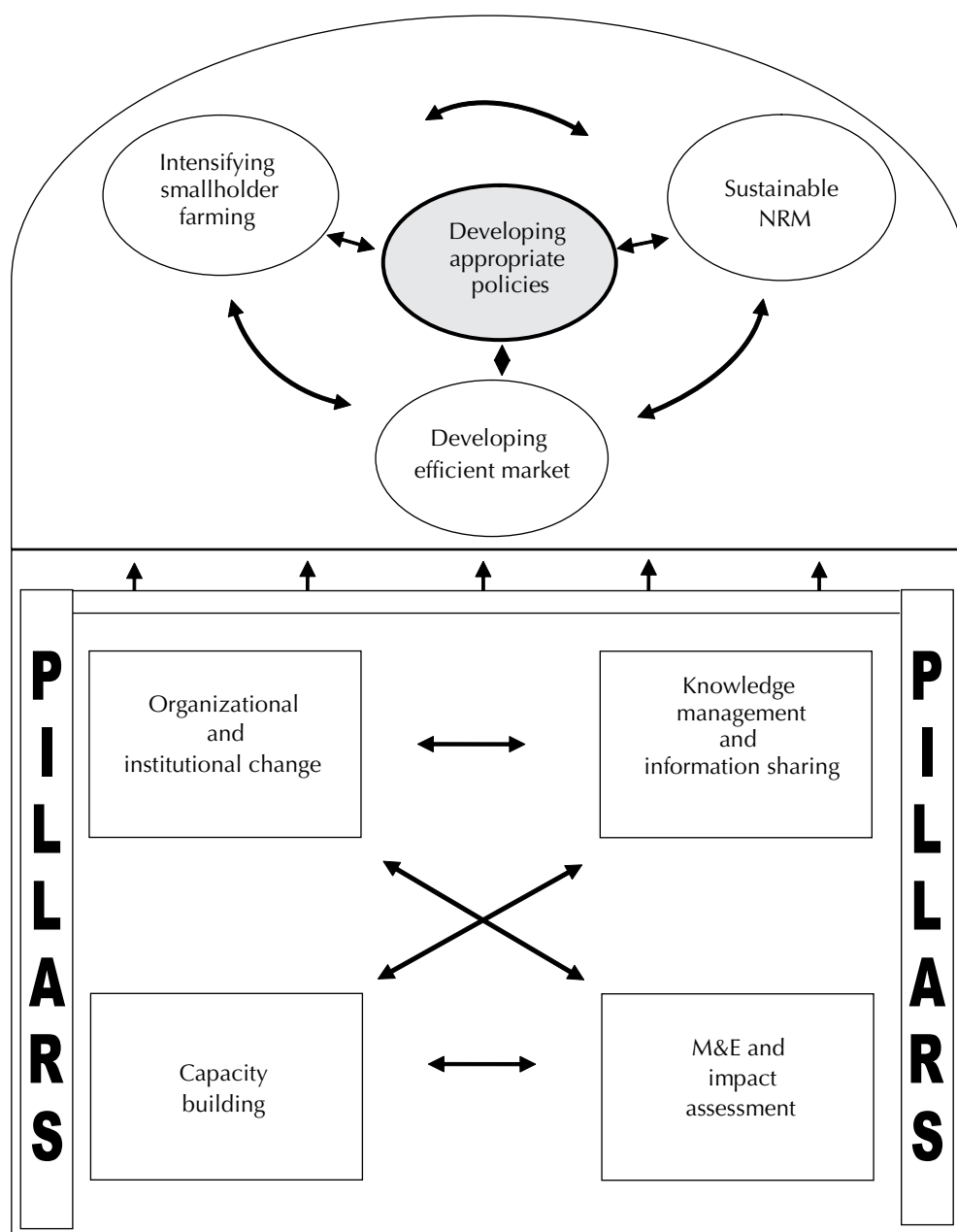


Figure 3. The four pillars of AR4D and their important interactions.

## 2.2 Approaches for organizational analysis

### 2.2.1 National Agricultural Research Systems (NARS)

For a considerable period, the R&D practitioners were dealing with public sector agricultural research institutions (NARIs) as vehicles to promote agricultural development. NARIs framework emerged to facilitate major investments in agricultural technology to increase food production and to promote export cash crop production. Due to its early success this institutional framework dominated for decades. However, the inadequacy of the NARIs concept to address agricultural R&D problems forced the R&D practitioners to look for alternative framework that could accommodate all public institutions involved in agricultural research, extension and education. Hence, the need to look at the various organizations undertaking agricultural research as a system gave birth to the National Systems Framework (NSF). The

NSF included the National Agricultural Research Systems (NARS), the National Agricultural Extension System (NAES), and the National Agricultural Education and Training System (NAETS). This trend of thinking continued to include other institutions involved in agricultural R&D and resulted in a number of other concepts such as Agricultural Knowledge and Information System (AKIS), the Technology Development and Transfer system (TDT) and the Agricultural Innovation Systems (AIS).

The NARS concept is a soft system concept for which no watertight definition exists despite it having been in existence for some 25 years. It is essentially a loose conglomerate of agencies or actors involved in conducting national agricultural research. Trying to define the NARS concept more precisely leads only to a whole series of rather arbitrary borderlines. In many African countries, there is still a tendency to equate the NARS with the dominant national agricultural research organization or institute. The idea of a more pluralistic NARS is only gradually being accepted by the key players in agricultural research.

### 2.2.2 Agricultural Knowledge and Information Systems (AKIS)

The AKIS concept is slightly less well known than the NARS concept, but has gained popularity in recent years. AKIS combines agricultural research, extension, and education in one system (also known as the knowledge triangle) and focuses on how the three activities generate new knowledge and information for farmers. The emphasis in this model is very much on the linkages between the different components. While some would argue that it is an old concept already applied by the US land-grant universities in the late 19<sup>th</sup> century, the linkage problem is still acute in most countries. Nagel (1979) was the first to describe the properties of an Agricultural Knowledge System (AKS) in detail. Others further developed and popularized the concept during the 1980s (Röling 1986, 1988; Blum et al. 1990).

The basic premises of AKIS is that research and extension should not be seen as separate institutions which must somehow be linked; instead scientists working on different types of research and extension agents at all levels should be seen as participants in a single Agricultural Knowledge and Information System (AKIS). Röling (1986) defined 'AKIS as a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in such processes as the generation, transformation, transmission, storage, retrieval, integration, diffusion, and utilization of knowledge and information, with the purpose of working synergically to support decision-making, problem solving, and innovation in a given country's agriculture'.

More recently, FAO and the World Bank joined forces in promoting the AKIS concept with the publication of 'strategic vision and guiding principles' on the topic in 2000. This document gives the following definition of an AKIS:

*'[An AKIS] links people and institutions to promote mutual learning and generate, share, and utilize agriculture-related technology, knowledge and information. The system integrates farmers, agricultural educators, researchers, and extension personnel to harness knowledge and information from various sources for better farming and improved livelihoods' (FAO and World Bank 2000).*

An AKIS can be defined in three different ways:

1. As set of organizations and people engaged in knowledge and information processes;
2. As set of coherent cognitions that have evolved among members of organizations, communities or societies; and

3. As computer-based 'intelligent' software (for example, expert systems, artificial intelligence).

When an AKIS is seen as a cognitive system, the components of the system are cognitions, that is, concepts, theories and beliefs about 'reality' that guide our behaviour (Röling 1986). The cognitive approach has been used to explore several aspects of reality as perceived by the farming family, including the classification of weeds, and male/female users of cassava (Jiggins 1986).

The institutional approach looks at sets of interconnected actors, each engaged in different activities, such as research, technology transfer, production or consumption, and each playing different but complementary roles and hence functioning synergically, e.g. Land grant universities and co-operative extension systems. The institutional approach leads to theory building about the way people and organizations receive, transform and transmit information, about the interfaces between them, and about the complementary roles institutions play in relation to each other. The purpose of the approach is to improve the management or design of the AKIS so as to make it function in the ways deemed desirable by policymakers, farmers, and other participants in the system. AKIS includes a number of basic knowledge processes such as generation, transformation, integration, storage and retrieval.

Knowledge generation appears to be more effective when carried out in groups than when attempted by individuals. Empirical studies have shown that the productivity of researchers is related to the extent to which they participate in networks. An important goal of the analysis, design, and management of an AKIS is to increase the synergy of its components, i.e. the total impacts of an AKIS should be more than the sum of the impacts of its constituent parts. Hence, the essence of an AKIS is that the knowledge generated in one part of the system is turned into information for use in another part of the system.

The transformations taking place within an AKIS are as follows:

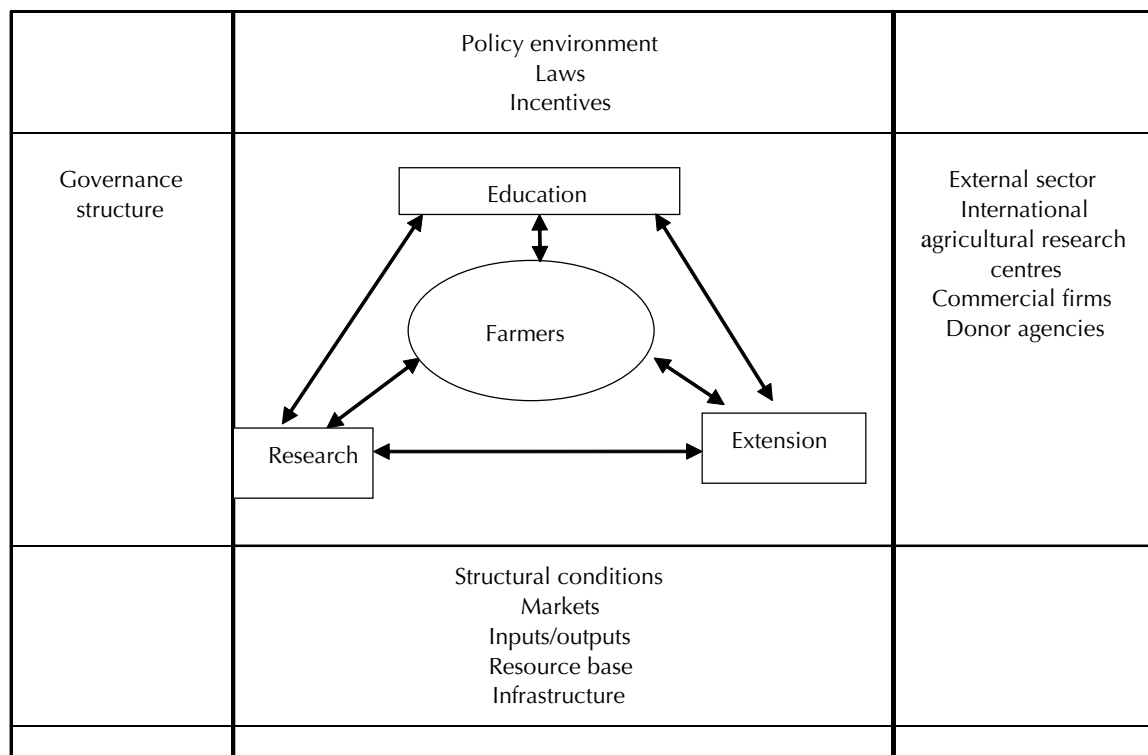
1. From information on local farming systems to research problems;
2. From research problems to research findings;
3. From research findings to tentative solutions to problems (technologies);
4. From technologies to prototype recommendations for testing in farmers' fields;
5. From recommendations to observations of farmer behaviour (male, female, children);
6. From technical recommendations to information affecting service (inputs and marketing) behaviour;
7. From adapted recommendations to information dissemination by extension; and
8. From extension information to farmer knowledge.

When modelling the AKIS, it is important to bear in mind that the system takes place in a larger context, from which it is not separate (see Box 1). Agricultural knowledge and information processes must be examined at national level against the backdrop of: (1) the policy environment, which formulates the laws and incentives that influence agricultural performance; (2) structural conditions, such as markets, inputs, the resource base, infrastructure, and the structure of farming; (3) the governance structure through which interest groups influence the system; and (4) the external sector, comprising donor agencies, international agricultural research centres (IARCs) and/or commercial firms (Elliott 1987).

The policy environment plays a crucial role, so much so that in some AKIS model it is considered one of the components of the AKIS itself. Once again policy is considered as a prime mover outside the AKIS. Together with two prime movers inside the system, namely management and user control, policy is considered as a force which can overcome the default conditions to which a system reverts unless pressures are applied to prevent it from doing so (Sims and Leonard 1989). Likewise, structural

conditions play an important role. Variability in the production environment and among the farmers who use it has tremendous implications for the design and management of the AKIS.

### Box 1. The AKIS as part of a larger system



To sum up, an effective AKIS requires:

1. The input of information from external sources. If the system does not have the capacity to generate and enhance appropriate roles for its constituent parts, it will not be in a position to absorb such information. In the agricultural sectors of developing countries, the lack of social organization among small-scale farmers is therefore a considerable barrier to development;
2. Improving the linkage mechanism between the various components. A linkage mechanism is the concrete procedure, regular event, arrangement, device or channel which bridges the gap between components of a system and allows communication between them. The linkage mechanism is the device which operationalizes the interface (Engel, personal communications); and
3. A detailed understanding of the functions which are to be performed by the system. If agricultural development is to be enhanced, there is a need to nudge widely differing institutions, often under different administrative arrangements, both public and private, into compatible roles.

### 2.2.3 Innovation Systems Perspective

The Agricultural Knowledge and Information system brings together the three core pillars of the knowledge system. It explicitly focuses on the knowledge/technology generation and dissemination. Very little attention has been placed on the utilization aspect of the knowledge or at least it is considered implicit. However, in order to derive the benefits to the society, the knowledge must be transformed into products and/or process and be put into some social and/or economic use. This is the crux of the



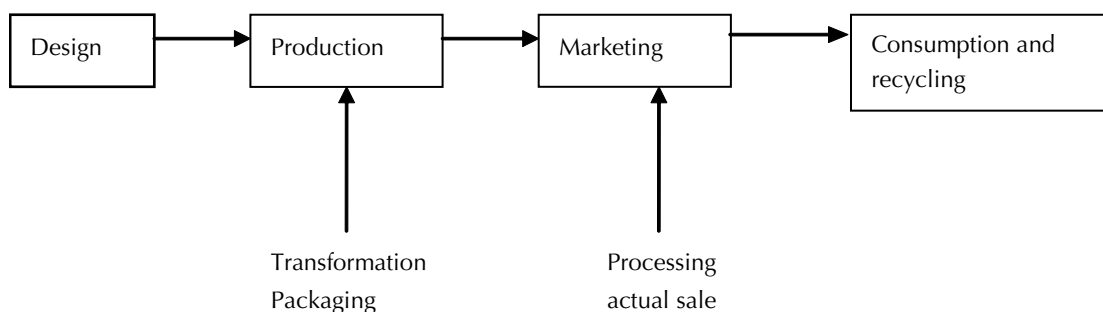
concept of innovation. The term innovation in its broadest sense covers, the activities and processes associated with the generation, production, distribution, adaptation and use of new technical, institutional, organizational and marginal knowledge (Hall et al. 2005). An innovation system on the other hand can be defined as ‘a network of organizations, enterprises, and individuals that focuses on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect their behaviour and performance’ (Rajalahti 2008).

The evolution of the innovation systems concept, innovation systems perspective and its applications are discussed in detail in Session 3 of this module.

The innovation systems approach enables us to make a clear distinction between ‘invention’ and ‘innovation’; and ‘institution’ and ‘organization’. The approach shifts our thinking about research as being central actor in an innovation system to being one important part of the whole system. The two important contextual factors affecting innovation processes are the actors who start and participate in the processes and the factors that trigger innovation. Thus one of the key features or core element of the innovation systems concept is partnership and networks. The various aspects of partnerships and networks are discussed in Session 6 of this module.

## 2.3 Agri-food chain/value chain

A value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production, delivery to final consumers, and final disposal after use (Kaplinsky and Morris 2000). It is worth noting that production is only one of a number of value added links in the agri-food chain (Figure 4). Some people refer to this chain as from hoe (plough) to the finger (fork). A simple value chain has four basic links.



**Figure 4.** Value links in the agri-food chain.

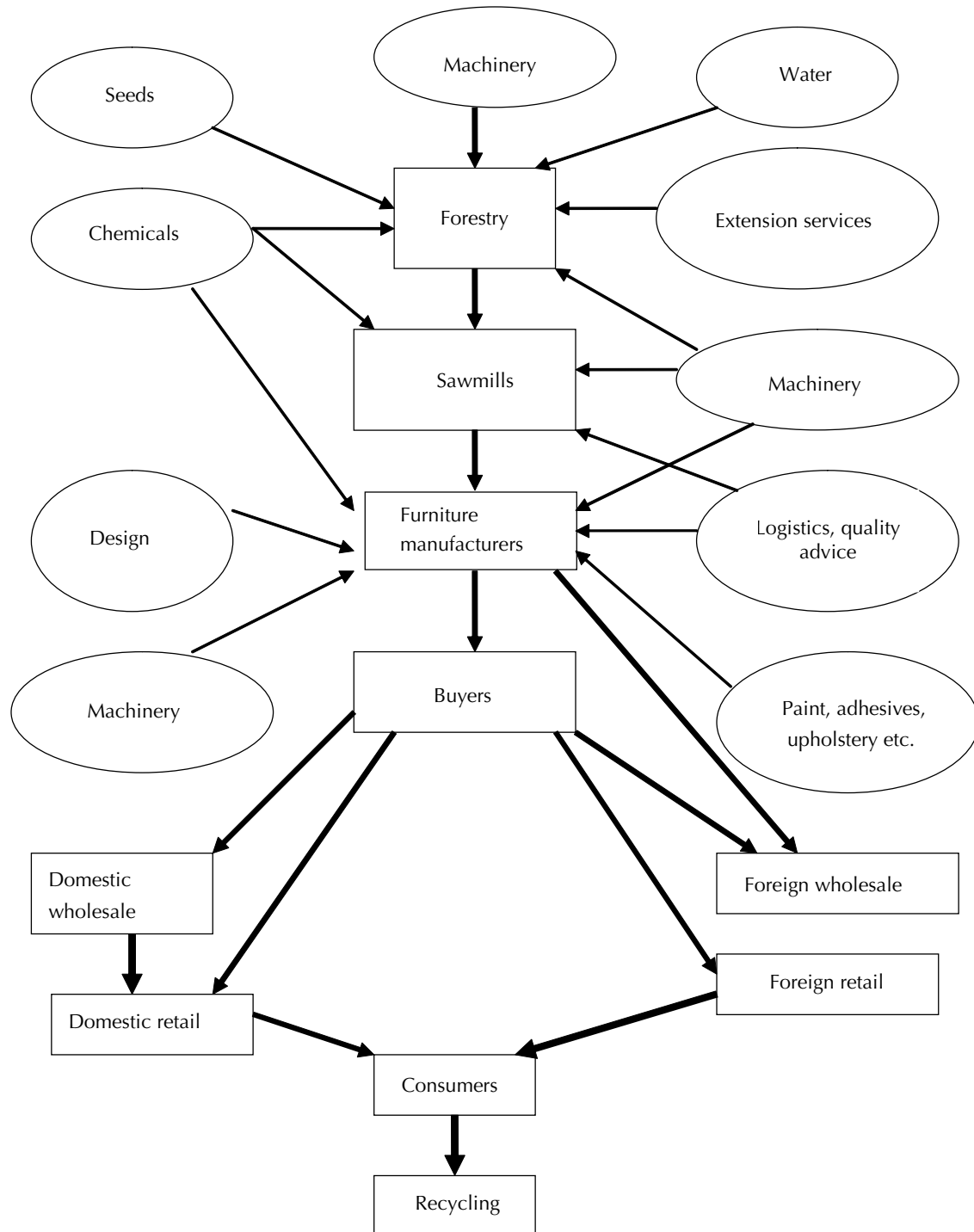
In the real world, value chains are much more complex than this simple depiction. A good example is a furniture industry shown in Figure 5.

In many circumstances, the intermediary producers in a particular value chain may feed into a number of value chains. It is also important to note that the share of sales may obscure the crucial role that a particular individual/group controlling a key core technology or input has on the rest of the value chain.

Porter (1985) distinguished two important elements of a modern value chain analysis:

- The various activities which were performed in particular link in the chain and
- Multi-linked value chain or the value system.

Both these elements are subsumed in the modern value chain described in Figure 6 below.



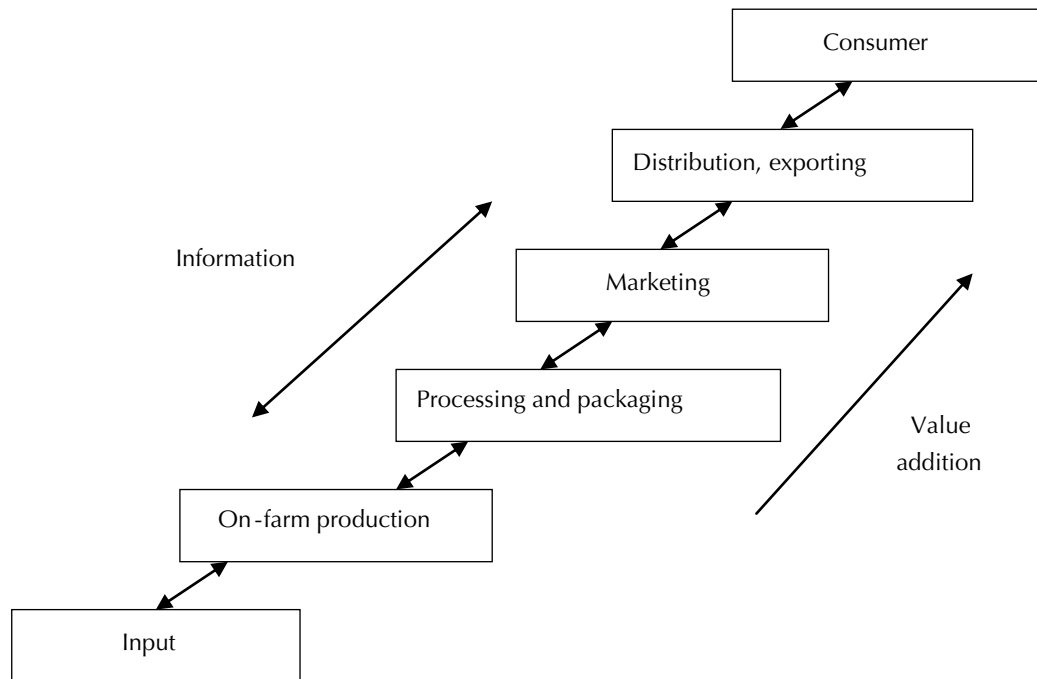
Source: Extracted from Kaplinsky and Morris (2000).

**Figure 5.** *The forestry, timber and furniture value chain.*

Another concept often used to describe the value chain is the global commodity chain (Gereffi 1994). This approach focuses on the power relations which are imbedded in value chain analysis. It explicitly focuses on the co-ordination of globally dispersed, but linked production systems; where the dominant party varies determining the overall characters of the chain.

Kaplinsky and Morris (2000) identified three main sets of reasons why a value chain analysis is important. These are:

- With the growing division of labour and the global dispersion of the production of components, systemic competitiveness has become increasingly important. Value chain analysis plays a key role in understanding the need and scope for systemic competitiveness.
- Efficiency in production is only a necessary condition for successfully penetrating regional and global markets.
- Entry into the various markets: national, regional, and global requires an understanding of dynamic factors within the whole value chain.



**Figure 6.** *Agricultural food chain: Value adding.*

In addition, in many developing countries there is heavy emphasis on the commercialization of smallholder production system; and production is increasingly becoming market oriented. In order to reap the immediate benefit, it is important to understand the nature, structure, and the dynamics of the value chain related to the various enterprises produced by the smallholder farmers. Given the new agricultural innovation system perspective, we need not only to understand the dynamic but should also focus on the enabling environment, facilitating institutions as well as the facilitating services associated with a given value chain.

The value chain includes life cycle cost elements that are not normally included in common definition of products. Analysis of these extended product/service definitions is key to finding new opportunities. Each element or process in the value chain represents a part of the total cost paid by the customer with respect to the product. Think of the total customer purchases as totalling one dollar. How many cents go for each value-added component making up the dollar? We first need to know what major elements are in the larger schemes of providing the customer with products and services directly or indirectly involved in satisfying his/her overall needs, i.e. identifying the various elements in a value chain. Each institution/organization/group of actors may participate in only a limited number of value-creating processes related to its customer's total experience of the product. The key question is whether the institute/organization/group of stakeholders can undertake greater responsibility in its value chain? Accordingly opportunity may exist to add revenue sources to its income. Expansion may be even more desirable when the potential for synergy exists. Opportunity may also exist for new possible processing.

In order to realize a greater proportion of the cost paid by the customer, i.e. adds value to the current operation:

1. Determine the current value chain;
2. Identify those parts of the value chain in which you are currently involved;
3. Re-engineer the value chain to reflect changing environment identifying the additional role you can play or service you can provide; and
4. Identify other main process cluster to be provided by you in this new or modified value chain.

Laying a ground work for such a transition may involve cost and take time. So, having a pretty clear vision of the desired results help a great deal.

### 3 Positive deviance

This is a new paradigm for addressing contemporary problems. This approach has been tried in early 1990s in Vietnam to address the issue of malnutrition. But it may be a useful tool in addressing emerging agricultural and rural development issues of the rural poor in Africa.

The term 'deviance' refers to the departure from the 'norm'. Positive deviance (PD) is a departure from the norm which results in a positive outcome. The uncommon behaviour or practices of certain people enable them to out-perform their neighbours with whom they share the same problems and resource base. This new paradigm called 'positive deviance' spots 'positive deviants' to identify solutions that are cost-effective, sustainable and internally owned and managed (2005). The successful deviants' practices that work are then amplified to the community and is called 'amplifying positive deviance' (2005). The key here is to discover local answers to the problem and give everyone access to the secrets.

The positive deviants provide proof that it is possible to find viable solutions today to complex problems before all the inter-related factors underlying the problem can be addressed. The positive deviance not only provides us with an impetus for action, but an accompanying demonstrable successful strategy as well. A critical component of the definition of 'positive deviants' is that PD individuals have exactly the same resource base as their non-PD neighbours. Hence, whatever they are doing and whatever resources they are using to achieve their successful outcomes, are by definition, accessible to their neighbours. The use of PD provides two distinctive advantages for those working in development area. First, by discovering and sharing the actual successful practices and behaviours utilized by the positive deviants, development practitioners can make those behaviours/solutions accessible to others. The second is the use of PDs themselves as change agents.

#### Positive deviance and sustainability

Traditional development efforts are often 'need based'. The development efforts begin by assessing the community needs which are often met through provision of external resources. During the program implementation the community has access to the needed resources through their development partners. Very often, once the program has finished, the external partner will depart and the community returns to their pre-program status.

PD provides a radically different approach in that the resource needed already exists in the community. PD is the tool to help the community to find it. Hence, the solutions to the community's problem can be found today within the community. The approach not only ensures that the critical resources are

owned by the community, but that the problems' solution is discovered and owned by them as well. The sense of ownership is a critical factor in the sustainability of community development efforts. The very core of PD is the belief in the wisdom and untapped resources inherent in the community. The key is that you cannot import change from outside. Instead, you have to find small, successful but 'deviant' practices that are working in the community and amplify them.

## Steps in adopting positive deviance approach

*Step 1: Do not presume that you have the answer.*

Be ready to listen and not to talk. Key informants may be very useful in identifying the positive deviants.

*Step 2: Do not think of it as a dinner party.*

Make sure not to mix people from different social groups. Everyone in the group that you want to help change must identify with the others in the group. Everyone must face the same challenges and rely on the same set of resources to come up with answers. If the group members do not see themselves as working on identical challenges with identical set of resources, then positive deviance will not work.

A solution has to be repeatable. If you are going outside where things are culturally very different, then it is just another way to impose best practices, and you are not using the positive deviance.

*Step 3: Let them do it themselves*

Set up a situation in which people—including those who need to change the way they operate—can discover, on their own a better way to do things. Raise questions, but let the group come up with the answers on their own. Establish research guidelines that isolate and analyse the behaviour of positive deviants inside the group itself—and that highlight the superior results that the study achieves.

*Step 4: Identify conventional wisdom.*

Before you can recognize how the positive deviants stray from conventional wisdom, you first have to understand clearly what the accepted behaviour is. Establish what it is that most group members do? Clarify the conventional wisdom of the average and of the majority.

*Step 5: Identify and analyse the deviants.*

As one tracks down how people in the group go about their tasks, and begin to list the behaviours that they all have in common, the positive deviant will naturally emerge. If the development practitioner helps the community to identify the positive deviants then they will not feel that an outside solution has been imposed on them. They will have discovered a new way of doing things themselves, making it their own discovery. Analyse and list the set of behaviours that the deviants have in common. Single out exactly what makes them successful.

*Step 6: Let the deviants adopt deviations on their own.*

Design an intervention that requires and enables people to access and to act on these new premises. You enable to practice a new behaviour and not to sit in class learning about it. It is all about changing behaviour. The key here is 'Do not teach the knowledge—encourage new behaviour' (Fast Company 2005). Let the people who have discovered the deviations spread the word in their group. We need to provide incentives for it.

*Step 7: Track results and publicize them*

Post the results and show how they were achieved, and let the other groups develop their own curiosity about them. It is important to go back to the community periodically and observe how different groups have changed, and track the results quantitatively to show how positive deviance works.

*Step 8: Repeat step one through seven*

Make the whole process cyclical. Once people discover effective ways to deviate from the norm, and once those methods have become common practice, it is time to do another study to find out how the best performers in the group are operating now. The chances are that they have discovered new deviations from the new norm.

To repeat, the key principle is: ***‘discover original local answers to the problem, and then give everyone access to the secrets.’***

Table 1 summarizes the key features of paradigm shifts over time highlighting how the major characteristics differ in the current paradigms as compared to the conventional ones.

**Table 1.** Key features of paradigm shifts in R&D

Characteristics	Conventional paradigm for agricultural R&D	Current paradigm for agricultural R&D
Driving motive	Efficiency: maximize productivity and profit/return to limited resources; competitiveness	Productivity, achieving food and nutritional security, poverty alleviation, ecological sustainability and equity
Assumed causes of problems	Lack of knowledge, farmers are irrational	Political-economic roots of problems, neglect of ecology and farmers’ needs (farmers’ knowledge), poor understanding of the production systems
Assumption and key features	Crop/commodity specific monoculture, uniformity/homogeneity, reductionism, simplification of system, efficiency focus on limited variable (land, labour, capital)	Agro-ecosystems, polycultures, multiple and high value crops and resources in system, diversity/heterogeneity, holistic view of productivity and resource management
Institutional relations and actors	Top-down (linear) technology development and transfer model Research to extension (or private sector) to farmers	Interactive systemic model, collaboration and networks, horizontal relations (farmer to farmer); agricultural innovation systems, pluralism (research, extension, NGOs, education, civil societies, CBOs, private sectors)
Main beneficiaries and locus of control of technology	Private sector, formal institutions	Public interests, communities and farmers (especially the poor), women and children, vulnerable groups
Focus of innovation	Single technologies (seeds, agro-chemical, biotechnology) Production technologies	Agro ecological principles, institutional innovations, ITK, empowerment and capacity strengthening, relationship among partners and actors Both production and R&D technologies
Main types of research	Unidisciplinary, reductionist, scientists or private sector generate knowledge, mainly done in laboratories and research stations	Multidisciplinary, farmers are researchers and innovators, on-farm, participatory, in communities
Common view of farmers	Passive audience/partners, irrational seen as conservative and ignorant	Active, rational, key partners in the innovation process with valuable knowledge Farmers are active in adopting new research findings to improve productivity
Skills required	Specialization in technology, biological/agronomic sciences, business/finances, biotechnology	Biological systems management, social and institutional relations, people/partnering skills, facilitating skills
Policy arena	Political agencies form rules, close connection with private sectors	Public (community) actively involved in setting agenda and decisions Link to environmental/social/food interests

## 4 Emerging challenges

In the previous sections we discussed the organizational and institutional transformations that are taking place within the agricultural research for development and the associated paradigm shifts to address the broadened agricultural agenda. In addition, the system is also confronted with a number of emerging challenges which shapes the priority agenda. Some of the key challenges facing the R&D communities are discussed in this section.

### 4.1 Emerging food and energy crisis

In the recent past global food prices are increasing at an unprecedented rate and the analysts say that they will continue to remain high for a considerable period. Since the start of 2006, the average world price of rice has risen by 217%, wheat by 136%, maize by 125% and soybean by 107%.

Both the demand side and supply side factors contributed to the current price crisis. The demand side factors include:

- the economic growth and the associated changes in life style and eating habits in many countries;
- diversion of food crops (maize, sugarcane) for making biofuels;
- declining world stock piles, the financial speculation in commodity markets (a collapse of the financial derivatives market); and
- increase in population (although at a slower rate).

The supply side factors include:

- increased fuel and fertilizer prices and the associated increase in cost of production (and low input use);
- biofuel subsidies pushing production towards biofuel rather than food;
- idle crop land under a conservation program, export bans and tariffs by many grain exporting countries;
- production shortfalls from natural disasters and the long term effects of climate change;
- trade liberalization making many developing nations depend on food imports (subsidized) which are cheaper;
- loss of crop lands due to mainly soil erosion, water depletion and urbanization; and
- declining investments in agriculture.

The continuing increase in fuel prices is pushing countries towards biofuels. Few of the current biofuel programs are economically viable and many pose social (rising food prices) and environmental (deforestation) risks. A better understanding of the impact of biofuels is a must in determining energy options.

As a result of rising energy costs, inputs such as fertilizers become more and more unaffordable for small farmers who are at the centre of response to the world food crisis. The transport costs have become higher and higher once again resulting in higher consumer prices. Thus the rising fuel prices and the emerging food crisis are closely linked.

World cereal and energy prices are becoming increasingly linked. A worrisome implication of the increasing link between energy and food prices is that high energy price fluctuations are increasingly translated into high food-price fluctuations. The impact of cereal price increases on food-insecure and

poor households is quite dramatic. It has been projected that the current food crisis could push 100 million people deeper into poverty.

The increased prices could have a positive supply response. However, this response for better price incentives depends on public investments in markets, infrastructure, institutions and support services.

In order to address the current food crisis, countries need a comprehensive plan to ensure long-term food availability and security as well as short term relief. They also must invest now and for the longer term in problem solving agriculture.

## 4.2 Greater concern for the environment

Since the 1992 Earth Summit in Rio, it is generally accepted that the environmental agenda is inseparable from the broader agenda of agriculture for development. Both intensive as well as extensive agriculture lead to environmental consequences. The long term climate change has its own consequences in the environment. Developing country agriculture and deforestation are also major sources of green house gas emission. The solution to these problems is to seek more sustainable production system and enhancing agriculture's potential for provision of environmental service (World Development Report 2008).

## 4.3 Climate change

To address the expected climate change challenges and impact, R&D need to play a major role in increasing the adaptive capacity of the most vulnerable groups in different regions. Climate change could create changes in the geographical production patterns, as well as deterioration of natural resource base due to scarcity of water and rising temperature. Pressure on resources will lead to degradation of land, water and animal genetic materials both intensive and extensive livestock system. Climate change will also affect parasites like the tsetse fly and parasitic diseases such as malaria. A major challenge is to ensure that livestock growth opportunities do not marginalize smallholder producers and other poor people who depend on livestock for their livelihoods.

With the increased risk of droughts and floods due to rising temperatures, crop yield losses are imminent. In more than 40 developing countries—mainly in SSA—cereal yields are expected to decline, with mean losses of about 15% in 2080. Projections also show that land suitable for wheat production may almost disappear in Africa. In many parts of the developing world, especially in Africa, an expansion of arid lands of up to 8% may be anticipated by 2080. World agricultural GDP is projected to decrease by 16% by 2020 by global warming. Output in developing countries is projected to decline by 20% while the outputs in industrialized countries are projected to decline by 6% (PAPA 2008).

Climate change both influences and is influenced by agricultural systems. The negative effects of climate variability and projected climate change will be predominantly felt in the tropics and subtropic areas. Scientists (IPCC) have concluded that although SSA produces less than 4% of the world greenhouse gases, the regions diverse climates and ecological systems have already been altered by global warming and will undergo further damage in the years ahead. Sahel and other arid and semi-arid regions are expected to become even drier. A third of Africa's people already live in drought-prone regions and climate change could put the lives and livelihoods of an additional 75–250 million people at risk by the end of the next decades (Africa Renewal 2007). Climate change will create new food insecurities



in the coming decades. Low income countries with limited adaptive capabilities to climate variability and change are faced with significant threats to food security.

It is crucial to mitigate GHG emissions from agriculture and to increase carbon sinks and enhance adaptation of agricultural systems to climate change impacts. Research and development efforts can play a significant role in responding to the challenges of climate change and mitigating and adapting to climate-related production risks.

#### 4.4 Trade, market liberalization and the emerging agri-food system

Emerging market liberalization, trade reforms and globalization are transforming national and regional economies and the farming sector. The global and national food systems are increasingly being driven by consumer interests, changing consumption patterns, quality and safety concerns and the influence of transnational corporations and civil society organization.

Although a more open trade regime would benefit the global economy, in the area of agriculture, developed countries have been unwilling to make major concessions. There has been some improvement of the terms of trade for commodity exporters as a result of increase in global prices. However, Africa's share in global exports, was increased from 2.3% in 2000 to 2.8% in 2006.

The changes in the emerging food systems such as rapid rise and economic concentration in supermarkets, need for quality standards; a shift towards non price competition among supermarket chains, biosafety issues and the development of new forms of (contractual) relationships between suppliers and buyers offer both challenges and opportunities. They can either squeeze small producers out of certain markets contributing greater poverty and inequality or can offer new sources of income and market improvement in the quality and safety of food. In order to take advantage of this emerging situation, capacity of all the stakeholders along the value chain need to be enhanced (Tschirley 2006).

There is enormous potential existing for regional integration of African agricultural markets, which currently suffers from great fragmentation (ECA 2002). As Hazel comments 'there is no other agricultural market that offer growth potential on this scale and which could reach huge number of Africa's rural poor'. In order to exploit these potentials, there is an urgent need to accelerate regional market integration. Through increased specialization in production and free intra-regional trade, competitiveness and efficiency in resource allocation could be enhanced effectively (ECA 2002).

Enhancing smallholder participation in high-value and emerging markets requires upgrading farmer's technical capacity, risk management instruments and collective action through producer organizations addressing the stringent sanitary and phytosanitary standards in global markets is even a bigger challenge. Small scale producers also must follow these rules if they are to go ahead. The potential for rural economic development would remain very limited if the production and marketing strategies are based exclusively on traditional agricultural production, frequently oriented in selling surplus (supply) rather than market. To make use of the emerging opportunities and make economic progress, rural producers must not only improve quality and offer new products with greater value added, but also need an organizational arrangement that link and coordinate producers, processors, merchants and distributors of specific products (PAPA News).

## 4.5 Emerging diseases

The incidence and impacts of diseases such as HIV/AIDS and malaria are well documented. These two diseases and the associated health complications constitute the greatest threat to food security and poverty alleviation in Africa. HIV/AIDS is both a crisis and chronic condition in Africa. It is a crisis because of the speed of the spread of the epidemic and its interactions with other stresses and shocks. It is also a chronic condition because of its impacts most heavily on the most productive sector of the African economies, namely prime-aged adults (Dione 2004). This also places a heavy burden on the public budget.

Additional threats and challenges are posed by emerging diseases. Approximately 75% of emerging diseases are transmitted between animals and human beings; the increasing demand for meat increases this risk of transmission. Serious socio-economic consequences occur when diseases spread widely within human and animal populations. Even small-scale animal disease outbreaks can have a major economic repercussions in pastoral communities.

Control of zoonotic diseases require training and strengthening of coordination between veterinary and public health infrastructure. Identifying emerging infectious diseases and responding effectively to them requires enhancing epidemiologic and laboratory capacity and providing training opportunities.

Building sustainable capacity for innovations in emerging zoonotic disease surveillance and control by institutionalizing, harmonizing and targeting participatory veterinary public health approaches at national, subregional and continental levels is another challenge confronting livestock R&D practitioners.

## 4.6 Growing need for intersectoral linkages

One of the major constraints to getting agriculture moving in SSA is the general lack of comprehensive policies and weak intersectoral linkages. Now there is growing awareness that a number of sectors such as agriculture, education, health, water, and energy are very closely linked. Thus any agenda to transform the smallholder agriculture should follow a multi-sectoral approach and capture the synergies between technologies (seeds, fertilizer, livestock breeds); sustainable water and soil management, institutional services (extension, insurance, financial services) and human capital development (education and health)—all linked with market development (World Development Report 2008).

## 4.7 Changing expectations of science and technology and innovation

Over the years, there has been a significant change in the expectations of science and technology and innovations, from increasing crop and livestock productivity to creating competitive, responsive and dynamic agriculture, that directly contribute to the Millennium Development Goals (MDG); a competitive agriculture which will result in market-driven exchange of both knowledge and products; viable in domestic, regional and global markets; a responsive agriculture that is addressing multiple sources of small farmers, agribusiness, food insecure customers, wealthy consumers etc.; and a dynamic agriculture that is able to adapt to long-term agro-ecological changes, medium term structural changes and short term shocks (Spielman 2008).

## 4.8 Underinvestment in agriculture and agricultural research

Public spending on agricultural research as a proportion of agricultural GDP in Africa declined from 0.93% to 0.69% between 1980s and 1990s (ECA–OECD Review 2005). The current average level of public expenditure to support agriculture is around 4%. CAADP reports estimate that if the MDGs are to be met, 10% of the national budget should go to the agricultural sector and at least 2% of the GDP should go to national agricultural research and development by 2010. This 10% should be real and not the product of accounting. The broader rural expenditures should not be included in the definition of ‘spending on agriculture’. Those countries in Asia which have successfully managed to transform their agrarian economies have consistently spent a much higher percentage of public expenditure to support agriculture. Publicly funded research will continue to play a key role since the type of agricultural research needed to address poverty involves long lead time, and this requires additional investment.

## 4.9 Recent technological advances in biotechnology and ICT

Biotechnology has provided unparalleled prospects for improving the quality and productivity of crops, livestock, fisheries and forestry. Conventional biotechnologies have been around for a very long time, while genetic modification (GM) technologies have emerged more recently. GM technologies are making rapid progress worldwide. Africa lacks capacity and resources to move biotechnology research forward. Countries have not yet developed proper legislation frameworks on bio-safety of GM organisms (Eicher et al. 2006).

Bio-safety is a highly technical field, which typically requires high initial investments for building the necessary human resource capacity and institutional infrastructure (including laboratories and greenhouses for risk assessment or testing and identification of genetically modified organisms). Bio-safety issues transcend national boundaries. Transboundary movement of GMOs across porous borders is going to be a formidable challenge which may require policy interventions and co-ordinations (PAPA 2008).

There is general consensus that both transgenic and conventional breeding will be needed to boost crop and livestock productivity during the next 50 years (Science, March 2008). However, the low public investment in biotechnology and slow progress in regulating possible environmental and food safety risks is restraining the development of GMOs that could help the poor. Improving the capacity of the public sector R&D organizations to assess the risks and benefits to harness and deploy new agricultural technologies is very important.

The revolution in ICT technologies and increased access to them in developing countries is enabling a variety of new approaches to capacity building and knowledge sharing. Exploiting these opportunities require additional investments.

## 4.10 Globalization of private agricultural research and innovation

In the recent past there is a trend towards globalization of private agricultural research. Drivers of globalization of R&D are growing markets for agricultural products and agricultural inputs (reduced restrictions on trade in agricultural inputs), new technological opportunities due to breakthrough in biotechnology; improved ability to appropriate the gains from innovations, improved policy environment for foreign investments and technology transfer (tax breaks); and growth in demand due to increased

income and policy changes (Pray 2008). If carefully nurtured and managed this may offer additional opportunities for public–private partnership, to mobilize additional resources and to move the poverty reduction agenda forward.

## 4.11 Meeting commitments and targets

Over the last several years countries in the regions are committed to a number of targets and goals. Under the United Nations Millennium Development Goals targets are set for: reducing hunger and poverty, achieving universal primary education, promoting gender equality, improving maternal health and nutrition, combating HIV/AIDS, malaria and other diseases and ensuring conservation and the enhancement of basic life-support systems including land, water, forests, biodiversity and the atmosphere. There is increasing evidence to show that we will not meet any of the targets set for 2015. It has been observed that if the prevailing trends persist SSA is expected to miss every single of the 18 targets of the MDGs (Rippin and Bruntrup 2006). In 2001, 46% of SSAs population lived in extreme poverty. Though this proportion is expected to decline in the coming years the decline can only be described as marginal as the expected value of 38.4% in 2015 is far from the set target of 22.3%. Furthermore, the absolute number of extreme poor is even expected to rise, from 313 million in 2001 up to 340 million in 2015 (World Bank 2006).

In 2001, African heads of states adopted the strategic framework to develop integrated socio-economic development framework for Africa—the New Partnership for Africa’s Development (NEPAD) under the auspicious of the African Union (AU). The agricultural agenda of NEPAD is driven by the Comprehensive African Agricultural Development Programme (CAADP). This strategy calls for an annual growth rate of 6.5%. At least 10% of the national budget as defined in the Maputo Declaration (February 2003) should be allocated to agriculture.

The World Development Report (2006) showed that in 2004, SSA achieved an annual growth rate of 4.8%, exceeding the global growth rate of 4.1%, 20 countries grew by more than 5% in 2004. Fifteen non-oil producing countries have had a growth rate of 5.3% since 1995. The current growth rate of around 4–5% is well below the 6.5% required to achieve the MDGs. While a few countries are above the target set in the Maputo Declaration with respect to public expenditure on agriculture (Ethiopia), several (Kenya, Malawi, Zambia) are above 5% and the majority are still below 5% (PAPA, February 2008).

Meeting the MDG targets is going to be a daunting task calling for additional resources and targeted actions.

To sum up, there is a need for agriculturalists to grow intellectually and operationally from a narrow focus on agriculture and technological research and dissemination to a better understanding of rural societies and their needs. There is a need to seek greater understanding of alternative pathways for rural economic development, placing the role of agriculture in perspective, and redefining the role, mission, and strategy of the agricultural institutes and agents as facilitators of rural economic growth. This calls for the change in the mind sets of the change agents and greater flexibility and creativity in defining the agenda as well as in defining new public–private–civil society partnerships on the basis of whatever is necessary to improve opportunities, productivity and income generation capacity of poor rural households.

## 4.12 Global financial crisis

The current financial crisis is contributing significantly to the slow down of many countries resulting in reduction in the capital availability at a time when accelerated investment is urgently needed in the agricultural research and development arena. The root causes of the financial crisis are flawed regulatory regimes in the financial sector, and sub-prime mortgage lending. Although the crisis started in USA, it has had spill-over effects in a number of economies both developed and developing, leading to reduced economic growth globally.

Although the current food and financial crises were developed from different causes, these two crises have fed into each other and could have significant impact on financial and economic stability and, political security (von Braun 2008).

The projected low economic growth is likely to have negative second-round effects for investment and productivity with direct ramifications for food prices and food security around the globe. IFPRI (2008) projected that under slow growth and declined agricultural investment, the prices of major cereals increase significantly. As a result of the recession the poor people are likely to consume fewer calories. Accordingly to the projections in SSA the per capita consumption would be 10% lower in 2020 and its share of the number of malnourished children will increase from one-fifth in 2005 to one-fourth in 2020. The study concluded that if the developing countries and investors can maintain agricultural productivity and investment under recession, they can avoid many of the negative effects of slower growth. Given the current financial crisis, much of the needed investment would have to be facilitated by public sources.

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## Annex

### Other concepts/phrases coined related to agricultural research for development

#### 1 Knowledge quadrangle, knowledge development, dissemination, and use continuum

Participatory innovations, information, knowledge and education quadrangle with Information Communication Technology (ICT) play a critical role in knowledge development, dissemination and use continuum. Research for development continuum includes technology development, adaptation, dissemination, and adoption. Note that it is not a linear process.

#### 2 Doubly Green Revolution and African Green Revolution

Green Revolution is the process of introducing improved varieties with technological packages that allowed the yield potential of the crops to be realized more fully and under conditions experienced by medium to large scale farmers of developing countries. This was heavily experienced in Asia and Latin America where the yield on major cereals (rice, wheat and maize) doubled during the period 1960–1990. ‘The Green Revolution proved that poverty and hunger could be alleviated through the application of modern science and technology and without it, the numbers of poor and hungry today would be far greater’ (Conway 1998). Furthermore, poor and well to do farmers have benefited directly through more efficient production that has led to lower unit costs and increased profits. Poor consumers have benefited indirectly through lower prices.

The Green Revolution is generally considered to have been a tremendous success in Asia and Latin America—success at the time being defined as production increases that staved off potential malnutrition, quite apart from concerns about the environment (Wu and Butz 2004). Increasing food production was top priority in Green Revolution.

Furthermore, the conventional wisdom of the time was that the environment was either insignificant or at least, capable of being easily redressed at a future date, once the main task of feeding millions of hungry people was accomplished. Moreover, there was a strongly held view that a healthy, productive agriculture would necessarily benefit the environment.

However, this has not been the case with the use of Green Revolution technologies over the last 40 years. The combination of pesticides and fertilizers with the HYV seeds, through increased food production, turned out to have an adverse effect on the environment. In order to address environmental issues a Doubly Green Revolution was instructed taking lesson from Green Revolution. As Conway (1998) put it, a doubly green revolution is a revolution that is even more productive than the first Green Revolution and even more ‘green’ in terms of conserving natural resources and the environment. The doubly green revolution aims to be equitable, sustainable, and environmentally friendly. While the first green revolution took as its starting point the biological challenge inherent in producing new high-yielding food crops and then looked to determine how the benefits could reach the poor, the doubly green revolution has to reverse the chain of logic, starting with the socio-economic demands of poor households and then seeking to identify the appropriate research priorities. Its goal is the creation of food security and sustainable livelihoods for the poor. The concept of doubly green revolution goes



beyond seed technology to look at knowledge intensive methods to promote agricultural and rural development. The focus here is on both high risk marginal and remote environment as well as high potential areas.

Africa has not yet had a Green Revolution of its own. This is partly because the scientific breakthroughs that worked so well in Asia are not directly applicable to Africa. Africa produces a wide and different variety of food crops using a wide variety of farming systems. Agriculture in Africa depends largely on rainfed agriculture rather than irrigation, leaving them vulnerable to climatic shocks. Africa's farmers also face much higher transport costs, the soils have become severely depleted of nutrients, erosion, deforestation, and biodiversity loss also takes a toll.

Hence, Africa calls for the launch of an ever green revolution in agriculture driven by the enhanced productivity, profitability, stability, and sustainability of the major farming systems of its diverse and rich resources. This productivity based progress of African agriculture is referred to as a 'rainbow revolution' because unlike Asia, where wheat and rice are the dominant food crops, Africa does not have dominant farming system on which food security largely depends.

### 3 African Green Revolution or Rainbow Revolution

The proponents and advocates of MDG are now calling for a uniquely African Green Revolution of the 21<sup>st</sup> century. This is based on:

- Combination of science and policies with community empowerment and natural resources management;
- Healthy crops, environmentally sound and profitable smallholder farming systems (green); and
- Diversity of farming systems that reflect African realities and institutions.

The key components of African Green Revolution are: agriculture, nutrition, politics, markets, ecosystem regeneration and policies. In order to achieve these, actions are needed to:

- increase productivity of food-insecure farmers;
- improve nutrition of the chronically hungry;
- reduce vulnerability through productive safety nets;
- increase income and market access; and
- restore degraded agro-ecosystems.

This set of activities calls for political action, enabling policy reforms and community action. It is also important to consider the potential of bio-technology in creating this revolution but this must be developed judiciously with adequate and transparent safety measures.

## Exercise 2 Setting the scene: Reflecting on contemporary scenario of agricultural research for development (individual and group exercise)

### Phase 1 Individual work (10 minutes)

1. Mention three major changes that have occurred in the agricultural sector during the past 10 years.
2. How did the R&D organizations respond to this changed scenario?
3. Do you feel what is done was enough?
4. If yes, give examples.
5. If no, write two to three actions/interventions that should be taken up to improve the responsiveness of R4D organizations to this changed scenario.

Use the worksheet (handout 2.4 to record your ideas)

### Phase 2 Group work (45 minutes)

1. Form four groups and have each group elect a rapporteur (5 minutes)
2. Each group member shares his/her contributions (answers to questions 1, 2, 3, 4 and 5) and the group discusses them well and then cluster these answers by: (a) *changes* (b) *responses* (c) *suggestions for improvement*. The results should reflect the group consensus. Remind the facilitator to provide you with new cards to complete this task (40 minutes)

### Phase 3 Reporting and discussion (30 minutes)

1. The rapporteurs present the group responses using cards on the soft board or wall (20 minutes).
2. The facilitator asks feedback on this exercise and closes the session (10 minutes)

## Exercise 2 Worksheet (individual responses)

1. Major changes that have occurred in agricultural sector during the last 10 years

- a. \_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_
- c. \_\_\_\_\_  
\_\_\_\_\_

2. R&D organizations' response to this changed scenario

- a. \_\_\_\_\_  
\_\_\_\_\_
- b. \_\_\_\_\_  
\_\_\_\_\_
- c. \_\_\_\_\_  
\_\_\_\_\_

3. Do you feel what is done was enough? (Yes/No)

\_\_\_\_\_  
\_\_\_\_\_

4. If yes, give examples,



\_\_\_\_\_  
\_\_\_\_\_

5. If no, list actions/interventions that could be made to improve the responsiveness of R&D organizations to the changed scenario.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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# Trainer's guide

## Session 3 Evolution of ISP and important concepts

**Purpose** The purpose of this session is to clarify and create a common understanding on the evolution of ISP and concepts used in analysing innovation systems

**Objectives** At the end of this session participants will be able to:

- understand the evolution and application of systems thinking in agricultural R for D;
- delineate the differences between NARIs, NARS, AKIS, and AIS;
- clear understanding of the concepts: innovation, innovation systems, innovation system perspective

**Resources**

1. Flipcharts
2. White board
3. Flip chart and white board markers
4. Copies of handouts 3.1, 3.2, 3.3 and 3.4 for each participant
5. Computer and LCD projector

**Time needed** One hour and thirty minutes

### Session structure

Activity		Time required	Remark
Presentation	<ul style="list-style-type: none"><li>• Distribute handout 3.1 (Presentation slides) before you start your presentation</li><li>• Give a presentation on Evolution of ISP and important concepts</li><li>• Allow some time for questions to make sure that participants understand what is presented</li><li>• Distribute handout 3.2 (presentation text) to supplement your presentation</li></ul>	45 minutes	
Exercise	<ul style="list-style-type: none"><li>• Distribute handouts 3.3 and 3.4 for exercise 3 on Evolution of ISP and important concepts</li><li>• Ask a volunteer to read the exercise</li><li>• Ask participants to answers the questions in pairs</li><li>• Remind them the time allotted to the exercise</li></ul>	1 hour and 25 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

# Session 3: Presentation slides

Slide 1

Session 3

Evolution of ISP  
and  
important concepts

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Slide 2

Objectives of the session

- Understand the evolution and application of system thinking in agriculture
- Differentiate between NARIs, NARS, AKIS and AIS
- Identify and describe commonly used concepts and terms in analysing innovation systems

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Slide 3

System

- A collection of related elements that must function in a coordinated manner to achieve a desired result
  - Consists of interlinked subsystems
  - The whole is greater than the sum
  - Inter-related parts drive the system
  - Feedback loops are central to the system behaviour and are circular rather than linear in nature

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Slide 4

## Hard system

- These are physical entities — one could touch, feel, dismantle, reassemble, modify, and improve
  - E.g. Fuel injection system in locomotives



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Slide 5

## Soft system

- Describes a loose conglomerate of different agencies that perform similar tasks or work towards a common goal
- A social/analytical construct that does not physically exist — not a real entity but a virtual system
  - E.g. Financial system, legal system



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Slide 6

## Application of systems thinking in agriculture

- Framework for Technology Development and Dissemination (TDD)
- Organizational analysis within R&D

Both are interlinked



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Slide 7

## Framework for TDD

- Cropping systems — Intercropping, multiple cropping, relay cropping etc.
- Farming systems — Crops, livestock, trees, fish
- Households production system—on-farm, off-farm, household



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Slide 8

## Framework for TDD (cont'd)

- Farming systems research — Focus on research
- Farming systems research and extension — focus on R&E
- FSA — R+E+T
- FSD — R+E+T+ Policy + Institution
- AR4D
- Innovation system perspective



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Slide 9

## Application to organizational analysis

- Application of systems concept to organizational analysis began in mid 1980s
- NARIs — focus on public sector research institute
- National systems framework (**NAES, NARS, NAETS**) — includes research, extension, education focusing on generation of knowledge
- AKIS – R, E, T (focus on generation and diffusion of knowledge)
- AIS — Focus on generation, diffusion and application of knowledge



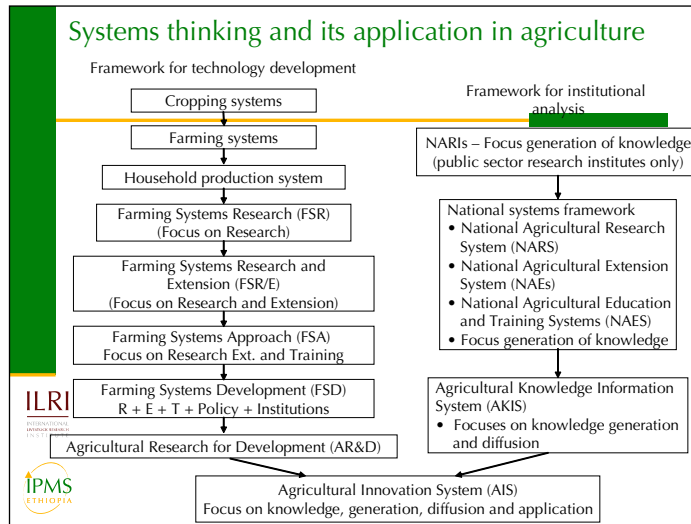
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Slide 10



Slide 11

### Application to organizational analysis: components, partners and environment

No.		NARI	NARS	TDT	AKIS	AIS
1	Commodity, factor and Thematic Research Institutes	C	C	C	C	C
2	National Coordinating Body or Mechanism	C	C	C	C	C
3	Universities and Faculties of Agriculture	E	C	C/P	C/E	C
4	International Agricultural Research Centers	E/P	E/P	E/P	E/P	C
5	Other International Research Organizations	E/P	E/P	E/P	E/P	C
6	Advanced Research Institutes	E/P	E/P	E/P	E/P	C
7	Universities in Advanced Countries	E/P	E/P	E/P	E/P	C
8	Private Sector Research (domestic and international)	E/P	E/P	E/P	E/P	C
9	Farmer Organizations and Commodity Organizations	E/P	E/P	E/P	E/P	C
10	National extension or parastatals development organizations	E/P	E/P	C	C	C
11	Agricultural input and output marketing organizations	E	E/P	E	E	C
12	Cooperatives and farmer based intermediaries	E	E/P	E/P	C	C
13	Non-governmental organizations: agricultural	E	E/P	E/P	C	C
14	Non-governmental organizations: community based	E/P	E/P	E/P	E/P	C
15	Sub-Regional, Regional, Global coordinating bodies	P	P	E/P	P	C
16	National policy making mechanisms	E	E	E	E	C
17	External S&T context				E	C

Logos for ILRI and IPMS ETHIOPIA are present at the bottom left.

Slide 12

- ### As one moves from NARI to AIS...
- The goal of the system becomes broader
  - The number of organizations considered as 'components' become larger and all inclusive
  - Issue of linkages, partnerships and interactions become central to organizational performance
- Logos for ILRI and IPMS ETHIOPIA are present at the bottom left.

Slide 13

## Knowledge and technology

- Knowledge is the set of concepts, meanings, skills and routines developed over time by individuals or groups as they process information
- Technology is defined as the sum of knowledge — of received information — which allows things to be done. It is a flow of new knowledge

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ETHIOPIA

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Slide 14

## Innovation vs. invention

- Invention — delivers new technology/knowledge as solution to a problem — things new to the world
- Innovation — Economically successful use of invention is innovation, delivers social and economic change
- Knowledge cannot be regarded as innovation unless it is transformed into products and processes that have social and economic use

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Slide 15

## Innovation

- In its broadest sense, innovation covers the activities and processes associated with the generation/production, distribution, adaptation and use of new technical, institutional, organizational and managerial knowledge

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ETHIOPIA

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Slide 16

## Innovation

- Innovation
  - Deals with product innovation, process innovation, management and organizational innovation and service delivery innovation
  - Two important factors are knowledge and networking
    - Value of knowledge increases with its use, and exchange can only be realized in a cooperative environment



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Slide 17

## Organizations and institutions

- Organizations are entities created by individuals to support the collaborative pursuit of specified goals. Formal organization is that kind of cooperation that is conscious, deliberate, and purposeful
- Institutions are the 'rules of the game' which prohibit, permit, or require certain actions. Whether formal or informal, they are recognized and generally followed by members of the community



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## Innovation system

- An innovation system is
  - a group of organizations and individuals involved in the generation, diffusion, adoption and use of new knowledge and
  - the context and institutions that govern the way these interactions and processes take place.
- Not a theory, but an organizing principle
- Can be defined at different levels
- It is an analytical construct



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## National Innovation System (NIS)

- The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse technologies (Freeman 1997)
- Not a theory but an organizing principle
- Reveals that R&D organizations are one type of knowledge agents in a larger system
- Need for multiple roles for R&D organizations
- Importance of institutions and framework conditions

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## National Innovations Systems include (cont'd...)

- Those institutions that affect the process by which innovations are developed and delivered (laws, regulations, customs, norms)
- Incorporates actors, processes as well as products

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## Agricultural Innovation System

- A collaborative arrangement bringing together several organizations and individuals working towards a desired change in agriculture can be called Agricultural Innovation System (AIS)

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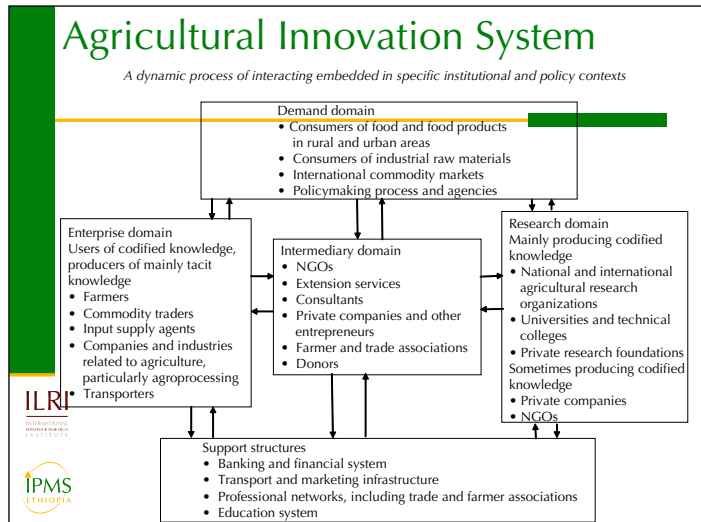
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- ## Agricultural Innovation Systems include
- Traditional sources of innovation (ITK)
  - Modern actors (NARIs, IARCs)
  - Private sector including agro-industrial firms and entrepreneurs (local, national and multinational)
  - Civil society organizations (NGOs, farmers and consumer organizations, pressure groups)
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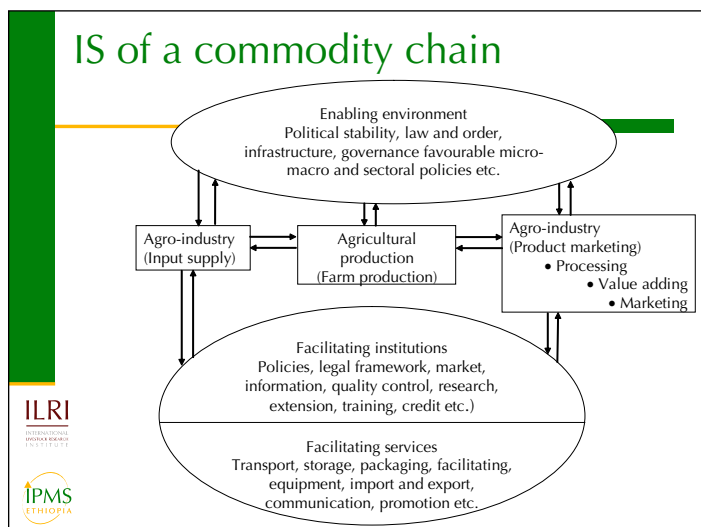


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## Innovation systems

- An innovation system incorporates
  - the invention system, as well as
  - the complementary economic processes required to turn invention into innovation and subsequent diffusion and utilization
- Innovation systems do not occur automatically
  - it is the problem situation that defines a particular innovation opportunity

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- Innovation systems are created for a purpose
- they will change in content and patterns of interaction as the problem situation evolves and
- They are constructed at micro and macro levels
- Although the IS can be defined at different levels (national, sectoral, commodity and problem/intervention), the most relevant innovation system is the one that is constructed to address a particular problem

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## Innovation ecology

- Refers to a set of individuals usually working within organizations who are the repositories and generators of existing and new knowledge
- Included in this ecology are those organizations that store and retrieve information as well as those that manage the general flow of information
- The principal actors are usually profit seeking firms (in the value chain), universities and other public and private specialist research organizations and knowledge based consultancies

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## Innovation ecology vs. problem-focused IS

- 'Innovation ecology' and a 'Problem focused IS'
- Innovation ecologies are typically national in scope, with sub-national degree of variation (often generic in nature), necessarily reflecting rules of law, business practice and the social and political regulation of business of the economies in which they are located
  - Innovation systems are very specific in nature and deal with the connection between the relevant components of the ecology; and ensures that the flow of information is directed at a specific purpose
  - While the ecologies are more permanent, the problem focused innovation systems are transient or temporary in nature

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## Innovation Systems Perspective

- Focuses on innovation as its organizing principle
- Using the innovation lens in analysing critical constraints; identifying, implementing and assessing appropriate interventions and; subsequent utilization of knowledge generated
- Suggests the analysis of three elements
  - Components (organizations and actors)
  - Relationships and interactions (institutions)
  - Competencies, functions and result of such interactions

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## Key features of ISP

- Focuses on innovation as its organizing principle
- Makes the distinction between 'organizations' and 'institutions' explicit
- Learning and role of institutions are critical
- Partnership and networks are integral parts
- Escapes the polarized debate 'demand driven' vs. 'supply push'

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## Key features of ISP (cont'd)

- IS are social systems focusing on connectivity, learning as well as the dynamic nature of the process
- Strength of information flow and the absorptive capacity of individual agents are crucial
- Helps to identify the scope of the actors involved and the wider set of relationships in which innovation is embedded



Leads us to new and more flexible organization of research and new type of policymaking for science, technology and innovation

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## Successful innovation systems

- Continuous, dynamic and evolutionary cycles of learning and innovation
- Combinations of technical and institutional innovations
- Interactions of diverse research and non-research actors
- Shifting roles of information producers, users and transfers of knowledge dependent on a need basis
- An institutional context that supports interactions, learning and knowledge sharing between actors



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## Factors contributing to the adoption of ISA in agriculture

A number of factors contributed to the adoption of AIS:

- Successful application of the concept in the industrial sector
- Inadequacy of the existing framework to be all inclusive in terms of coverage
- Multiple sources of innovation model
- Inadequacy of the linear model to explain the process of innovation
- Increased demand for demonstrated developmental impact — Impact orientation



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## Activities influencing innovation

- Provision of research and development
- Competence building
- Formation of new product markets
- Articulation of quality requirements emanating from the demand side
- Creating and changing organizations
- Networking through markets and other mechanisms
- Creating and changing institutions
- Incubating activities
- Financing
- Provision of consultancy services

Source: Edquist (2004).



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## Notes

- The innovative performance of an economy depends not only on how individual institutes (firms, research institutes, extension services, universities etc.) perform in isolation, but on how they interact with each other as elements of a collective system and how they interplay with social institutions — values, norms, and legal frameworks



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## Note...

- Innovation takes place throughout the whole economy, and not all innovations have their origin in formal S&T nor are all innovations exclusively technical. This new perspective places more emphasis on the role of farmers, input suppliers, transporters, processors and market in the innovation process



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## Note...

- Institutional, organizational and managerial types of innovations in particular, more often have their origin in on-site learning processes rather than off-site formal research. These forms of innovations are often far more complex and difficult because one cannot experiment and fine-tune them off-site
- ISA is simply an approach or framework, within which different analytical tools can be used



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## Additional concepts

- Scaling up and out
- Capacity strengthening
- Response/innovation capacity



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## Concepts of scaling up/out

- Different terminologies are used to describe replications, spread, adaptation of practices
- 'Going to scale is to bring more benefits to, more people more quickly more lastingly and more equitably'
  - IIRR (2000).



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## Concepts...

Three types are identified which are linked (GTZ 2006)

1. Horizontal scaling out
  - Quantitative expansion and increase geographic coverage
2. Vertical scaling up
  - Changes in institutional arrangement
3. Scaling down
  - Devolving responsibilities



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## Scaling out and scaling up

- Scaling out (horizontal)
  - Quantitative expansion
  - Increased geographic coverage
  - Doing 'more of the same'
  - Repeating a success case in other places, so that the methodology/technology attains a regional or national significance
  - Adoption as a general approach
  - Feasibility depends on funds availability and favourable institutional conditions



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## Scaling up (vertical)

- Changes in institutional arrangements and policies to encourage use of new approaches at different level
- Scaling up = f (time, system, quality) + (institutional change, linkages, resources)



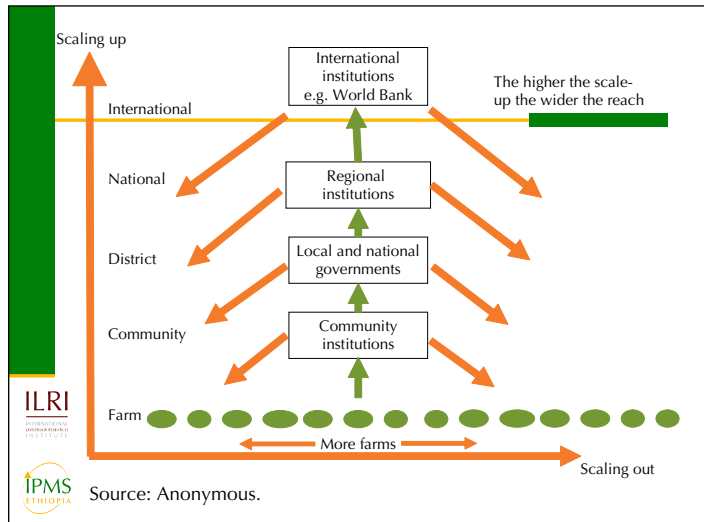
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### Concepts

Scaling up/out can be obtained in two ways

1. Expansion of experiences
  - Scaling up impacts within an area or country based on successful initiative
2. Transfer of experiences
  - Scaling up impacts to new and unassociated areas based on successful initiative

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### Key elements for scaling up/out to occur

- Internal factors
  - Demand driven technology generation/introduction
  - Systems and procedures adapted to scale
- Partnership
  - Communication among stakeholders
- Policymakers involvement
  - Since scaling up is linked to wider policy agenda at local, regional and national levels

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## Modalities in scaling up/out technologies

Three types recognized (IIRR 1999)

1. Scaling up after initial success stories
2. Spontaneous scaling up
  - No planned intervention, e.g. The Green Revolution
  - It happens naturally due to market force
3. Scaling up at the time of project planning



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## Capacity strengthening

- 'Capacity strengthening' is the process by which individuals, groups, organizations, systems, and societies increase their abilities to:
  - Perform core functions, solve problems, define and achieve objectives; and
  - Understand and deal with their developments in a broad context and in a sustainable manner (UNDP 2000)



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## Capacity strengthening is more than training

Capacity strengthening refers to...

- People's ability to understand a situation, and take action to improve it
- Building of confidence
- Development of knowledge, skills, and creativity
- Formation of positive attitudes
- Strengthening of relationships

It is more than training, rather it is more like empowerment



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- Capacity development for innovation is not the same as training
  - Integrating different sources of knowledge stimulating interaction and learning among different individuals and organizations that hold this knowledge
  - Networks have to include policy actors — have an important role in creating an environment that supports knowledge use and innovation



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### Capacity strengthening (cont'd)

- Building capacity for scientific agriculture can be broken down into several parts
  - Existence of human capital at professional and managerial level
  - 'Research' infrastructure
  - Ability at the national level to train own scientists on local problems
  - Indigenous knowledge and skills base of smallholder farmers
  - R&D organizations ability to educate farmers so as to build on this base



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### Absorptive capacity

- Absorptive capacity is a limit to the rate or quality of scientific or technological information that a firm/individual/household organization can absorb (Cohen and Levinthal 1990)
- Absorptive capacity can also be defined as the ability to scan and monitor relevant technological and economic information, to identify technical and market opportunities, and to acquire knowledge, information and skills needed to develop technologies



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## Absorptive capacity...

- Four distinct dimensions of absorptive capacity: acquisition, assimilation, transformation and exploitation (Zahra and George 2002)
- Recently absorptive capacity has been adopted to describe the ability of developing countries to effectively utilize the increasing aid flows



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## Response capacity

- Response capacity is the ability of a network of actors interacting and taking action to deal with various challenges and opportunities



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## Innovation capacity

- The context specific range of skills, actors, practices, routines, institutions and policies needed to put knowledge into productive use in response to an evolving set of challenges, opportunities, and technical and institutional contexts (Hall and Dijkman 2006)
- Not just promoting knowledge, technology and information but developing the capacity to access, adapt and apply this knowledge in a particular context



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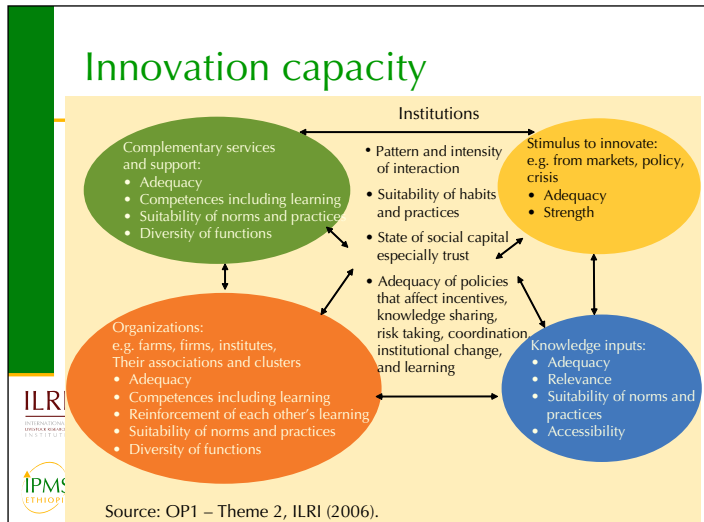
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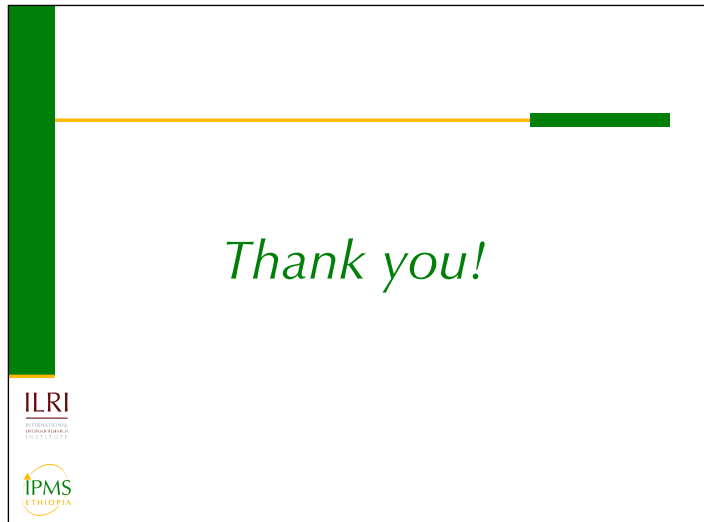
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# Evolution of ISP and important concepts

## 1 Introduction

Systems thinking is not new to agricultural research and development in sub-Saharan Africa. It has been there since the 1970s when a significant shift in paradigm for agricultural research, development, and knowledge generation and dissemination was observed. The emerging paradigm includes many elements and knowledge of modern science, yet it also encompasses major reforms in technological and institutional approaches. There is a gradual evolution of the central source model of the 1970s and 1980s towards a multiple source model in the 1990s to the current agricultural innovation systems approach.

A common definition of a system is a collection of related elements that must function in concert to achieve a desired result (Bean and Radford 2002). A system consists of interlinked subsystems, but is more than the sum of its subsystems. The central feature of a system is its integrity. The behaviour of a system depends on how the parts are connected, and the specific relationships between them. In a system it seems that everything is connected to something else in an apparently endless web of relationships. Hence, understanding, predicting, and managing such 'systems' requires both different view (that the parts are all connected) and a suitable tool or theory to guide our action. A system also contains one or more feedback loops which are central to the system behaviour. Feedback loops permit a system to function in a self-managed, self-sustained way. The two key conclusions of system thinking are that the interrelated parts drive systems, and the feedback loops are circular rather than linear in nature.

Comparing system thinking to analytical thinking, one finds that system thinking is contextual, which is the opposite of analytical thinking. Analysis means taking something apart in order to understand it. System thinking means putting it into the context of a larger whole (Capra 1997). Systems thinking are an essential tool in the process of understanding organizational behaviours. Innovative organizations are dynamic systems, continuously changing while stable unchanging systems cannot innovate. Since the stable state of equilibrium seeks to preserve stability, it does its best not to innovate/change.

Systems can be classified as 'hard' or 'soft'. Since systems analysis has its origin in the hard sciences, most people are more familiar with the hard version than with the soft version. A soft system is a social construct that does not physically exist but that is nevertheless the more relevant concept when studying social phenomena such as research, knowledge, or innovation systems. A soft system is an analytical concept that we use to describe a loose conglomerate of different agencies that perform a similar task or work towards a common goal. Such a system is not a real entity, although we often talk about it as though it really does exist (e.g. the education system, the legal system, the financial system etc.). For many reasons, people often treat a soft system as a more tangible, hard system. For example, there are endless discussions concerning which agencies or activities should or should not be considered part of a certain system, because there is neither a hard boundary to begin with, nor necessarily common objectives.

The evolution of the application of the systems concepts and the concepts and the principles of innovation, innovation system and the innovation systems perspectives are discussed in the following sections of this chapter.

## 2 Evolution

The first factor contributing to the adoption of the concept of innovation systems in the agricultural sector is the successful application of the concept in the industrial sector. The origin and application of Innovation Systems concept in agriculture can be traced to a number of sources. These include the National Innovation System (NIS) Freeman (1987) applied in the industrial sector of the developed economies; the multiple source of innovation model for agricultural research and technology promotion as suggested by Biggs (1989); the inadequacy of the linear model to explain the actual process of innovation in the real world, inadequacy of the existing organizational frameworks to be all inclusive in terms of the coverage of the various actors, increasing demand for demonstrated developmental impacts and the expanded mandate and expectations from the R&D communities.

The concept of NIS was first mentioned in the industrial innovation literature in the late 1980s. The NIS approach was pioneered by Christopher Freeman at the Science and Technology Policy Research Institute, University of Sussex, UK and Benget – Aka Lundvall at the University of Aalborg, Denmark. Freeman (1987) defined NIS as ‘the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse technologies’. Lundvall (1992) highlighted that learning and the role of institutions are critical components of NIS and emphasized the notion of diffusion of ‘economically useful knowledge’.

Metcalf (1995) expanded this concept explicitly and introduced the context of defining NIS as ‘... a set of institutions which jointly and individually contribute to the development and diffusion of new technologies and which provides the framework within which governments form and implement policies to influence the innovation process. As such it is a system of interconnected institutions to create, store and transfer knowledge, skills, and artifacts, which define new technologies. The element of nationality follows not only from the domain of technology policy but from elements of shared language and culture which binds the system together, and from the national focus to other policies, laws and regulations which condition the innovation environment.’ Edquist (1997) emphasized the notion of institutions and innovations and pointed out that ‘authors working within the system of innovation approach (have been) centrally focused on technological innovation, and in addition, all are interested in organizational and institutional change.’

Therefore, NIS is defined as a set of functional institutions, organizations and policies that interact constructively in pursuit of a common set of social and economic goals and objectives, and that uses the introduction of innovation as the key promoter of change. At its simplest, this concept states that innovation emerges from evolving systems of actors, their interaction and processes that are involved in research and the application of research findings for socioeconomic benefit. A NIS will allow better governance, more effective resource allocation and better outcomes in the short, medium and longer term.

The study of NIS started with relatively simple descriptive analysis that tried to explain the difference in innovative activity and performance between countries. More recently, however, the theoretical underpinning of NIS approach has been substantially improved by the addition of insights from various streams of thinking, including evolutionary economics, theories of learning, institutional thesis and systems theory (Roseboom 2004). Okamura and Vonortas (2004) attempted to provide some insight into the theoretical underpinning with respect to NIS and concluded that:

'The theoretical foundations of the studies on [technological] alliances has been shifting from a mainstream industrial organization perspective (de Bondt et al. 1992; Suzumura 1992; Vonortas 1994) and a transaction cost economics perspective (Williamson 1985, 1991; Menard 1996a, b) that viewed each alliance as an island, towards a systems view leaning heavily on the concepts of the resources based view of the firm (Teece 1992; Eisenhardt and Schoonhoven 1996) and of learning networks (Gulati 1995, 1998; Powell et al. 1996; Walker 1998; Oliver 2001).'

Therefore, it is worth noting that NIS is not a blue print for how innovation should be organized but is simply an analytical tool that can be used for planning and policymaking to enhance innovations. The concept can be applied to any sector of the economy.

NIS permits actors and stakeholders within the system to identify their distinctive roles and understand their relationships to others in the system. The net result is the potential for better articulation, identification of gaps and challenges, and greater agreement, at least in principle, on the future requirements for the system (Paterson et al. 2003). The same authors also proposed a functional approach to describe the elements of a NIS for South Africa (see Table 1). Their approach identified two sets of functions, namely that are exclusively the responsibility of the government (policy formulation, resource allocation, specialized advisory functions, international relations) and all other innovation actors and stakeholders (financing performance, creation of linkages and knowledge flows, human resources, infrastructures). By creating a matrix or map (actor linkage matrix or map) of stakeholders and functions, the relative position of each stakeholder relative to a specific function can be described. Each cluster of actors/stakeholder and functions can be further refined in order to identify the position of specific actors/stakeholders *vis-à-vis* specific function.

**Table 1.** *The relative importance to stakeholders of the functions of a National Innovation System*

Actors/ stakeholders	Core functions of government					
	Policy and resource allocation	Regulatory (policy level)	Financing (performance level)	Perform- ance	Human resources/cap- acity building	Infrastructure provision
Government	Key function	Shared function— some standards set by government, some by business	Extensive involvement in supporting both business and tertiary educa- tion institutions	Extensive involve- ment	Some involvement in post-graduate training	Extensive involvement
Business sector	Some advisory function	Shared function— some standards set by government, some by business	Extensive involvement as source and recipient	Key function	Some involve- ment in post- graduate train- ing. Should be important in life-long learning	Some involvement
Tertiary education	Some advisory function	Advisory?	Key recipient	Extensive involve- ment	Key function	Some involvement
Other education- al institutions	No involvement	No involvement	Recipient	Limited	Key function	Some involvement
Multipartite bodies	Key function as advisors	Advisory?	No involve- ment	No involve- ment	No involve- ment	No involvement
Organized civil society	Key function as advisors	Advisory?	No involve- ment	Limited function	Some involve- ment?	No involvement
Interested outsiders	Some may have an advisory function	Some important at global level	Some have this as a key function	Possible partners	Possible partners	No involvement

Source: Paterson et al. (2003).

Recent analysis of innovation systems points to institutional hybridity—integration of public and private incentive regimes and standards of accountability—as an important, but often overlooked, feature of technical systems (Wolf and Zilberman 2001). To point to the market (private) without reference to the state (public or collective organizational structure) is a seriously deficient framework for understanding mechanisms through which innovation occurs. State and market are now recognized as two forces among a large collection of co-coordinating mechanisms such as communities, associations, networks and supra-national governing bodies that promote innovations. Commercial modes of interaction play a larger role in contemporary knowledge systems, and to some extent there has been a blurring of ‘traditional’ public and private roles as division of labour in research, extension and support services have changed. Hybrid institutions that encourage private initiative, enterprise and idealism but are at the same time accountable to public can harness the best of private profit-making sector, the voluntary sector and public sector.

The important characteristics of NIS and the lessons learned (Metcalf 1995; Arnold and Bell 2001; Roseboom 2004; Hall et al. 2005) are:

- NIS place emphasis on interdependence and non-linearity in innovation process, and on demand as a determinant of innovation.
- They are strongly influenced by evolutionary thinking. A unique optimal NIS does not exist, and dynamic NIS are continuously adopting and transforming themselves as new opportunities arise.
- NIS place great emphasis on role of the institutions both in terms of the rules of the game and the players (organizations). The success of innovation relies heavily on the ‘framework conditions’—policies, laws, rules and other cultural aspects—and the basic infrastructure of the system. Indeed, a particular culture’s way of working, the social values it places on innovation and entrepreneurship, funding priorities, and notion of risk often most effectively explain the difference between those who innovate and those who do not.
- Greater emphasis is placed on the pattern and intensity of interactions between the different actors within the NIS.
- Successful innovation requires both the ‘supply-push’ of the research community and the ‘demand-pull’ of the users of new knowledge. Indeed, a successful system of innovation requires a constant interaction between many organizations and individuals in both camps.
- Innovation takes place within a social system of which research and researchers form only a part of. Other essential components are the networks of actors that provide communication channels linking organizations and individuals. Such networks can be both formal and informal.
- ‘Intermediate organizations’ often prove crucial to successful innovation, particularly when their risk is to find out what producers (and their end users) want, and to search through the options within the stock of existing and new knowledge to find what best meets the needs.

A second root is the multiple source of innovation model for agricultural research and technology promotion first proposed by Biggs (1989). In the multiple source model all technology generation and promotional activities are seen as to take place in a historically defined political, economic, agroclimatic and institutional context. In this model, major emphasis is given to the idea that innovations come from multiple sources. Not only do innovations come from those who have been designated the role of ‘researchers’ but also come from ‘practitioners’ in numerous settings throughout the research, extension, and production systems. This may include research minded farmers, innovative research practitioners, research minded administrative practitioners, innovations from NGOs, innovations from private corporations etc. Another key feature of this model is the

recognition that agricultural research and technology dissemination systems contain a multitude of actors and institutions that have very diverse objectives. In addition, the model focuses attention on the continuous state of disequilibrium in which agricultural research and production activities take place. Biggs argued that the multiple source model appears to better fit the practice of agricultural technology generation and dissemination.

The third major source is the inadequacy of the linear model to explain the actual process of innovation in the real world. The linear model of technical change is now widely regarded as dysfunctional. A sequence conception is inadequate because the task domain of basic and applied research (science and technology; research and extension) are seen as requiring multiple inputs and generating multiple outputs. As a result a systemic model has gained substantial favour for purposes of design, administration and analysis of innovation capabilities. Beyond empirical demonstrations on non-linearity in innovation, an interactive model is considered to be attractive because of the interdependence and potential complementarities that arise in an environment in which diverse actors (e.g. firms, universities, government agencies etc.) invest in knowledge production at comparable levels. In other words, co-ordination and competition are dynamics of consequence when no single actor is dominant and therefore, one must pursue an interactive model of technical change.

It is important to keep in mind that the Innovation System Approach (ISA) is not an argument against the value of research, good communication or effective extension services. These are necessary preconditions. The ISA underlines the need to invest not only in the research that generates this knowledge, but the quality and effectiveness of the delivery channels and the process mechanisms, and institutions that will use the knowledge once it emerges.

The fourth factor, the inadequacy of the existing frameworks for organizational analysis, and the fifth factor, the expanded mandate and the enhanced expectations are discussed in the following section.

The application of the 'systems' concept in agricultural R&D started in the mid-1970s with the farming systems research to address the farm level productivity constraints and issues. However, in the mid-1980s development practitioners began to use the concept in the organizational analysis. National Agricultural Research Institutes (NARIs) framework was the first framework that emerged after the Second World War to facilitate major investments in agricultural technology to increase food production. NARIs were setup as organizational structure for agricultural research by the colonial powers to serve their interest in promoting export cash crop production. Due to its early success this organizational framework dominated for decades. However, the inadequacy of the NARIs concept to address agricultural R&D problems forced the R&D practitioners to look for alternative framework that could accommodate all public organizations involved in agricultural research, extension and education. The need to look at the various organizations undertaking agricultural research as a system gave birth to the National Systems Framework (NSF). The NSF included the National Agricultural Research Systems (NARS), the National Agricultural Extension System (NAES), and the National Agricultural Education and Training System (NAETS). This trend of thinking continued to include the other organizations involved in agricultural R&D and resulted in a number of other concepts such as Agricultural Knowledge and Information System (AKIS), the Technology Development and Transfer system (TDT) and the Agricultural Innovation Systems (AIS). Thus, the application of the concept evolved in two different directions—as a framework for organizational analysis and as a framework for technology development and dissemination—both leading to the innovation systems concept as shown in Figure 1.

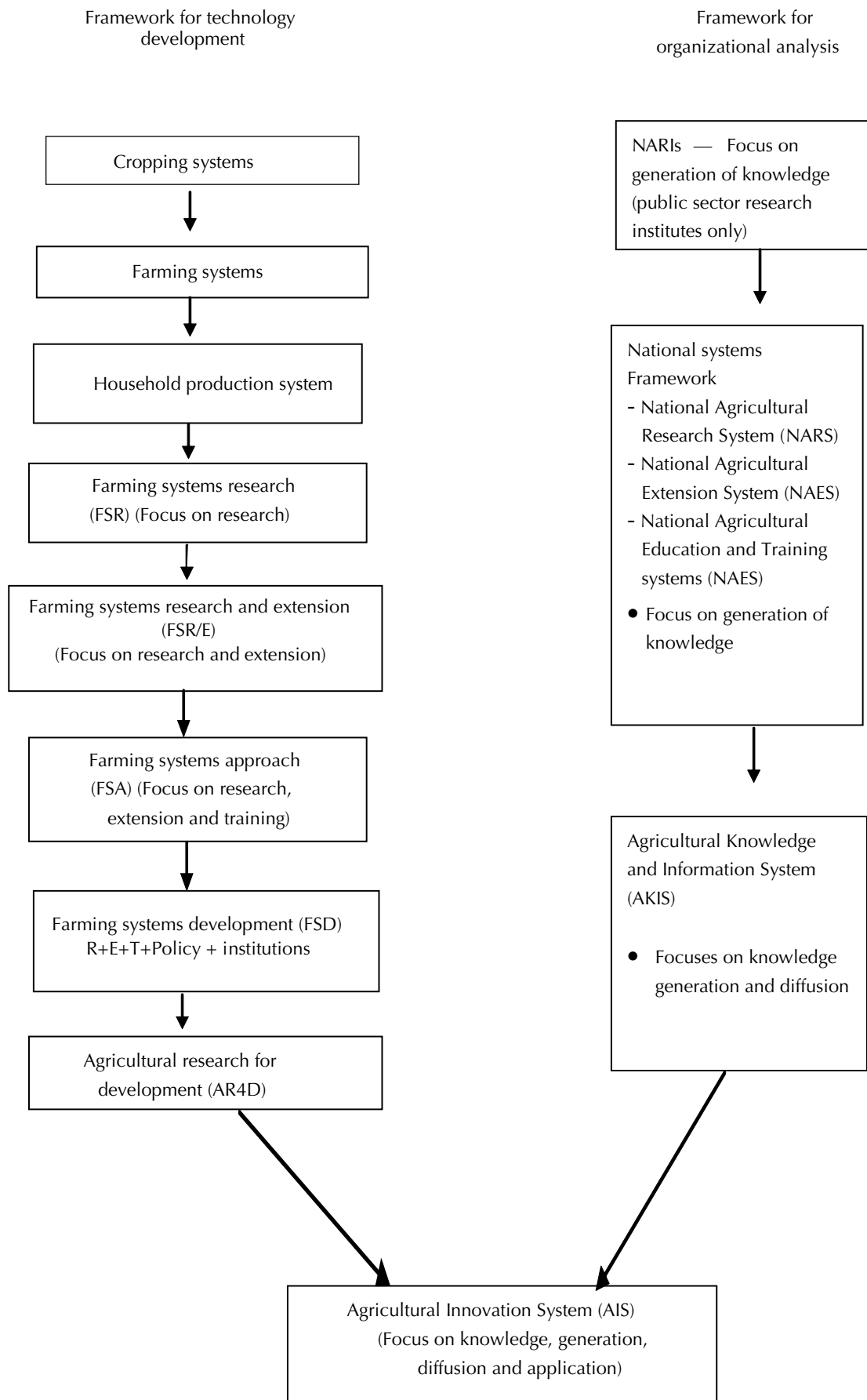


Figure 1. Systems thinking and its application in agriculture.

According to Elliot (2004), the difference among the different concepts is usually found in the expression of the objective of the system which then helps analysts describe given organizations as Components of the system (C) or 'part of the Environment' of the system (E) or linked as Partner (P) as shown in Table 2.

**Table 2.** *Components, partners and environment*

No.		NARI	NARS	TDT	AKIS	AIS
1	Commodity, factor and thematic research institutes	C	C	C	C	C
2	National coordinating body or mechanism	C	C	C	C	C
3	Universities and faculties of agriculture	E	C	C/P	C/E	C
4	International agricultural research centres	E/P	E/P	E/P	E/P	C
5	Other international research organizations	E/P	E/P	E/P	E/P	C
6	Advanced research institutes	E/P	E/P	E/P	E/P	C
7	Universities in advanced countries	E/P	E/P	E/P	E/P	C
8	Private sector research (domestic and international)	E/P	E/P	E/P	E/P	C
9	Farmer organizations and commodity organizations	E/P	E/P	E/P	E/P	C
10	National extension or parastatals development organizations	E/P	E/P	C	C	C
11	Agricultural input and output marketing organizations	E	E/P	E	E	C
12	Cooperatives and farmer based intermediaries	E	E/P	E/P	C	C
13	Non-governmental organizations: agricultural	E	E/P	E/P	C	C
14	Non-governmental organizations: community based	E/P	E/P	E/P	E/P	C
15	Sub-regional, regional, global coordinating bodies	P	P	E/P	P	C
16	National policymaking mechanisms	E	E	E	E	C
17	External S&T context				E	C

Source: Elliot (2004).

It is worth noting that moving from NARIs to AIS, the goal of the system becomes broader (from research and technology to agricultural innovation); the number of organizations considered as 'components' also becomes larger and all inclusive. The issue of linkages, partnerships and interactions become more central to organizational performance. These developments also demonstrate that there is no uniquely best system. The defining features of NARS, AKIS and AIS are very well summarized and presented in Table 3 (World Bank 2006).

While each of these concepts has their own strengths and weaknesses, they can be seen as interlinked and cumulative. NARS focuses on the generation of knowledge, AKIS on the generation and diffusion of knowledge and AIS on the generation, diffusion and application of knowledge (Roseboom 2004).

Similarly at the beginning most agricultural research focused on the generation of technology/knowledge; with little consideration for technology adaptation, dissemination and utilization. The expected output was the productivity gain. Now, we have moved away from output to outcome and the research activities (research for development) are expected to contribute to the broader development goals such as poverty alleviation, food security, environmental sustainability etc.

To summarize the successful application of IS concept in the industrial sector, inadequacy of the existing conceptual frameworks in terms of coverage, recognition of the multiple sources of innovation, inadequacy of the linear model (research to innovation and basic research to adaptive research) to explain the process of innovation, broader mandate, and the increasing demand for demonstrated developmental impacts of the R&D system, i.e. impact orientation have contributed to the adoption of ISA in agriculture. The key concepts are discussed in the next section.



**Table 3.** Defining features of the NARS and AKIS frameworks in relation to agricultural innovation systems

Defining feature	NARS	AKIS <sup>1</sup>	Agricultural innovation system
Purpose	Planning capacity for agricultural research, technology development, and technology transfer	Strengthening communication and knowledge delivery services to people in the rural sector	Strengthening the capacity to innovate throughout the agricultural production and marketing system
Actors	National agricultural research organizations, agricultural universities or faculties of agriculture, extension services, and farmers	National agricultural research organizations, agricultural universities or faculties of agriculture, extension services, farmers, NGOs, and entrepreneurs in rural areas	Potentially all actors in the public and private sectors involved in the creation, diffusion, adaptation, and use of all types of knowledge relevant to agricultural production and marketing
Outcome	Technology invention and technology transfer	Technology adoption and innovation in agricultural production	Combinations of technical and institutional innovations throughout the production, marketing, policy research, and enterprise domains
Organizing principle	Using science to create inventions	Accessing agricultural knowledge	New uses of knowledge for social and economic change
Mechanism for innovation	Transfer of technology	Interactive learning	Interactive learning
Degree of market integration	Nil	Low	High
Role of policy	Resource allocation, priority setting	Enabling framework	Integrated component and enabling framework
Nature of capacity strengthening	Infrastructure and human resource development	Strengthening communication between actors in rural areas	Strengthening interactions between actors; institutional development and change to support interaction, learning and innovation; creating an enabling environment

1. As defined by FAO and World Bank (2002).

Source: World Bank (2006).

### 3 Innovation, Innovation Systems (IS), and Agricultural Innovation Systems (AIS)

The term innovation is defined differently by different authors (see Box 1). The simplest definition of innovation is ‘a purposeful focused change’ (Drukker 1998). It can also be defined as ‘anything new introduced into an economic or social process’ (OECD 1999). Bacon and Butler (1998) defined innovation as ‘the economically successful use of invention’. He then defined invention as a ‘solution to a problem’. This is an important and useful distinction that points out that invention is not by itself necessarily commercially important.

#### Box 1. Different definitions of innovation

- ‘Innovation is something that is new or novel’ (Oxford English Dictionary)
- ‘The development of new products and processes from which the business can derive commercial value and profit’ (The Swart manager 2004)
- ‘Innovation is the expression of knowledge and creativity in tangible form—it is the result of human intelligence brought to bear on some practical problems in a given context’ (Quintas 1977 cited in ISNAR 2001)
- ‘The successful production, assimilation and exploitation of novelty in economic and social spheres’ (EC 1995)
- ‘A purposeful focused change’ (Drukker 1998)
- ‘Anything new introduced into an economic or social process’ (OECD 1999).

In the past, science and technology generation were equated with innovation. It is crucial to recognize that innovation is strongly embedded in the prevailing economic structure, which largely determines what is going to be learned and where the innovations are going to take place. Moreover, such innovations are not limited to technological (both product and process) innovations only but also include institutional, organizational, managerial and service delivery innovations. This also emphasizes the notion that the responsibility of agricultural research organizations does not end with the production of new technology or knowledge only. They can claim success when their 'innovations' are being disseminated, adopted and used (Chema et al. 2001).

Innovations are new creations of economic significance. They relate to the production of new knowledge and/or new combination of existing knowledge. The critical point to note is that this knowledge cannot be regarded as innovation unless it is transformed into products and processes that have social and economic use (Edquist 1997). This transformation does not follow a linear path but rather characterized by complicated feedback mechanisms and interactive relations involving science, technology, learning production policy and demand. Interaction and interdependence are two of the most important characteristics of innovation systems approach (Edquist 2001). The use of the term 'innovation' in its broadest sense covers, the activities and processes associated with the generation, production, distribution, adaptation and use of new technical, institutional and organizational or managerial knowledge (Hall et al. 2005). Innovation is the key process by which products, processes and services are created, and businesses including farming generate jobs and wealth. Effective innovations have a direct impact on the reduction of poverty and the improvement of quality of life.

The thinking up to early 1990s was that innovations were created by knowledge and technology production process and through formal R&D initiatives by firms and technology creating agents such as universities and public-private research institutes. The assumption was that the market would draw upon the technological resources it needs, as and when necessary. The demand for knowledge would be identified by the formal R&D systems, produced and passed down to those who necessarily apply it because of its usefulness (Hartwich and Meijerink 1999). In reality, however, innovations are sometimes associated with or stem from major scientific discoveries, but often they develop as a fairly minor scientific and technological advances and can occur without any research, e.g. through learning and adaptation process. Innovations can be generated by different organizations, group or individuals and the conventional research institutions is only one such entity. People working on a similar issues, be it in a specific commodity sector, at a particular location or in any problem area tend to form a chain or network that can be described as innovation system.

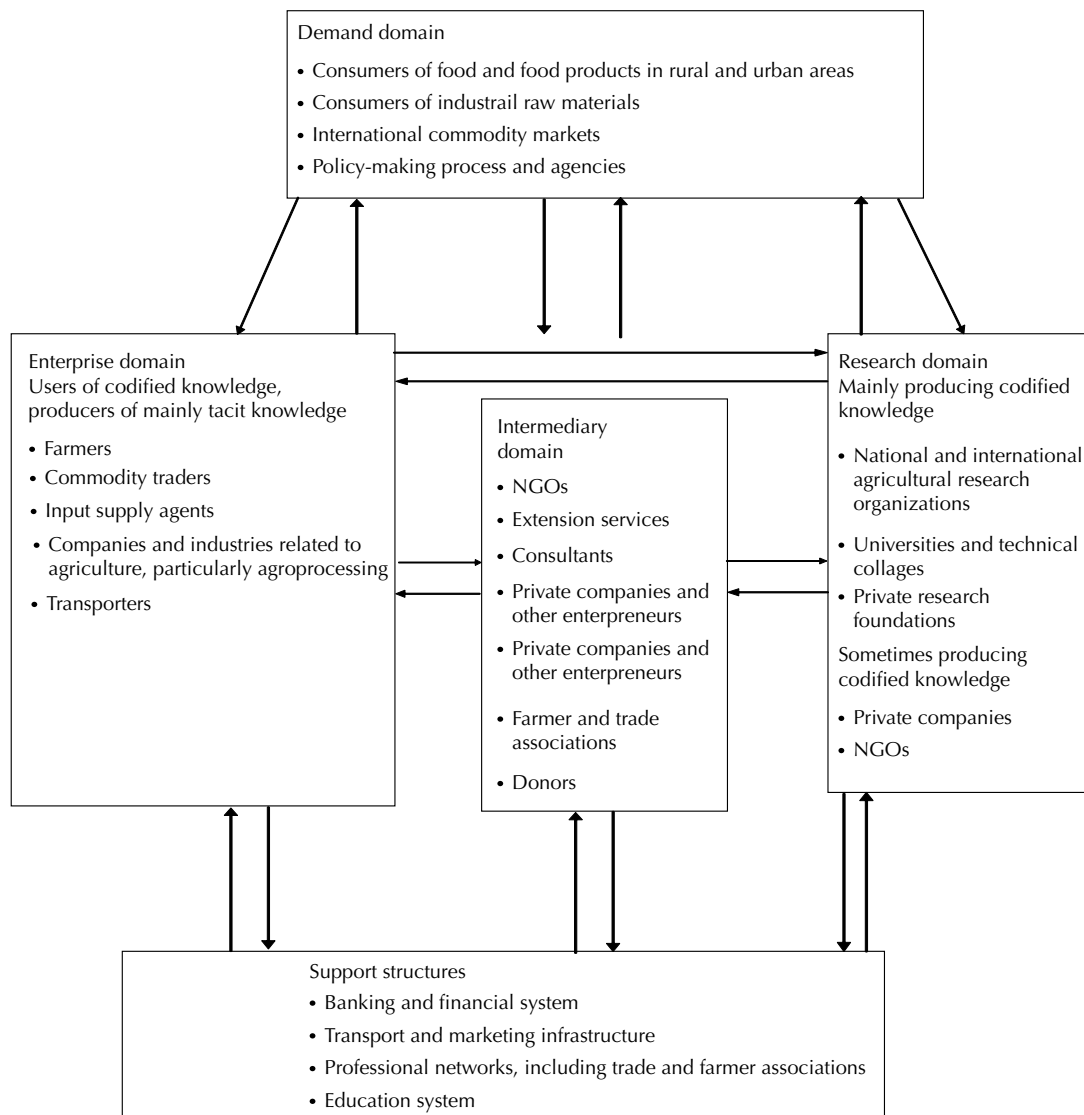
An innovation system is the group of organizations and individuals involved in the generation, diffusion, adaptation and use of new knowledge and the context that governs the way these interactions and processes take place. In its simplest, an innovation system has three elements:

- the organization and individuals involved in generating, diffusing, adapting and using new knowledge;
- the interactive learning that occurs when organizations engage in these processes and the way this leads to new products and processes (innovation); and
- the institutions (rules, norms and conventions) that govern how these interactions and processes takes place (Horton 1990).

A collaborative arrangement bringing together several organizations working towards technical change in agriculture can be called 'Agricultural Innovation System'. Such a system may include the traditional

sources of innovations (indigenous technical knowledge); modern actors (NARIs, IARCs, advanced research institutions); private sectors including agro-industrial firms and entrepreneurs (local, national and multinationals); civil society organizations (NGOs, farmers and consumer organizations, pressure groups); and those institutions (laws, regulations, beliefs, customs and norms) that affect the process by which innovations are developed and delivered (see Figures 2 and 3 as illustrative examples of AIS). Figure 2 generally illustrates the various actors involved in the AIS as it applies to R&D system whereas Figure 3 puts this concept in the context of an agri-food system analysis.

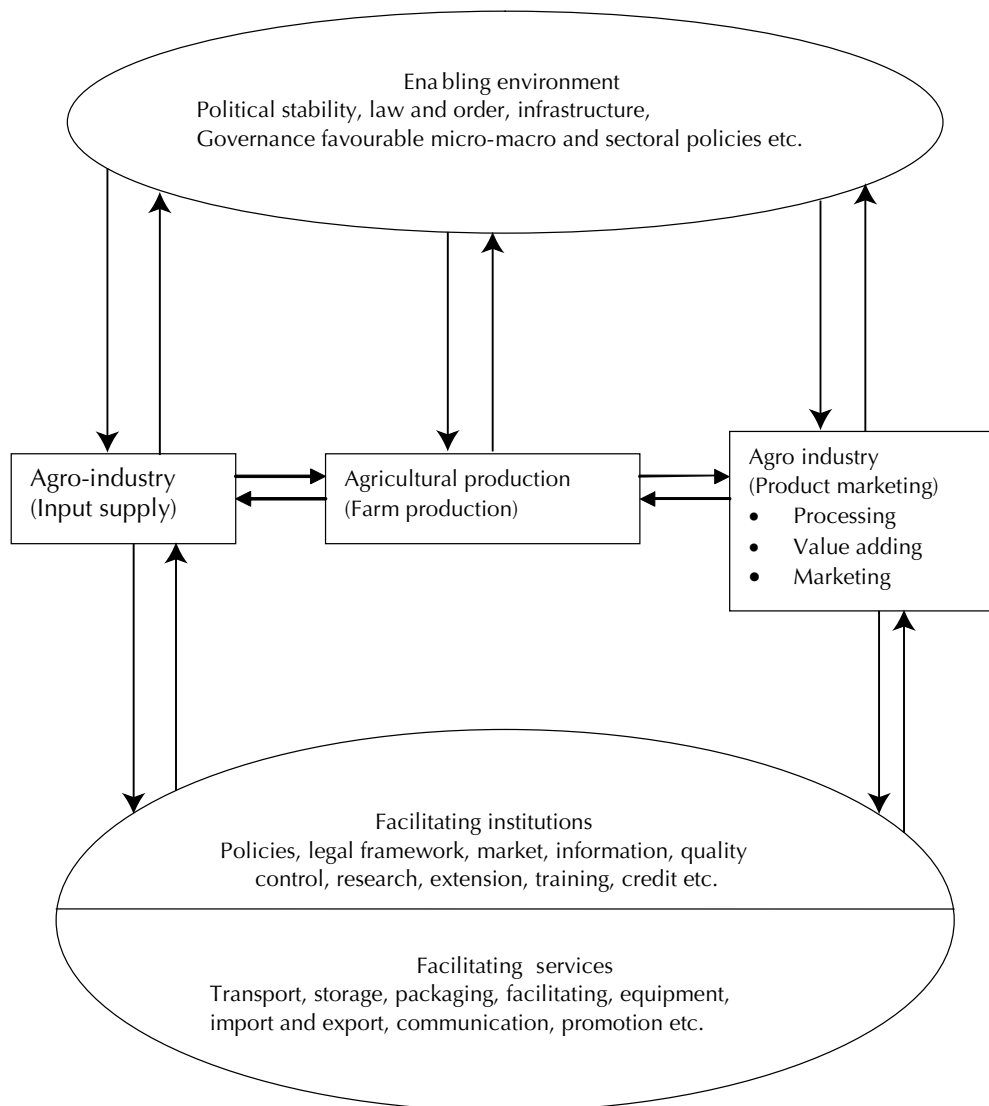
Dynamic processes of interacting embedded in specific institutional and policy contexts



Source: Adapted by Hall et al. (2006) from Arnold and Bell (2001, 279).

**Figure 2.** Elements of agricultural innovation systems.

AIS perspective provides a means of analysing how knowledge is exchanged and how institutional and technological change occurs in a given society by examining the roles and interactions of diverse agents involved in the research, development and delivery of innovations that are directly or indirectly relevant to agricultural production and consumption. The key differences and similarities between agricultural research systems and agricultural innovation systems are illustrated in Table 4. It is also worth noting that the transforming agricultural R&D systems have already incorporated the elements of the evolving AIS.



Source: Anandajayasekaram et al. (2005).

**Figure 3.** An innovation system at the commodity (value chain) level.

According to Clark (2002) the AIS concept recognized:

- That the innovation process involves not only formal scientific research organizations, but also a range of other organizations and other non-research tasks.
- The importance of linkages, making contracts, partnership alliances and conditions and the way these assist information flows.
- That innovation is essentially a social process involving interactive learning by doing and that process can lead to new possibilities and approaches inevitably leading to a diversity of organizational and institutional change. The interactions of the agents both condition and are conditioned by social and economic institutions.
- The innovation process depends on the relationships between different people and organizations. The nature of those relationships and its political economy is important.

That knowledge production is a contextual affair, i.e. innovation is conditioned by the system of actors and institutional contexts at particular location and point in time.

**Table 4.** *Similarities and differences between agricultural research systems and agricultural innovation systems*

Institutional features	Agricultural research systems	Agricultural innovation systems
Guiding agenda	Scientific	Sustainable and equitable development
Role of actors/partners	Researchers only/fixd. Predetermined by institutional roles defined by the arrangements of the research system	Multiple, evolving and flexible. Determined by the nature of task, national institutional context and skills, and resources available
Relationships involved	Narrow, hierarchical	Diverse, consultative, interactive
Partners	Scientists in agricultural research organizations and other public agencies such as universities	Evolving coalitions of interest. Various combinations of scientists, entrepreneurs, farmers, development workers and policy actors from the public and private sectors
Selection of partners	Predetermined by institutional roles defined by the arrangement of the research system	Coalitions of interest. Determined by the nature of task, national institutional context and skills, and resources available
Research priority setting	Fixed by scientists	Consensual by stakeholders and depending on the needs of different task. Technology foresight and technology assessment approach
Work plans and activities	Fixed at the beginning of project	Flexible, iterative
Policy focus	Narrow, related to agricultural research and agriculture and food policy disconnected from other policy domains	Broad, also inclusive of trade, rural development, industry, environment, education. Integration and coordination between many policy domains
Policy process	Disconnected from stakeholders and knowledge	Integrated with stakeholders and sensitive to differing agendas
Knowledge produced	Codified, technical/scientific	All forms of codified and tacit knowledge: technical, scientific, organizational, institutional, marketing and managerial
Indicators of performance	Short-term: scientific publications, technologies and patents Long-term: patterns of technology adoption	Short-term: institutional development and change/new behaviours, habits and practices/links Long-term: social and economic transformation
Responsibility for achieving impact	Other agencies dedicated to extension and technology promotion	All partners: scientists and their partners in task networks
Capacity building	Trained scientists and research infrastructure	Training and infrastructure development related to a range of research and economic activities and people. Policies, practices, and institutions that encourage knowledge flows, learning and innovation among all participants

Source: Hall et al. (2005).

## 4 Innovation ecology and innovation system

It is important to make sure that the innovation system is not confused with the intervention system. An innovation system incorporates the invention system as well as the complementary economic processes required to turn invention into innovation and subsequent diffusion and utilization. The most useful definition of innovation in the value chain context is given by Metcalfe (2008, 437). He defined innovation 'as a continuous learning process in which individuals/groups of individual/organizations and firms master and implement the design, production and marketing of goods and services that are new to them, although not necessarily new to their competitors—domestic or foreign'. This definition emphasizes the fact that innovation can rely on both new technologies/knowledge as well as the novel combination/adaptation of existing technology/knowledge to address the local innovation problem.

Innovation systems do not occur automatically, it is the problem situation that defines a particular innovation opportunity. Hence, innovation systems are created for a purpose, they will change in content

and patterns of interaction as the problem situation evolves and they are constructed at micro and macro levels. Thus, although the innovation systems can be defined at different levels (national, sectoral, commodity and problem/intervention), the most relevant innovation system is the one that is constructed to address a particular problem. As Antonelli (2001, 2005) argued, innovation systems are constructed to solve 'local' innovation problems and they are constructed around market problems (along the value chain) that shape innovation and not problems that shape the growth of science and technology.

To explain the difference between generic systems and the problem centred innovation system, Metcalfe (2008) made a distinction between 'innovation ecology' and a problem focused innovation system. The term innovation ecologies refer to a set of individuals usually working within organizations who are the repositories and generators of existing and new knowledge. Included in this ecology are those organizations that store and retrieve information as well as those that manage the general flow of information. The principal actors are usually profit seeking firms (in the value chain), universities and other public and private specialist research organizations and knowledge based consultancies. They exhibit collectively a division of labour that is characteristic of the production of knowledge (Metcalfe 2008). These ecologies are typically national in scope, with sub-national degree of variation (often generic in nature), necessarily reflecting rules of law, business practice and the social and political regulation of business of the economies in which they are located (Carlsson 1997; Cooke et al. 2000; Carlsson et al. 2002).

Innovation systems are constructed to address specific problems. These systems are very specific in nature and deal with the connection between the relevant components of the ecology; and ensure that the flow of information is directed at a specific purpose. Depending upon the problem at hand there can be multiple innovation systems supported by the same innovation ecology. Moreover, since the solution of one problem typically leads to different and new problems, we would also expect that as the problem evolves the actors in the system as well as their interconnectedness will also vary. Thus, while the ecologies are more permanent, the problem focused innovation systems are transient or temporary in nature. Once a particular problem situation is solved the associated system can be dissolved. The dynamism of an economy/value chain depends on the adaptability with which innovation systems are created, grow, stabilize and change as problem situation evolves (Metcalfe 2008, 442). A problem focused innovation system can be transboundary in nature or cut across national boundaries and may be spatially unconstrained. This problem focused, transboundary, dynamic nature of the innovation system is the most relevant one for the R&D community.

## 5 Innovation systems perspective

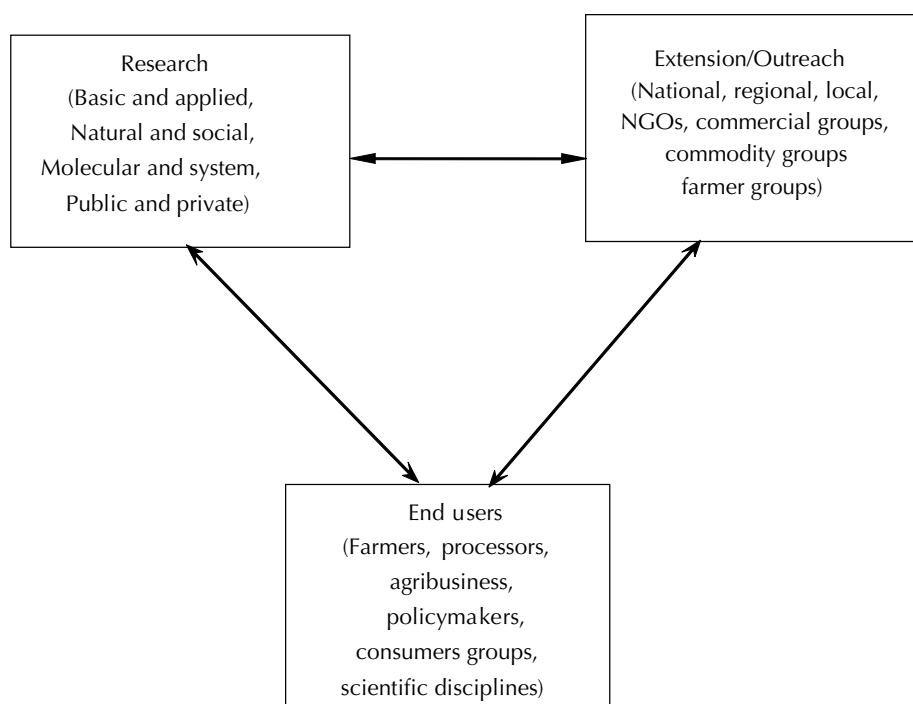
Innovation Systems Perspective (ISP) sees the innovative performance of an economy as depending not only on how individual institutions (firms, research institutes, universities etc.) perform in isolation, but on how they interact with each other as elements of a collective system and how they interplay with social institutions such as values, norms and legal frameworks. ISP suggests the analysis of three elements: the components of the system, principally its actors; the relationships and interactions between these components and the competencies, functions, process and results such components generate. Therefore the analytical implications of ISP are that there is a need to consider a range of activities and organizations related to research and development and how these might function collectively and the need to locate R&D planning and implementation in the context of norms and the cultural and political economy in which it takes place, i.e. the wider institutional context.

The key features of ISP are (Hall et al. 2005):

- Focus on innovation (rather than research/technology/knowledge) as its organizing principle;
- Helps to identify the scope of the actors involved and the wider set of relationships in which innovation is embedded;
- Escapes the polarized debate between 'demand driven' and 'supply push' approaches;
- Recognizes that innovation systems are social systems, focusing on connectivity, learning as well as the dynamic nature of the process;
- Leads us to new and more flexible organizations of research and to a new type of policymaking for science, technology and innovation;
- Emphasize that partnerships and linkages are integral part of the innovation system;
- Emphasize that learning and the role of institutions are critical in the innovation process; and
- The dynamics do not depend on the agents 'expanding the frontier of knowledge' but on the innovative abilities of a large number of agents. This dynamics depends on the strength of information flows and the absorptive capacity of the individual agents of institutions and of society as a whole.

The innovation processes depend on the interactions among physical, social and human capital, but mostly on the absorptive capacity of individual agents (Ekboir 2004).

The application of systems perspective also led to the triangular (supply and demand) model for commercialization of knowledge as shown in Figure 4.



Source: Adapted and modified from Lacy (2001).

**Figure 4.** *Triangular model for commercialization of knowledge.*

This new perspective automatically calls for new and innovative partnerships and networks in agricultural R&D. These aspects are discussed in another session in detail.

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## Exercise 3 Discussing the contemporary use of system concept in organizations

(Group work)

1. Form four groups and have each group elect a rapporteur (5 minutes)

### Phase 1 Group work (1 hr 20 minutes)

1. Please try to respond to the following questions in relation to your organization (1 hr 20 minutes)
  - Discuss how the system concept is applied in R for D in your organization
  - Do you think that adopting the 'innovation system' perspective will make the research processes more effective, efficient and impact-oriented? Please explain.
  - Identify three important changes needed to facilitate the application of ISP in your organization.

The rapporteur writes down the results of the group work on the flipchart (5 minutes)

### Phase 2 Reporting and discussion (35 minutes)

1. The trainer invites rapporteurs from the groups to present the results to the audience (30 minutes)
2. At the end, the trainer asks feedback on this exercise and closes the session (5 minutes).



# Trainer's guide

## Session 4 Steps in project cycle and application of ISP in the design and implementation of R for D

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Purpose	The purpose of this session is to explain the project cycle and highlight the changes that will be considered in applying the innovation systems perspectives in R for D
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"><li>• Get an understanding of the concept ' project cycle'</li><li>• Outline and describe the steps in the application of innovation systems perspectives in agricultural R for D</li></ul>
Resources	<ol style="list-style-type: none"><li>1. Flipcharts</li><li>2. White board</li><li>3. Flipchart and white board markers</li><li>4. Copies of handouts 4.1, 4.2, 4.3 &amp; 4.4 for every participant</li><li>5. Computer and LCD projector</li></ol>
Time needed	Two hours
Session structure	

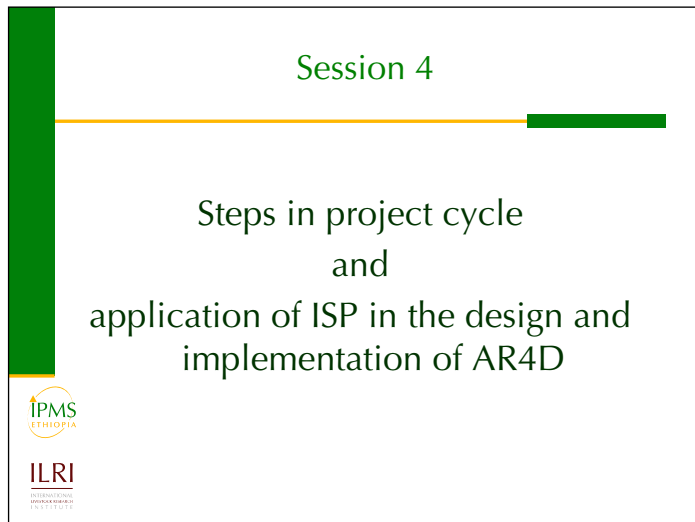
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Activity		Time required	Remark
Presentation	<ul style="list-style-type: none"><li>• Distribute handout 4.1 (presentation slides) before you start your presentation</li><li>• Give a presentation on steps in project cycle and applying ISP</li><li>• Allow some time for questions to make sure that participants understand what is presented</li><li>• Distribute handout 4.2 (presentation text) to supplement your presentation</li></ul>	30 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

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## Session 4: Presentation slides

Slide 1



Session 4

Steps in project cycle  
and  
application of ISP in the design and  
implementation of AR4D

IPMS  
ETHIOPIA

ILRI  
INTERNATIONAL  
INTEGRATED  
INSTITUTION

The slide features a green vertical bar on the left side. A horizontal orange line is positioned below the title 'Session 4'. Below this line, the main title 'Steps in project cycle and application of ISP in the design and implementation of AR4D' is centered. At the bottom left, the logos for IPMS Ethiopia and ILRI are displayed.

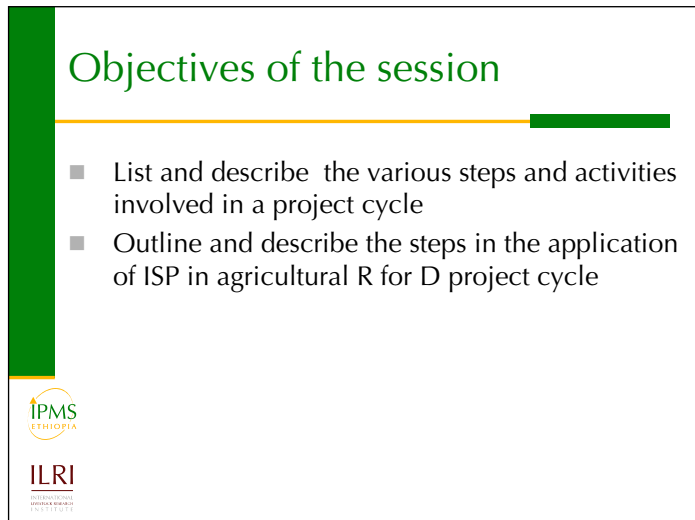
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Slide 2



Objectives of the session

- List and describe the various steps and activities involved in a project cycle
- Outline and describe the steps in the application of ISP in agricultural R for D project cycle

IPMS  
ETHIOPIA

ILRI  
INTERNATIONAL  
INTEGRATED  
INSTITUTION

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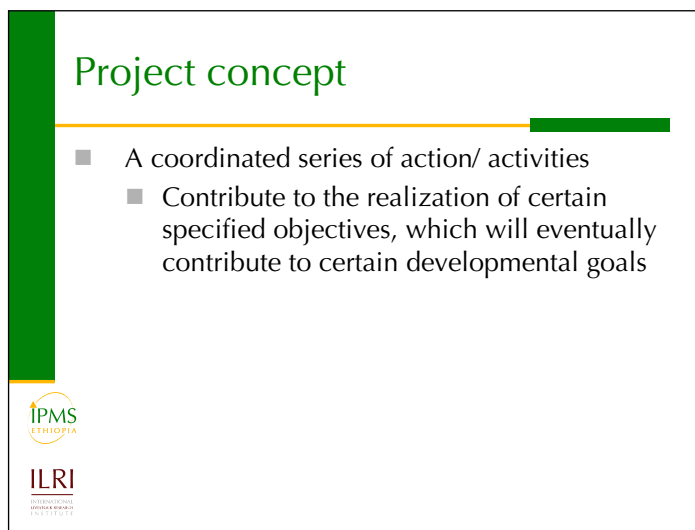
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Slide 3



Project concept

- A coordinated series of action/ activities
  - Contribute to the realization of certain specified objectives, which will eventually contribute to certain developmental goals

IPMS  
ETHIOPIA

ILRI  
INTERNATIONAL  
INTEGRATED  
INSTITUTION

The slide features a green vertical bar on the left side. A horizontal orange line is positioned below the title 'Project concept'. Below this line, a single bullet point is listed with a sub-bullet point. At the bottom left, the logos for IPMS Ethiopia and ILRI are displayed.

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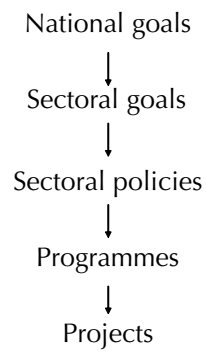
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Slide 4

## Agricultural R&D projects are the cutting edge/building blocks of rural development



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Slide 5

## Project concept (cont'd)

- Projects have:
  - Clear objectives
  - Definite boundary
  - Definite time frame
- Can be classified based on functions



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Slide 6

## Project cycle

- Identification — conceptualization
- Preparation — objectives and activities required to achieve objectives
- Appraisal — evaluation of alternative options and actions (*ex ante* analysis)
- Approval/rejection (decision-making)
- Implementation
  - Investment period
  - Development period
  - Monitoring
  - Completion
- Evaluation (*ex post* analysis) including impact assessment



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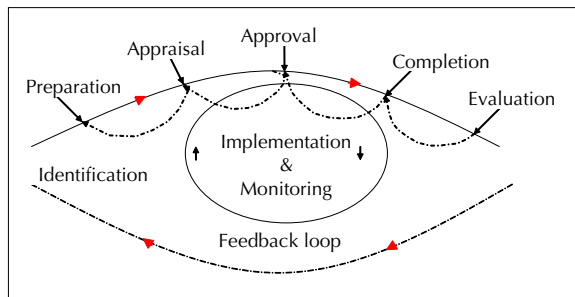
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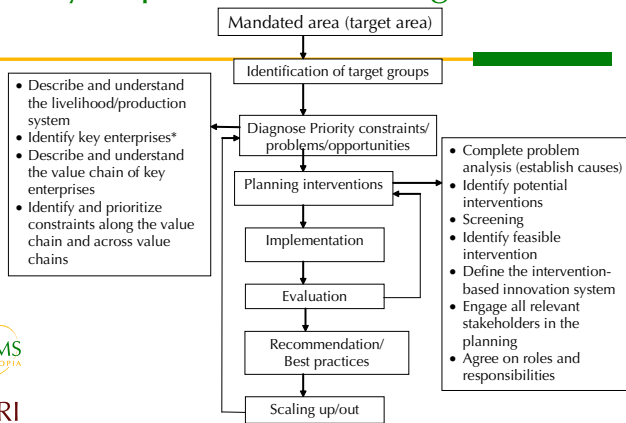
Slide 7

## The project cycle



Slide 8

## Key steps in R for D using ISP



\*A generic commodity-based IS can be defined at this level.

Slide 9

## Key steps


- Identification of target group
- Diagnosis of key/priority constraints
- Design/planning of interventions (focus on innovation)
- Actual implementation of the intervention (involving all relevant actors)
- Evaluation/review/re-planning
- Recommendation, scaling out/up
- Wider adoption and utilization by target group
- Feedback



Slide 10

## Identification of target group(s)

- Once the target area is defined, R&D practitioners should use the available secondary information about the target area to decide whether it is possible to identify the target groups
- It is important to identify a relatively homogenous group of farmers who will use the same knowledge within the area. A target group may cut across several administrative units
- In practice, a 'target group' includes farmers with similar livelihood and enterprise patterns, production and marketing practices and similar resource base
- Therefore, they will have similar opportunities for development and for whom the same research and development efforts are most likely to be relevant



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Slide 11

## Identification of target group(s)

- Both agro-climatic and socio-economic variables are equally important in identifying the target group
- Available secondary data can assist in identifying the initial target group
- Very often existing agro-climatic and production zones are used as starting points
- One might also use simple targeted questionnaires (agricultural administration and extension staff) to further refine the groups



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Slide 12

## Diagnosis of critical constraints/ opportunities

- The most critical stage in the process — crucial for developing appropriate interventions
- The main objective of the diagnostic stage
  - to describe and understand the current livelihood systems, production systems, value chain of selected priority enterprises and to identify key problems along the value chain and come up with a range of ideas to address these problems to enhance their livelihoods



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Slide 13

## Specific objectives of the diagnostic stage

- To describe and understand the current livelihood system and production systems and its operation? What is being done at the farm level and along the value chain? How it is being done? Why it is being done in such a way? Who does what? And when is it being done?
- To identify and prioritize major enterprises of the target group
- To describe and understand the value chain of each of the key enterprises
- Identify and prioritize major problems/opportunities along the value chain for the priority enterprises
- To define and analyse priority problems including causes and possible system interactions
- To explore the feasible options with the key stakeholders and identify potential partners/collaborators




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Slide 14

## Major activities in the diagnostic stage

- Collection, analysis, synthesis and interpretation of secondary information related to the target group — ‘the farmer circumstances’
- Primary data collection from the target group of farmers regarding their livelihood and production systems
- Various techniques and tools are used within each of these major activities
  - Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) and their derivatives
- Most commonly used data collection techniques
  - direct observation, key informant survey, group interview techniques and informal survey




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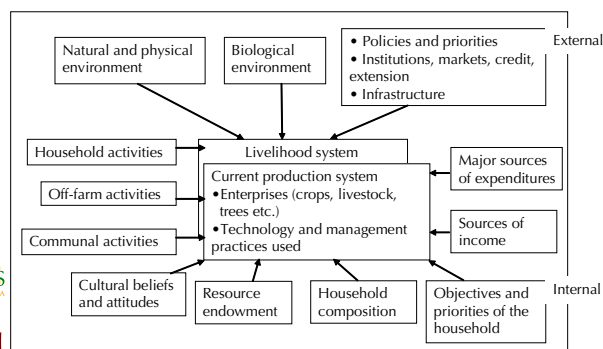
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Slide 15

## Farmer circumstances




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Slide 16

## Criteria for selecting major enterprises and identifying priority problems

- Preference and objectives of the farmer
- Relative importance of alternative enterprises in the livelihood system
  - current resource allocation, i.e. land and labour utilization
  - the number of farmers growing the crop(s) or keeping livestock
  - market opportunities
- Research opportunities associated with the crop/livestock value chain, and
- Specific mandate of the research institute conducting research



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Slide 17

## Criteria for selecting major enterprises and identifying priority problems

- These criteria are not mutually exclusive
- Often a combination of these criteria is used in ranking enterprises
- Consensus is also sought from the end users during the prioritization process
- For each one of these priority enterprises, one could develop a value chain
  - describe and understand the value chain to identify opportunities for value addition and/or increasing the productivity
- At this stage, develop an innovation system for each of these commodities



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Slide 18

## Prioritizing problems

- In any given target group, within the various value chains, one may identify a large number of problems
- They may not all be of equal importance and we may not have adequate resources and capacity to address all these problems simultaneously
- It is important to identify the most binding constraint in the value chain, which constrains the exploitation of the full potential of the value chain
- The prioritization of constraints could be accomplished in a two stage process:
  - Identify the relative importance of the different components of the value chain. Please remember at this stage the unit of analysis is the value chain
  - Identify and prioritize the binding constraints within the priorities established in the previous step



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Slide 19

## Prioritizing problems

For example

- In step 1, one could identify the most critical constraint to be input supply or farm level productivity
- Then in step 2, one could look at all those constraints inhibiting the realization of the full potential in terms of production at the farm level
- This is a two stage ranking process. Then one could complete the problem analysis for the key constraints identified



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Slide 20

## Prioritizing problems

- A close interaction with the key stakeholders is very crucial to ensure success of our interventions
- If they do not participate and own the process and identify themselves with the priority constraint and the proposed intervention, then the chances of success may be slim
- The most commonly used ranking techniques: card sorting, single list ranking, pair wise ranking and matrix ranking



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Slide 21

## Criteria used in ranking problems

- Problems important from farmers' point of view
  - Problem affecting farmers most
  - Problem affecting most farmers
- The frequency with which the problem occurs
- The probability of achieving the results
- Potential for improvement once the constraint is removed
- Time lag involved in generating recommendations
- The researchers ability to solve the problem based on the available technology
- Cost associated with research
- The flexibility of the FS with regard to this problem
- The political acceptability and conformity to national priorities



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Slide 22

## Planning

- Problem analysis and selection of the appropriate interventions are the crucial steps in the whole process
- The key steps involved in the planning process are:
  - Problem analysis (establish causes, systems interactions and draw a flow diagram)
  - Identify potential solutions including ITK, science based solutions and positive deviants
  - Screen the potential solution (*ex ante* evaluation) to identify feasible solution/interventions
    - A number of criteria can be used for screening (for example, sustainability, equity, competitiveness etc.)



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## Criteria for screening

- Technical feasibility
- Expected profitability
- Expected risk
- Relative research cost
- Simplicity and divisibility
- Sustainability
- Farming system compatibility
  - Objectives and preference
  - Resource availability and use pattern
- Compatibility with available institutions and infrastructure
- Social acceptability
- Farmer safety/health hazard
- Time lag/gestation period



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## Planning

- Develop an 'innovation system' for this intervention (actual and potential actors, their actions and interactions, institutional arrangements and the framework conditions that influence)
- Prepare problem analysis chart for discussion with the key stakeholders in the innovation systems identified
- Plan the details of each intervention to be implemented

'Think in terms of innovation'



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Slide 25

## Planning

- Prepare an implementation and annual plan. (Who will do what? how will it be done? when it will be done? who provide what resources?)
- Develop a monitoring and evaluation plan. How will the performance be monitored and shared. (Indicators, data needs, as well as data collection and information sharing responsibilities)
- For each type of intervention it is important to describe and explain the purpose, specific objectives, procedures and methods to be used, data to be collected as well as the roles and responsibilities to the various stakeholders
- An outcome mapping should be done to identify the behavioural changes expected from the boundary partners



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Slide 26

## Implementation of interventions

- An innovation can be technical, managerial, organizational, institutional, policy as well as service delivery type
- The nature of the activities depends on the type of innovation as well as where exactly the intervention is in the knowledge generation–use continuum
- Knowledge generation–knowledge adaptation–knowledge dissemination–knowledge use by the end user



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Slide 27

## Implementation of interventions

- The intervention could be
  - an experiment (on-station, on-farm), case study, pilot testing etc.
- The details and activities involved in the implementation will vary with the type of intervention
- One may not be able to identify all the problems and potential issues upfront. One might discover as they start implementing
- Flexibility and action learning are important elements while following an IS approach



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Slide 28

## Implementation of interventions

- One of the key activities in the implementation process is the monitoring and evaluation
- Monitoring should cover the implementation monitoring, processes, output(s) as well as the anticipated outcome
- On-going evaluation is crucial for mid term correction of intervention
- In many instances implementation may involve group formation and management, design and management of partnership; arrangements with stakeholders including negotiations, conflict resolution, risk sharing arrangements etc.



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Slide 29

## Evaluation/assessment

- Assessment begins at the planning stage, and continues through implementation to impact assessment
- *Ex post* assessment is done immediately after completion of the intervention and is closely linked to the purpose, objectives and the indicators of success identified
- Performance assessment is linked to the targeted output(s), outcomes at this stage are measured at the boundary partner level



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Slide 30

## Evaluation/assessment

- Depending on the nature of the intervention a number of techniques can be used for evaluation purpose—statistical techniques, budgeting techniques, perception analysis, surveys of different types; benefits–cost analysis etc.
- It is important to involve all the key stakeholders in the assessment process
- An assessment at this stage may lead to re-planning with modification or recommendations/ best practices for scaling up and scaling out



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## Adoption and utilization of knowledge products and process

- Adoption of knowledge products and processes are supported by a number of actors who provide important services to end users
- It is important to ensure that these support services are in place to facilitate the adoption and utilization of the innovation
- At this stage of the processes the researchers may play a minor role and the major role will be played by the extension staff, input suppliers, marketing agents and others



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Slide 32

## Adoption and utilization of knowledge products and process

- It is important to monitor and document the adoption and utilization process so that the lessons learned can be used in the future planning of projects and programs
- This will also provide feedback to the various actors involved
- New and emerging problems can also be identified
- If a full blown impact assessment of the intervention is planned, then the relevant data could be collected at the various stages



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Slide 33

## To summarize...

- You would have noticed that the key steps in the research process are the same as what you are doing at the moment
- But the focus is on innovation
- Thus the actors and activities involved at the various stages have changed
- It is important to recognize that what you are doing is necessary but the impact of your activities can be enhanced by adding on the missing elements of the new innovation systems paradigm



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Slide 34

## To summarize...

- For a considerable period of time, the research community was wearing a lens which focused on 'knowledge and technology' as the final output with very little attention paid to the outcomes
- As our thinking evolved the R&D community is viewing the world using a lens which focuses on 'innovation' as the end result
- Within an innovation framework, knowledge and technology are intermediate products, necessary but not sufficient to create innovation



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Slide 35

## To summarize...

- In designing and implementing research based interventions, consider and involve all those actors who could potentially contribute to all these aspects at the planning stage
- Engage them in the process and accept the fact that the role played by each actor will vary as we move down the road towards creating innovation



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Slide 36

What is needed is a mindset change...

An innovation perspective

- A learning culture
- Explicit recognition of the contribution of the various actors towards innovation!!!



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# Steps in project cycle and application of ISP in the design and implementation of agricultural R for D

## 1 Introduction

All of us are engaged in research projects as researchers, trying to find solutions to agriculture-related problems to support development and poverty alleviation. All projects go through a series of processes during design and implementation, which is often described as the project cycle. This session will explain how the innovation systems concept can be incorporated in the research projects, so that they create larger and wider impacts.

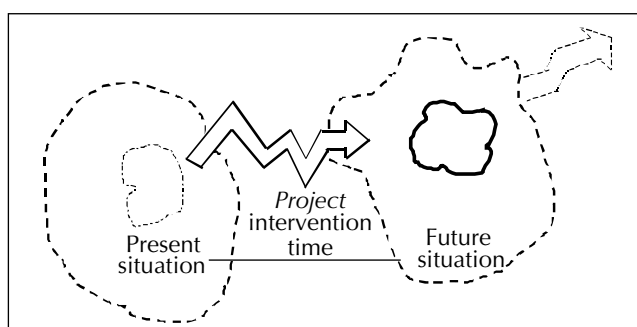
The chapter introduces the concept of project cycle and goes on to describe how the IS approach can be incorporated in the various steps of the projects.

### 1.1 The project concept and the project cycle

Research and development projects aim to change a present situation to an improved situation over time. A project is an instrument of change. Change processes have some basic common features. These include:

- the broader context in which a project is situated;
- a (problem) situation which must be changed;
- objectives, or visions of the improved future situation, that should be achieved; and
- choices about where and how to intervene through time with investments, actions and activities to achieve the envisaged improved future situation.

A project therefore represents a particular set of choices (or interventions) over time to move from a present situation to an envisaged future situation (see Figure 1). The concept of development is dynamic and essentially a human phenomenon, i.e. what we (the target group) want and how it is to be achieved over time.



**Figure 1.** *The project concept.*

### The project cycle

A project is viewed as an investment activity in which financial resources are expected to create capital assets that produce benefits over an extended period. A project is, therefore, a clearer, distinct portion of a larger, less precisely defined program. The project format is used to prepare and analyse a variety of agricultural investments and is an analytical tool for analysing information on a consistent basis across the expected life or different phases of a development initiative. The project approach to planning

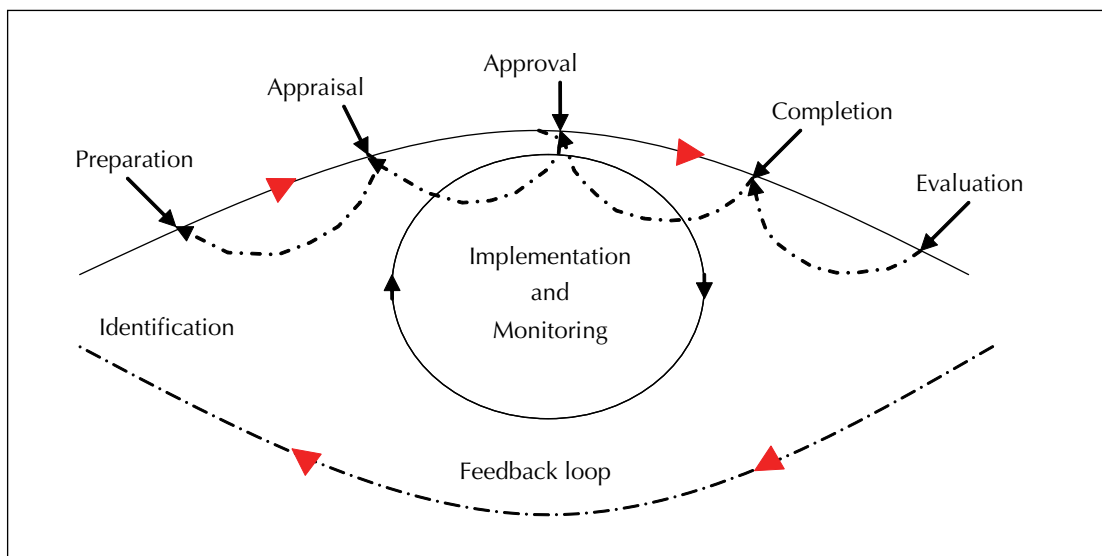
allows for comparison of several projects, or alternative designs of the same project, i.e. alternative options, thus making the resource allocation process efficient.

The concept of the project cycle and its various components are discussed in the following sections.

A project moves through stages. An idea germinates; then it passes through various steps which will clarify the concept; objectives and activities required to achieve the objectives; the appraisal of the alternative options and actions; decision-making; implementation; monitoring; completion and final evaluation. The entire process from the first idea to the final evaluation is called a **PROJECT CYCLE**, to indicate the phased or cyclical nature of this process.

In operational terms each stage in the project cycle can be understood as leading to a decision point. The decision to be taken at the end of each stage is if the project should continue to the next stage, and when it should continue. The various elements or stages in the project cycle are shown in Figure 2 with feedback processes between each stage in the cycle. The project cycle is thus interactive in nature.

Interactive in nature



**Figure 2.** The project cycle.

Elements of the project cycle:

- identification
- Preparation
- appraisal (*ex ante* analysis)
- approval/rejection
- implementation
- investment period
- development
  - monitoring
  - completion
  - Evaluation (*ex post* analysis) including impact assessment

**Identification:** The identification stage involves finding potentially fundable projects. Sources include technical specialists, local leaders, proposals to extend existing projects, rise in market price for

products, projection of future demand, economic development plans with priority areas, separate sector surveys of the current situation in agriculture, and so on. In the case of agricultural and natural resources projects, the diagnostic surveys and constraint analysis may result in the identification of priority problems and research themes, which may lead to project development.

**Preparation:** Preparation can be broken into two parts depending on size and complexity of the project. A pre-feasibility study focusing on qualitative and subjective analysis could provide enough information for deciding to proceed with a more detailed analysis. During the pre-feasibility stage, the major objectives of the project are however clearly defined. The question of whether alternative ways to achieve the same objective may be preferable should explicitly be addressed and poor alternatives excluded. The analytical aspects come into play at this stage, but often relying on existing and secondary sources of data. Once the pre-feasibility study is done, detailed planning and analysis follows. With large projects, the project may be prepared by a special team to include experts from the analytical areas considered crucial. These steps involve a lot of brainstorming and subjective judgment. The analysis will include aspects described in the section on project modules. A so-called 'screening' exercise during planning ensure that the project identified is technically and economically viable, and compatible with the existing production systems, resource use patterns, as well as the social and cultural beliefs of the target group.

**Appraisal:** After the report on the detailed analysis of all relevant project modules is completed, a critical review and appraisal (or execute analysis) of all these aspects are conducted by an independent team. This team re-examines every aspect regarding feasibility, soundness and appropriateness. The team may recommend further preparation work if some data are questionable or some of the assumptions are faulty.

Approval of a project triggers the required set of implementation actions.

**Implementation:** Implementation is a crucial part of the project cycle and, therefore, requires equally rigorous analysis and planning in order to develop a realistic project management plan.

The implementation is usually subdivided into the following stages:

- **Investment period** – in an agricultural project usually 2–5 years from the start of a project during which the major fixed investments are made, i.e. dam and canal systems, most staff is engaged, equipment procured etc. The major benefits are expected to flow after this stage.
- **Development period** follows investment.
- **Monitoring** of project activities as per the approved project and adjustments as required to keep the project on track.
- **Completion** or maturity of a project can be as long as 25–30 years from the start during which periodic benefits and costs continue to accrue, and impacts are more apparent and measurable.

**Evaluation (and impact assessment):** Evaluation involves measuring elements of success and failure of the project. Evaluation can start from on-going monitoring, to after completion of the project. Evaluation is usually done by an independent evaluation team. Evaluation (or *ex post* analysis) looks at the extent to which original objectives and specifications are met, in other words:

- Technical appropriateness
- Organization/institution/management
- Commercial undertaking
- Financial aspects

- Soundness of assumptions
- Economic implications
- Social and distributional issues.

Impact assessment goes beyond direct evaluation to look at the results of projects, both intended and unintended, and the differences, positive and negative, on the position of society that has been affected.

The evaluation stage is usually used as 'lessons-from-experience' for future project planning and analysis.

## 1.2 Framework for project analysis

Project analysis can be divided into seven major elements:

- Technical
- Institutional
- Organizational
- Social
- Commercial
- Financial
- Economic
- Environmental aspects

These are all inter-related, and the importance of each varies from project to project, or design to design. This list, however, is a comprehensive attempt to identify relevant processes, data and information that determine benefits and costs. This list, therefore, is used to identify analytical elements for each stage in the project cycle, i.e. during preparation, analysis, and subsequent evaluation, and impact assessment. Each aspect is discussed in detail in the following sections.

*Technical aspects:* Technical aspects concern the physical inputs and outputs of real goods and services, and examine the technical relations in the project. These will vary from project to project. Experts need to provide information on all major elements that lead to the identification of supplies, production, productivity, and technical input/output coefficients. Project analysts have to make sure that technical estimates and projections relate to realistic conditions.

*Institutional–organizational–managerial aspects:* Appropriateness of the institutional setting (i.e. rules of conduct) is important for the success of the project. Customs and culture of participants have to be understood and accounted for to avoid disruptions in the way in which farmers are accustomed, and hence, increase the possibility of adoption and success. Some important aspects include land tenure, indigenous farmer organizations, authority, and responsibility. The organizational structure, inter-organizational linkages and efficient management of the organizations are crucial for success.

*Social aspects:* Broader social implications, particularly resource and income distribution impacts or potential impacts are important. Responsiveness to national objectives may be a consideration. Other aspects include employment opportunities, regional dimensions, losers and gainers in terms of social groups, gender issues, impact on social organizations, change in tenure, division of labour, quality of life improvement, i.e. water, health, education etc.

*Commercial and business aspects:* Commercial aspects include market demand for the product, effects on prices, processing and value added effects, and effects on the domestic and/or export market, and

quality of the product. Input supply and demand issues include: securing supplies such as fertilizer, pesticides, seed and financing etc.

*Financial aspects:* The financial aspects are one of the most important areas in project analysis, and most data have to be translated into financial forms for comparability. Financial aspects include the financial effect of the project on participants, farmers' firms, public corporations, project agencies, and the national treasury. Financial aspects are dealt with at various levels, i.e. firm farm, organization, or corporate. At the farm level, financial data is often handled in farm budgets. Organizations usually have formalized systems of financial accounting and reporting which may have to be further manipulated to fit into the project format. In financial analysis mostly market prices are used and profits are important.

*Economic aspects:* The economic aspects are the most important in ultimately determining impact of any public sector investment in agriculture. Economic aspects lead to impact and economic efficiency of the project on development of the total economy, *vis-à-vis* the allocation of scarce resources, i.e. economic efficiency. Economic aspects determine the value of the project from the viewpoint of society at large and also to determine the economic efficiency with which scarce resources are allocated. In economic analysis the concept of opportunity costs are used. Financial and economic aspects are complementary but different, especially when markets are distorted.

*Environmental aspects:* Environmental aspects deal primarily with adverse biological and physical environmental impacts, i.e. irrigation, bilharzias, notable scenic beauty, preserving unique plants and animals etc.

## 2 Incorporating ISP in research project cycle

In the previous session, we discussed the various concepts such as innovation, innovation systems and innovation systems perspective. One of the biggest challenges confronting the research and development community is to operationalize these concepts in our mandated area of work.

In response to changing challenges and paradigms, the R&D activities of many institutes are increasingly being guided by four principles: **the innovation systems perspective, value chain analysis, research-development continuum (IAR4D); and impact orientation.** These are not mutually exclusive concepts but are complementary. The challenge is to effectively integrate/mainstream these concepts so that they could effectively contribute to the mission and mandate of the various institutes whose primary responsibility is research. The key change in our approach is that the end product is no longer knowledge/technology. The end result we would like to see is innovation. Unless the knowledge is transformed into products and processes that are used for generating social and economic benefit to the end users, they will not become an innovation.

The system concepts and participatory research methods have been in use for many decades. The innovation systems perspective is a logical evolution of the application of the systems concepts. The various steps involved, actors, activities, and tools used are briefly discussed in this chapter.

### Concepts revisited

As discussed in the previous chapter, over the years, the systems approach to research has undergone various modifications and changes leading to the development of a variety of methods and approaches. At the beginning, the focus was on technology generation, but now there is general consensus that the

approach, techniques and tools could be effectively used to generate innovation—a critical factor for economic growth and broad based development.

Becon and Butler (1991) defined innovation as ‘the economically successful use of invention’ and invention as a ‘solution to a problem’. In our view this is the most useful definition that will fit the context in which agricultural R&D is conducted in many developing countries. Innovations are new creations of economic significance. They relate to both the production of new knowledge as well as new combination of existing knowledge. The critical point to note is that this knowledge cannot be regarded as innovation unless it is transformed into products and processes that have social and economic use (Edquist 1997). In the words of Andrew Barnett (2008) ‘research converts money into knowledge and innovation converts knowledge into money’. Up to now researchers have focused on generating knowledge/technology and the responsibility for adaptation, dissemination and adoption were left to other actors. However, we need to realize that the job of the researcher is not complete until innovation occurs. The formal scientific knowledge is only one entry point to create innovation. We need both systems thinking and innovation thinking to solve complex problems and deal with the uncertainty arising from the dynamic and complex challenges of the agricultural sector.

An innovation system is defined as the group of organizations and individuals involved in the generation, adaptation, dissemination and the use of ‘new’ knowledge and the context that governs the way these interactions and processes take place. In its simplest, an innovation system (as discussed in the previous chapter) has four elements: (a) the organization and individuals involved in generating, adapting, disseminating and using the knowledge; (b) the iterative learning that occurs when organizations and groups engage in these processes and the way this leads to new products and processes; (c) the institutions (rules, norms and conventions) that govern how these interactions and processes takes place and (d) the context/framework conditions that facilitate and/or constrain the process and interactions. An innovation system can be defined at different levels depending on the purpose. The most relevant innovation systems for the research communities dealing with farm level issues is the system that is relevant to the particular constraint/intervention that is being addressed in any specific situation. The diagnostic phase of the project cycle and the planned intervention help define and determine the relevant innovation system.

An innovation system perspective means wearing an ‘innovation’ lens in planning and implementing R&D activities. Innovation system perspective implies:

- Focus on innovation (rather than technology/knowledge) as its organizing principle.
- Both tacit and codified knowledge are equally important for innovation.
- Science based technical innovations are important, but also are process, managerial, institutional, service delivery, organizational and policy innovations.
- Emphasizes that learning and the institutions (formal, informal; trusts, traditions and routines) are critical in the innovation process.
- Partnering and other forms of alliances and networking are key innovation strategies.

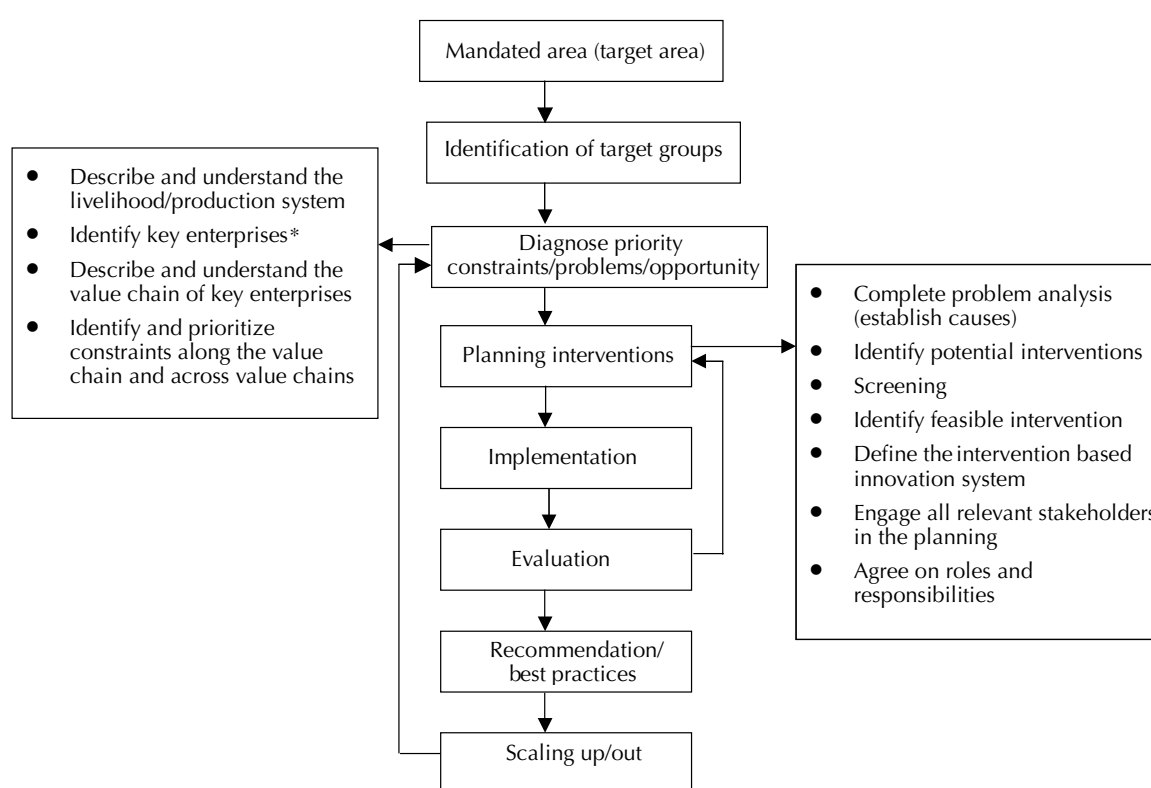
We need to consider these points while planning and implementing R&D activities. The ISP does not imply that the scientific community should take over all these responsibilities. It implies that while planning activities, we should consider all these aspects and involve the relevant actors in the planning and implementation process. One has to recognize that the process is dynamic and the roles of the agents vary depending on the stage of the innovation process.

The application of the innovation system perspective led to the triangular model for commercialization of knowledge as explained in the previous chapter: research (basic, applied, natural science, social science, molecular, systems, public and private); extension/outreach (national, regional, local NGOs, commercial groups, community based organizations and commodity groups), and end users (farmers processors, agribusiness firm, policymakers, consumer groups, scientific discipline etc).

## Steps in the application of Innovation System Perspective

All R for D interventions follow a definite project cycle as described in the previous section. The steps for the application of the farming systems perspectives in this cycle are fairly well established and have been used by R&D practitioners for a considerable period of time. These steps/procedures could be modified to incorporate the innovation systems perspective.

The key steps in the ISA to agricultural R for D are outlined in Figure 3.



\* A generic commodity-based innovation system can be defined at this level.

**Figure 3.** Stages in the ISA approach to agricultural R&D.

The key steps include:

- Identification of target group
- Diagnosis of key/priority constraints
- Design/planning of interventions (focus on innovation)
- Actual implementation of the intervention (involving all relevant actors)
- Evaluation/review/replanning
- Recommendation, scaling out/up
- Wider adoption and utilization by target group
- Feedback

The key objectives of each of these steps, activities and actors involved, tools used and some of the concerns about the actual implementation of the various stages are summarized in Table 1 and discussed in the following sections.

**Table 1.** Stages, objectives, activities, tools and concerns in using *ISP in agricultural R&D*

Steps	Objectives	Activities	Actors	Tools/approaches	Concerns
1(a) Diagnosis	To identify tentative target group	Collect, analysis and synthesis secondary data Field visit Discussions with farmers, farmer groups, NGOs, market agents and other key informants	Researchers, farmers, extension, NGOs, CBOs, marketing agents	Group interviews Key informant surveys Wealth ranking	Need for stratification Need for refining target group(s)
1(b) Diagnosis	To identify and analyse livelihoods; prioritize constraints and opportunities for improving livelihoods, (using innovation system perspective and value chain framework) Describe and understand the rural livelihood systems of the target group To identify and prioritize enterprises To establish the value chains of priority enterprises To identify and prioritize constraints along the value chains of priority enterprise (two stage process) To identify existing systems inter-actions Identify positive deviants and ethnic knowledge (ITK)	Collect, analyse and synthesis available secondary data Generate primary information using various participatory tools. (field and market visits) Ranking enterprises and constraints/opportunities with full participation of the target group	Researchers, farmers, farmer groups, farmer organizations, NGOs, CBOs, extension, market agents	Livelihood analysis Informal survey Group interviews Key informant surveys Formal surveys Ranking techniques Flow diagram Venn diagram Actor linkage matrix, map Innovation tree Participant observation Experimentation Gender analysis Problem tree Network mapping Participatory diagrams/maps Stakeholder analysis Value chain mapping	Integration of ISP and value chain analysis Identification of systems interactions Gender perspective/integration of gender concerns Multi-stakeholder platform for sharing information



Steps	Objectives	Activities	Actors	Tools/approaches	Concerns
Planning	To plan the detailed intervention(s) to address priority constraints (technical, policy, institutional, managerial, service delivery etc.) REMEMBER – Focus is on INNOVATION	<p>Problem analysis</p> <p>Identifying potential intervention(s)</p> <p>Screening for feasible interventions</p> <p>Validating intervention</p> <p>Defining the details of each intervention (technical and non-technical)</p> <p>Developing the annual plan (combining demand and available resources). This may involve prioritizing all identified feasible options</p> <p>Mapping the innovation system for the prioritized intervention(s)</p> <p>Identifying potential collaborators and partners</p> <p>Agreeing on the roles and responsibilities (resources, activities, M&amp;E etc.)</p>	<p>Relevant actors are chosen based on the activity; and the purpose and nature of the intervention</p> <p>Focus is on innovation, so ideally all actors in the specific innovation system should participate, but their roles will change over time</p>	<p>Flow diagram</p> <p>Screening/ex ante assessment using scoring model</p> <p>Breakeven analysis</p> <p>Logical framework analysis to plan M&amp;E</p> <p>Formal survey technique and procedure</p> <p>Case study methods</p> <p>Partial budgets</p> <p>Stakeholder consultation</p> <p>Innovation map for each intervention</p> <p>Outcome mapping</p>	<p>Stakeholder participation</p> <p>Development of baseline and M&amp;E system (indicators, data collection etc.)</p>
Implementation	To successfully implement planned activities and collect the necessary data for assessing intervention	<p>Technical involving experimentation</p> <p>Selecting actors and partners including farmers</p> <p>Site selection</p> <p>Arranging with farmers</p> <p>Data collection and recording</p> <p>On-going evaluations</p>	<p>Depending on the 'Innovation System' for the intervention</p> <p>FO, CSO, NGOs, private sector</p>	<p>Data collection/recording technique</p> <p>Perception analysis</p> <p>Data analytical and presentation techniques</p> <p>Techniques and procedures to organize and manage groups</p> <p>Tools to design manage and evaluate partnerships</p> <p>Process monitoring</p>	<p>Documenting processes and lessons learned</p>

Steps	Objectives	Activities	Actors	Tools/approaches	Concerns
Evaluation	To assess the output and outcome of the interventions	<p>Technical interventions (experiments)</p> <p>Statistical analysis</p> <p>Agronomic assessment</p> <p>Economic assessment</p> <p>Farmer evaluation</p> <p>Field days</p> <p>Non-technical interventions (non-experimental)</p> <p>Analysis and interpretation of data and synthesis of findings</p> <p>Multi stakeholder workshop—validation of results</p> <p>Planning the next step</p> <p>Same as for planning</p>	<p>Relevant actors are chosen based on the activity; and the purpose and nature of the intervention</p>	<p>Socio-economic research procedure and techniques (to assess technical and economic viability and system compatibility)</p> <p>Statistical technique</p> <p>Budgeting technique</p> <p>Sensitivity test</p> <p>Minimum returns analysis</p> <p>Impact chain analysis</p> <p>Perception analysis</p> <p>Participatory M&amp;E</p> <p>Participatory Impact monitoring</p>	<p>Outcome measures</p> <p>Lessons learned</p>
Replanning	To confirm original hypothesis Adjust and modify interventions based on additional information obtained during implementation	<p>Technical intervention</p> <p>Developing recommendation</p> <p>Discussing and planning follow up activities and role of different actors</p> <p>Sharing of finding/results</p> <p>Demonstrations</p> <p>Training of front line extension staff</p> <p>Development of communication materials</p> <p>Non-technical</p> <p>Policy briefs</p> <p>Best practices</p> <p>Sharing of results/findings</p> <p>Discussing and planning follow up activities</p>	<p>All those, who were involved in the implementation, administrators, managers, policymakers and other relevant stakeholders</p>	<p>Effective writing and communication tools and skills</p>	<p>Organizational policies</p> <p>Resources and commitment of various actors</p>
Recommendation/scaling up/scaling out	Testing the technology/result of pilot studies across the target group				

Steps	Objectives	Activities	Actors	Tools/approaches	Concerns
Adoption and utilization of results by the end users	Enhancing the livelihood of the target population	Monitoring and recording of issues Data collection—panel data from the target group Adoption studies	Research, extension, farmers, decision-makers	Formal surveys Key informant interviews Community surveys Group discussions Multi-stakeholder workshops	Resources and commitment of the various organizations Impact measurement
Feedback (to relevant stakeholders)	To identify the second generation problems Learning from the experiences	Recording information Periodically meeting with end user(s)—creating platform for sharing information Regular field visits Impact studies	Research, extension, farmers, decision-makers, private sector	Effective communication techniques Adoption surveys Innovation tree Techniques and tools to assess different types of impacts	Documentation Resources and commitment of the various organizations Documentation and wider sharing Platforms for sharing

## Identifying target group(s)

Because of the heterogeneous nature of the farm population, it is important to identify a relatively homogenous group of farmers who will use the same knowledge. In most national programs researchers often work in a given mandated area. A given target area may contain more than one target group. Therefore, once the area is defined (this may be a political decision), R&D practitioners should look at the available secondary information about the target area to decide whether it is possible to identify the target groups within the area. A target group may cut across several administrative units.

In practice, a 'target group' includes farmers with similar livelihood and enterprise patterns, production and marketing practices and similar resource base. Therefore, they will have similar opportunities for development and for whom the same research and development efforts are most likely to be relevant.

Both agro-climatic and socio-economic variables are equally important in identifying the target group. Available secondary data can assist in identifying the initial target group. Very often existing agro-climatic and production zones are used as starting points. One might also use simple targeted questionnaires (agricultural administration and extension staff) to further refine the groups. Farmers are usually grouped within relatively homogenous groups based on their existing livelihood/farming systems.

## Diagnosing critical constraints/opportunities

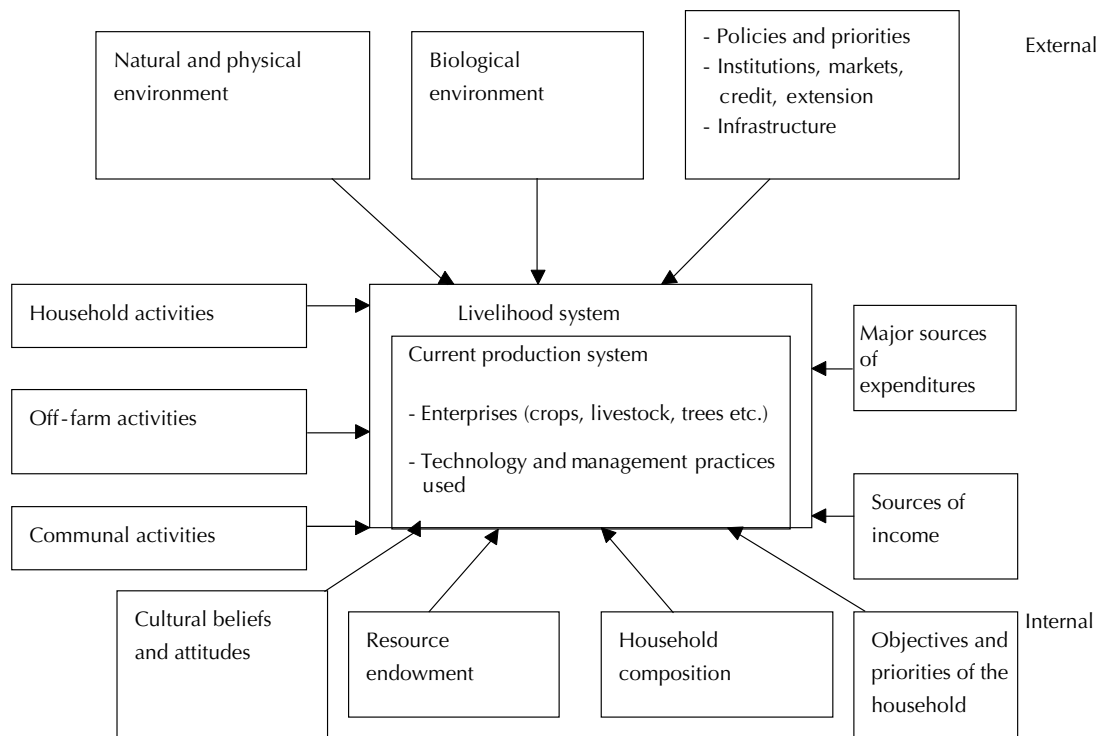
This is the most critical stage in the process as it is crucial for developing appropriate interventions. The main objective of the diagnostic stage is to describe and understand the current livelihood systems, production systems, value chain of selected priority enterprises and to identify key problems along the value chain and come up with a range of ideas to address these problems to enhance their livelihoods. The specific objectives are:

- To describe and understand the current livelihood system and production systems and its operation? What is being done at the farm level and along the value chain? How it is being done? Why it is being done in such a way? Who does what? And when is it being done?
- To identify and prioritize major enterprises of the target group.
- To describe and understand the value chain of each of the key enterprises.
- Identify and prioritize major problems/opportunities along the value chain for the priority enterprises.
- To define and analyse priority problems including causes and possible system interactions.
- To explore the feasible options with the key stakeholders and identify potential partners/collaborators.

The output of the diagnostic stage of the process is a detailed description of the circumstances/framework conditions of the target group, current livelihood system, value chains of priority enterprises, a clear definition of the key constraints that prevents the target group from meeting their livelihood aspirations, production potential of the available limiting resources, and the potential interventions to address the priority problems identified.

The major activities involved in the diagnostic stage are:

- Collection, analysis, synthesis and interpretation of secondary information related to the target group—often called as the farmer circumstances (Figure 4).
- Primary data collection from the target group of farmers regarding their livelihood and production systems.



**Figure 4.** *Farmer circumstances.*

Various techniques and tools are used within each of these major activities. The primary data can be collected from farmers, local leaders, farmer groups, village elders, middlemen and other relevant key informants. In the last two to three decades, there has been a rapid development of approaches and tools for diagnosing farm level problems. The most frequently used approaches are Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) and their derivatives. Most commonly used data collection techniques are direct observation, key informant survey, group interview techniques and informal survey. The informal survey procedure often used in the diagnosis is illustrated in Figure 5.

### Criteria for selecting major enterprises

One of the major objectives of informal survey is the identification of priority enterprises and the priority problems associated with these key enterprises. The criteria used in selecting key enterprises and priority problems include:

1. Preference and objectives of the farmer
2. Relative importance of alternative enterprises in the livelihood system (based on current resource allocation, i.e. land and labour utilization and the number of farmers growing the crop(s) or keeping livestock, market opportunities)
3. Research opportunities associated with the crop/livestock value chain, and
4. Specific mandate of the research institute conducting research.

These criteria are not mutually exclusive. Often a combination of these criteria is used in ranking enterprises. Consensus is also sought from the end users during the prioritization process. Thus feedback is very important.

For each one of these priority enterprises, one could develop a value chain. The important thing is to describe and understand the value chain to identify opportunities for value addition and/or increasing the productivity. At this stage one should be able to develop an innovation system for each of these commodities.

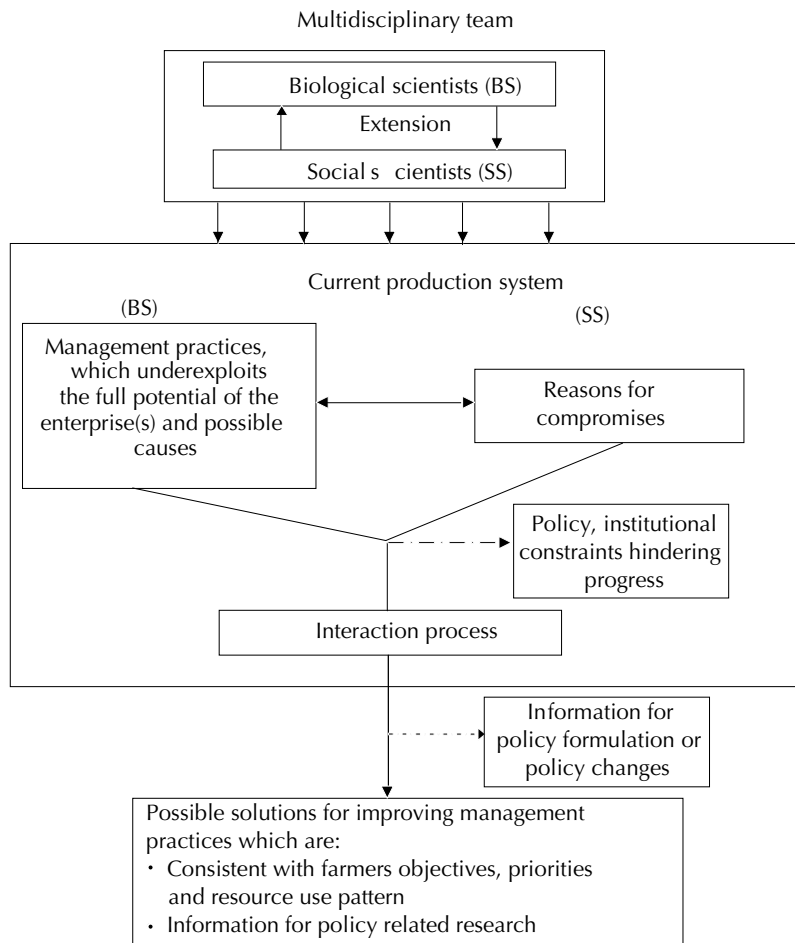


Figure 5. Informal survey procedure.

## Prioritizing problems

In any given target group, within the various value chains, one may identify a large number of problems, which may not all be of equal importance and we may not have adequate resources and capacity to address all these problems simultaneously. Even in a value chain it is very difficult to identify and address all constraints at the same time. So it is important to identify the most binding constraint in the value chain, which constrains the exploitation of the full potential of the value chain. Thus it is important to prioritize the constraints. This could be accomplished in a two stage process.

1. Identify the relative importance of the different components of the value chain. Please remember at this stage the unit of analysis is the value chain.
2. Identify and prioritize the binding constraints within the priorities established in the previous step.

For example in step 1, one could identify the most critical constraint to be input supply or farm level productivity. Then in step 2, one could look at all those constraints inhibiting the realization of the full potential in terms of production at the farm level. This is a two stage ranking process. Then one could complete the problem analysis for the key constraints identified. A close interaction with the key stakeholders is very crucial to ensure success of our interventions. If they do not participate and own the process and identify themselves with the priority constraint and the proposed intervention, then the chances of success may be slim. The most commonly used ranking techniques are: card sorting, single list ranking, pair wise ranking and matrix ranking.

Criteria used for ranking problems are given in Box 1.

#### Box 1. Criteria used in ranking problems

1. Problems important from farmers' point of view
  - Problem affecting farmers most
  - Problem affecting most farmers
2. The frequency with which the problem occurs
3. The probability of achieving the results
4. Potential for improvement once the constraint is removed
5. Time lag involved in generating recommendations
6. The researchers ability to solve the problem based on the available technology
7. Cost associated with research
8. The flexibility of the FS with regard to their problems
9. The political acceptability and conformity to national priorities.

## Planning

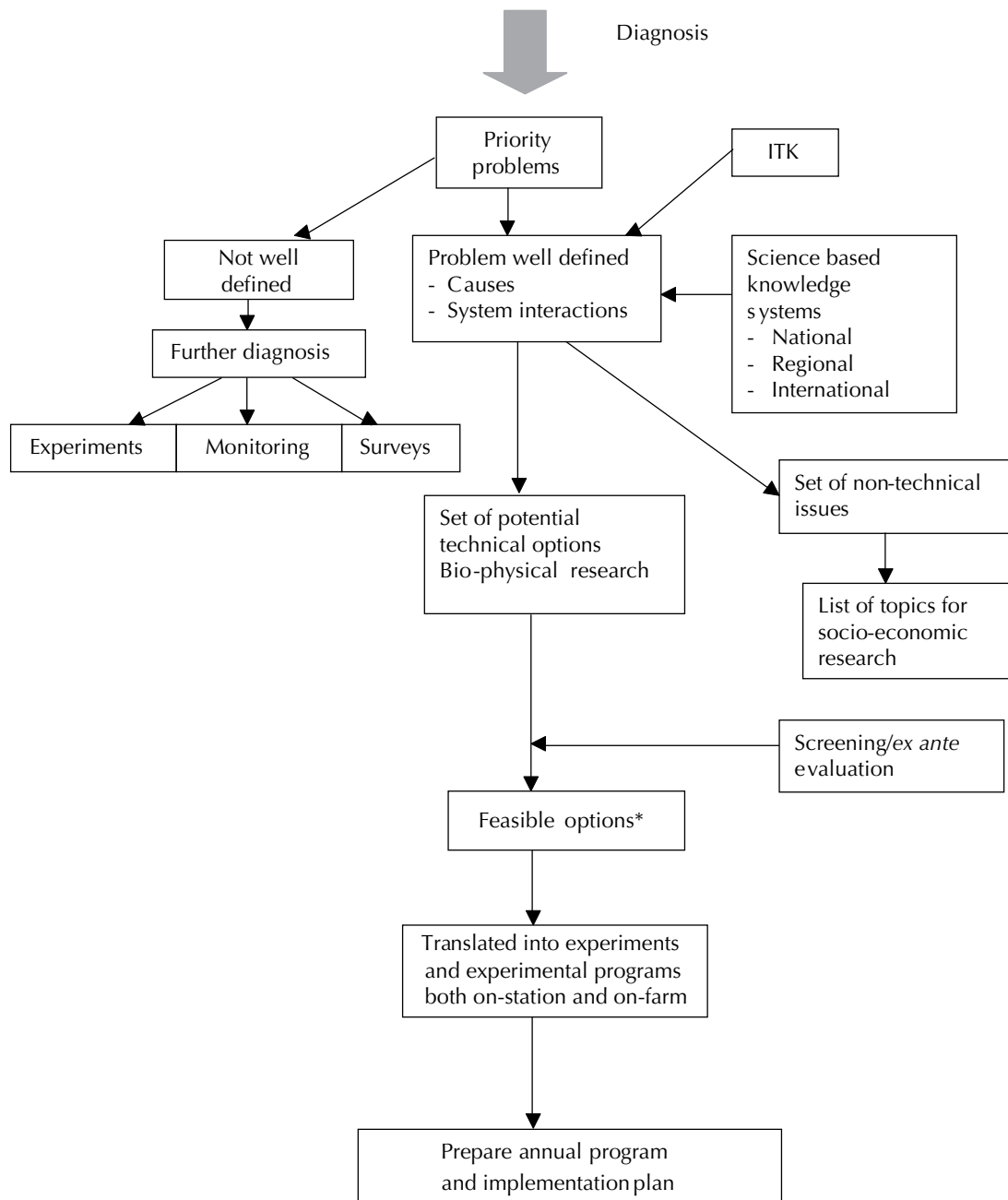
Problem analysis and selection of the appropriate interventions are the crucial steps in the whole process. It combines the diagnostic information, available technical knowledge of the community and ITK (ethnic science) in addressing the identified priority problem(s) of the target group as shown in Figure 6. The key steps involved in the planning process are:

- Problem analysis (establish causes, systems interactions and draw a flow diagram). Examples are presented in Figures 7 and 8.
- Identify potential solutions including ITK, science based solutions and positive deviants.
- Screen the potential solution (*ex ante* evaluation) to identify feasible solution/interventions. A number of criteria can be used for screening (for example, sustainability, equity, competitiveness etc.). See Box 2 for screening criteria.
- Develop an 'innovation system' for this intervention (actual and potential actors, their actions and interactions, institutional arrangements and the framework conditions that influence).
- Prepare problem analysis chart for discussion with the key stakeholders in the innovation systems identified. Seek consensus.
- Plan the details of each intervention to be implemented. Think in terms of INNOVATION.
- Prepare an implementation and annual plan. (Who will do what? How will it be done? When it will be done? Who provide what resources?)
- Develop a monitoring and evaluation plan. How will the performance be monitored and shared. (Indicators, data needs, as well as data collection and information sharing responsibilities.)

For each type of intervention it is important to describe and explain the purpose, specific objectives, procedures and methods to be used, data to be collected as well as the roles and responsibilities to the various stakeholders. An outcome mapping should be done to identify the behavioural changes expected from the boundary partners.

## Implementing interventions

As discussed earlier, an innovation can be technical, managerial, organizational, institutional, policy as well as service delivery type. Thus the nature of the activities depends on the type of innovation as well as where exactly the intervention is in the knowledge generation–use continuum (knowledge generation–knowledge adaptation–knowledge dissemination–knowledge use by the end user).



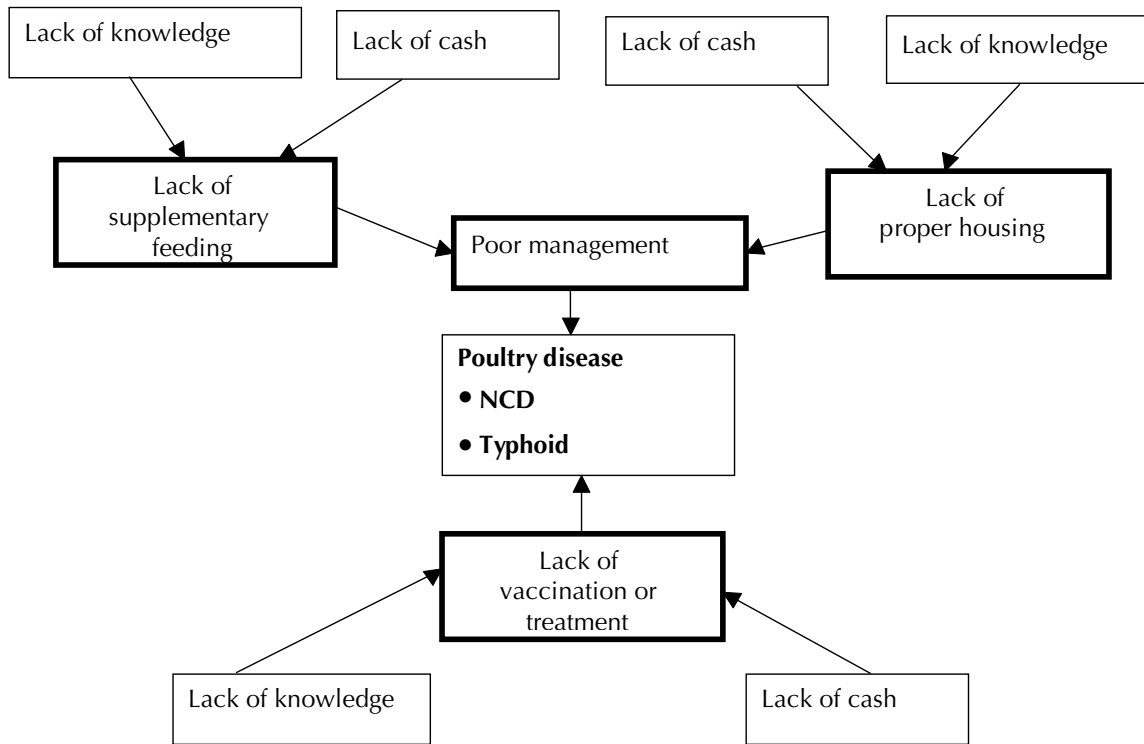
**Figure 6.** *The planning process.*

The intervention could be in the form of an experiment (on-station, on-farm), case study, pilot testing etc. Thus the details and activities involved in the implementation will vary with the type of intervention. Flexibility is also an important element while following an IS approach. One may not be able to identify all the problems and potential issues upfront. One might discover as they start implementing. Action learning is an important element of this approach.

Hence, building in some flexibility in activities would facilitate the process to a great extent.

One of the key activities in the implementation process is monitoring and evaluation. Monitoring should cover the implementation monitoring, processes, output(s) as well as the outcome anticipated. On-going evaluation is crucial for mid-term correction of intervention.

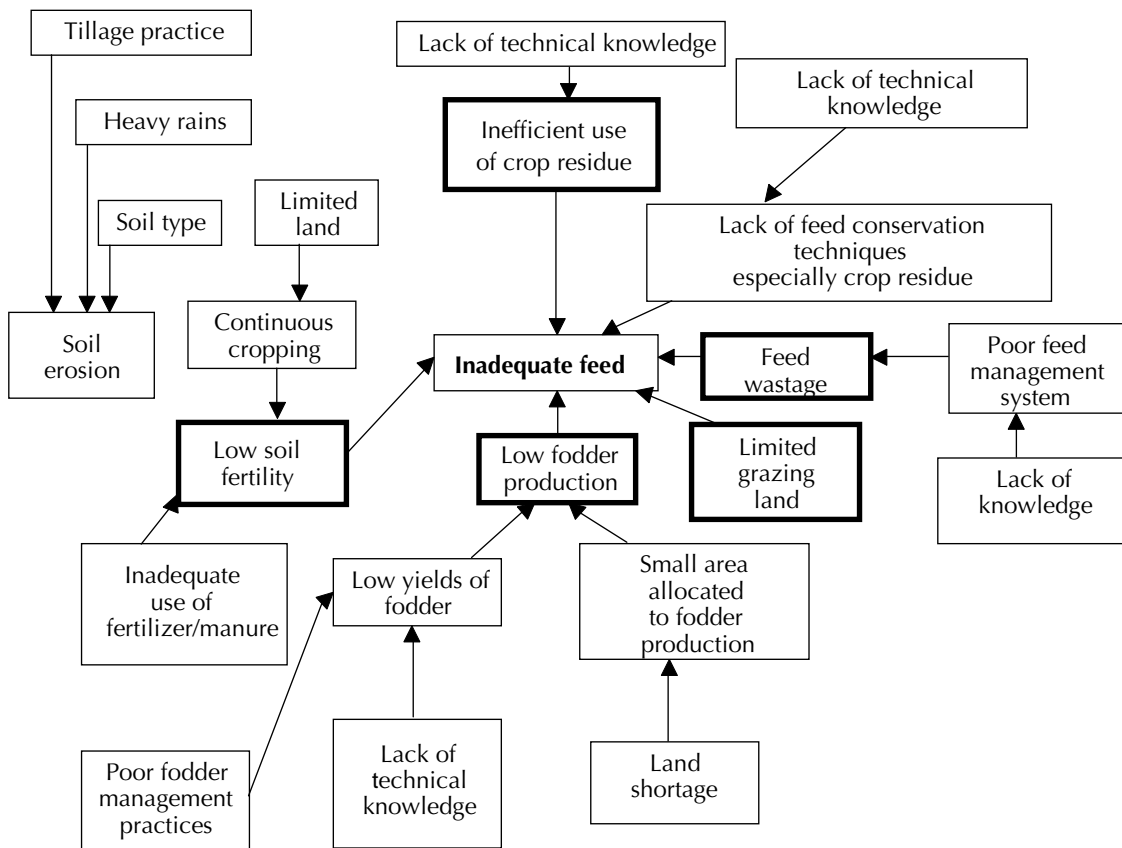




Note: The thicker lined boxes represent primary causes and the others secondary causes.

Source: Matata et al. (2001).

Figure 7. Cause-effect flow diagram—Poultry diseases (Zambia).



Note: The thicker lined boxes represent primary causes and the others secondary causes.

Source: Matata et al. (2001).

Figure 8. Cause-effect flow inadequate feed for cattle (Kenya).

## Box 2. Criteria for screening

1. Technical feasibility
2. Expected profitability
3. Expected risk
4. Relative research cost
5. Simplicity and divisibility
6. Sustainability
7. Farming system compatibility
  - Objectives and preference
  - Resource availability and use pattern
  - Compatibility with available institutions and infrastructure
  - Social acceptability
8. Farmer safety/health hazard
9. Time lag/gestation period

In many instances implementation may involve group formation and management, design and management of partnership; arrangements with stakeholders including negotiations, conflict resolution, risk sharing arrangements etc.

### 3 Evaluation/assessment

In fact the assessment begins at the planning stage, and continues through implementation to impact assessment, *ex post* assessment is done immediately after completion of the intervention and is closely linked to the purpose, objectives and the indicators of success identified. Performance assessment is linked to the targeted output(s), outcomes at this stage are measured at the boundary partner level.

Depending on the nature of the intervention a number of techniques can be used for evaluation purpose—statistical techniques, budgeting techniques, perception analysis, surveys of different types; benefits–cost analysis etc. It is important to involve all the key stakeholders in the assessment process.

An assessment at this stage may lead to replanning with modification or recommendations/best practices for scaling up and scaling out.

**Remember:** Technology/recommendations is a knowledge product but it is not by itself an innovation.

#### Adopting and utilizing knowledge products and processes

This is the final step in the innovation process. Adoption of knowledge products and processes are supported by a number of actors who provide important services to end users. It is important to ensure that these support services are in place to facilitate the adoption and utilization of the innovation. At this stage of the processes the researchers may play a minor role and the major role will be played by the extension staff, input suppliers, marketing agents and others.

It is also important to monitor and document the adoption and utilization process so that the lessons learned can be used in the future planning of projects and programs. In addition, this will also provide feedback to the various actors involved. New and emerging problems can also be identified.

If a full blown impact assessment of the intervention is planned, then the relevant data could be collected at the various stages.

## 4 Summary

You would have noticed that the key steps in the research process are the same as what you are doing at the moment. But the focus is on innovation. Thus the actors and activities involved at the various stages have changed. One of the common problems within the R&D community is ‘throwing out the baby with the bath water’, i.e. discarding everything that we have been doing when we get acquainted with a new concept. It is important to recognize that what you are doing is necessary but the impact of your activities can be enhanced by adding on the missing elements of the new innovation systems paradigm. For a considerable period of time, the research community was wearing a lens which focused on ‘knowledge and technology’ as the final output with very little attention paid to the outcomes. As our thinking evolved the R&D community is viewing the world using a lens which focuses on ‘innovation’ as the end result. Within an innovation framework, knowledge and technology are intermediate products, necessary but not sufficient to create innovation. The innovation concept incorporates:

- Knowledge/technology generation (including transformation of the knowledge into products and processes)
- Knowledge/technology adaptation (intelligent borrowing and testing)
- Dissemination of products and processes (including support services) and
- Adoption and use of products and processes by the end user.

**Please note:** this is not a linear process. It is in fact non-linear with feedback loops.

Hence in designing and implementing research based interventions, consider and involve all those actors who could potentially contribute to all these aspects at the planning stage. Engage them in the process and accept the fact that the role played by each actor will vary as we move down the road towards creating innovation. What is basically needed is a mind set change—an innovation perspective, a learning culture and explicit recognition of the contribution of the various actors towards innovation!!!

Innovation requires accessing knowledge existing in a number of different types of knowledge bases, and hence partnering and other forms of alliances and networking are key innovation strategies. Enough has been written and discussed and it is timely to start practicing, and share experiences in mainstreaming the innovation system perspective. After all, this has been used successfully in the industrial sector. Of course, the procedure should be modified to suit the context and peculiarities of the agricultural sector!

## References

- Anandajayasekeram P, Martella DR and Rukuni M. 1996. A training manual on R&D evaluation and impact assessment of investments in agricultural and natural resources research. SACCAR, Gaborone, Botswana.
- Gittinger JP. 1983. *The economic analysis of agricultural projects*. John Hopkins University Press, Baltimore, Maryland, USA.
- Little IMD and Mirrlees JA. 1980. *Project appraisal and planning for developing countries*. Heinemann, London, UK.

Further reading:

- Matata JBW, Anandajayasekeram P, Kiriro TN, Wandera EO and Dixon J. 2001. *Farming systems approach to technology development and transfer: A source book*. FARMESA, Harare, Zimbabwe. 420 pp.

# Trainer's guide

## Session 5 Tools for applying ISP in agricultural R for D

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Purpose	The purpose of this session is to familiarize participants with various approaches, methods and tools that can be used in applying ISP in agricultural R for D
Objectives	At the end of this session participants will be familiar with participatory tools: <ul style="list-style-type: none"><li>• that can be used while applying ISP in R4D projects</li><li>• to explore and explain the interaction/linkages and knowledge flows between the various actors in an innovation system</li></ul>
Resources	<ol style="list-style-type: none"><li>1. Flipcharts</li><li>2. White board</li><li>3. Flipchart and white board markers</li><li>4. Copies of handouts 5.1, 5.2, 5.3 and 5.4 for each participant</li><li>5. Computer and LCD projector</li></ol>
Time needed	Six hours
Session structure	

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Activity		Time required	Remark
Presentation	<ul style="list-style-type: none"><li>• Distribute handout 5.1 (presentation slides) before you start your presentation</li><li>• Give a presentation on tools for applying ISP in agricultural R for D</li><li>• Allow some time for questions to make sure that participants understand what is presented</li><li>• Distribute handout 5.2 (presentation text) to supplement your presentation</li></ul>	30 minutes	
Exercise	<ul style="list-style-type: none"><li>• Distribute handout 5.3 for exercise 5 exploring tools for applying ISP</li><li>• Ask a volunteer to read the exercise</li><li>• Ask participants to work on the group exercise</li><li>• Remind them the time allotted to the exercise</li></ul>	250 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

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# Session 5: Presentation slides

Slide 1

Session 5

Tools for applying innovation systems perspective in AR4D

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Slide 2

Session objectives

Expose participants to the various tools to

- provide a broad overview of participatory tools that can be used while applying ISP in R4D projects
- explore and explain the interaction/linkages and knowledge flows between the various actors in an innovation system

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Slide 3

Introduction

- Active participation by stakeholders improves the quality, effectiveness and sustainability of development actions
- Various participatory approaches, methods, tools and techniques have been developed to facilitate stakeholder participation in AR4D

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Slide 4

## Common participatory tools for applying ISP in AR4D

Tools used for data collection, analysis and presentation

- Interview techniques
- Ranking and scoring
- Matrices
- Diagramming
- Mapping



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Slide 5

## Interview

- Individual interview
- Semi-structured interview
- Community/group interview
- Focus group interview/discussion



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Slide 6

## Ranking and scoring

- Simple ranking
- Pair wise ranking
- Matrix ranking
- Wealth and wellbeing ranking



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Slide 7

## Matrices

- Stakeholder analysis matrix
- Resources access and control matrix

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Slide 8

## Mapping and diagramming

- Mapping, diagramming and other visual tools are useful for participatory problem diagnosis, planning, and M&E
- Allow complex information and processes to be presented in a simple, easily understood format
- Literate and illiterate people can participate and make meaningful contribution

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Slide 9

## Common visual tools

- SPACE: maps, transects
- TIME: seasonal calendar, daily routine charts, time trends, historical profile
- RELATION: flow and impact diagram, venn diagram, livelihood analysis etc.
- DECISION: decision tree
- RESOURCE USE: resource flow diagram
- CONSTRAINT: problem tree
- MOBILITY: mobility maps

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Slide 10

## Diagramming

- Flow diagram
- Venn/chapati diagram
- Calendars
- Time trends
- Historical profile or timeline

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Slide 11

## Mapping

- Transect map
- Village maps
- Natural resource maps

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Slide 12

## Actor analysis

- Purpose: to identify and assess the importance of key people, group of people, or organizations that may significantly influence the success or failure of the intervention/project
- To define whom to try to involve in designing a multi-stakeholder process and in which way, and it allows to find out whose information needs must be considered
- Can assess the organizational ownership — willingness to undertake and stick with the intervention over time

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Slide 13

## Actor identification matrix

- Step 1: List potential actors
- Step 2: Differentiate and group actors
- Step 3: Brainstorm who are the key actors and why?



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Slide 14

## Actor role matrix

- Step 1: Identify the relevant actors and their roles
- Step 2: Assess performance in each role
- Step 3: Identify gaps and overlaps
- *Roles change over time... Actors might also change...*



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Slide 15

## Actor identification

- Roles important — actors can change
- But all the roles have to be fulfilled...
- Look at actors who are also important for women
- What are the most critical roles?
- Are they all being fulfilled by existing actors?
- If not, which actors can fill the gaps?
- What are the future roles required to achieve the objectives?
- Who are the potential actors who could play this role?



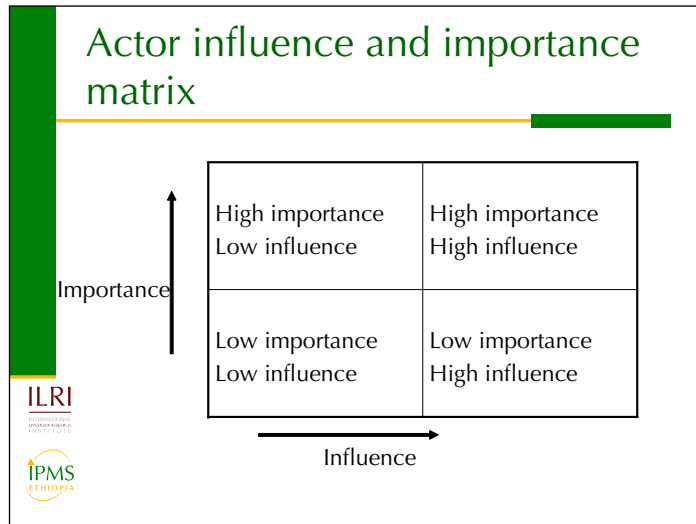
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Slide 16



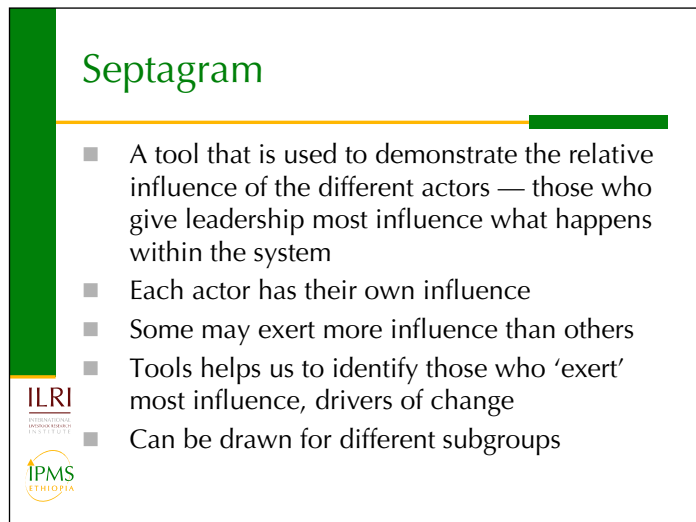
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Slide 17



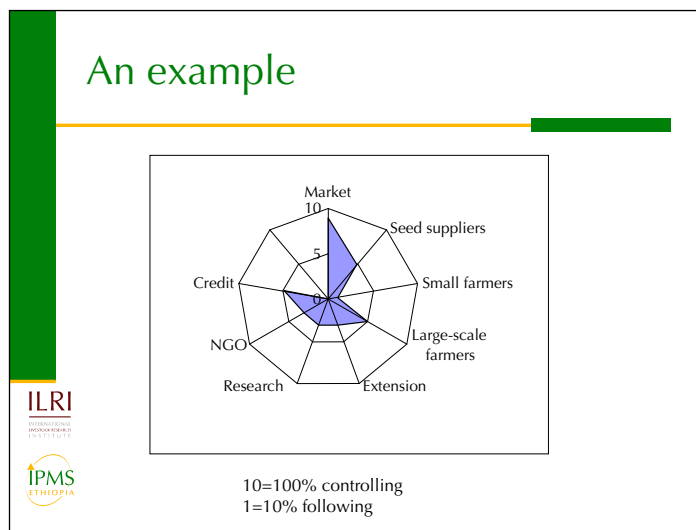
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Slide 18



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Slide 19

## Constructing a septagram

- Identify all the important actors in the innovation system under consideration
- Ask who exerts most influence
- On a scale of 1–10 ask them to identify the relative influence
- Draw a septagram consisting of a circle, and assign one line for each type of actor
- Let the group decide where to place a sticker on the line representing a particular group of actor
- Connect the points to form the septagram
- The stronger the influence, further away from the centre; weaker the influence, closer to the centre

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Slide 20

## Actor linkage analysis

- Purpose: identifying actors who are the actual drivers or hindrance to change — emphasis is on identifying specific social groups or actors, in a specific location at a given point in time
- Tools used: actor linkage maps, actor linkage matrix, actor determinant diagrams, actor time lines

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Slide 21

## Actor linkage map

- Key actors are shown in a map, arrows between them indicating flows of information
- Single two headed arrows are never used — main point is to examine power relationship in the control and flow of information in different directions
- The intensity of the flow can be illustrated by the width of the arrow
- As the number of actors increase, the map becomes complicated

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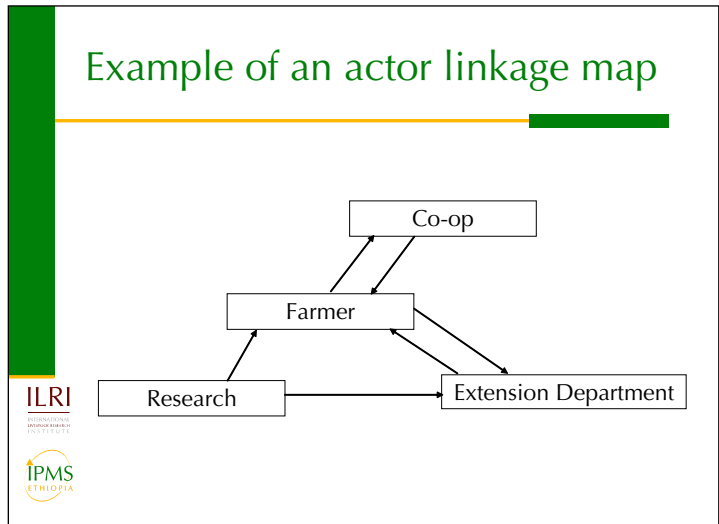
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Slide 22




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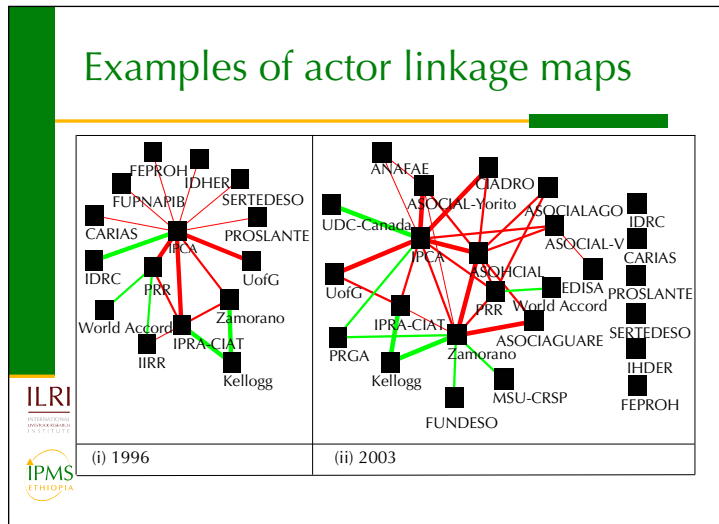


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Slide 23




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Slide 24

### Actor linkage matrix

- Actors are listed along the vertical and horizontal axes
- Cells represent flows of information from the actors in the rows to actors in the columns
- All cells can be identified by their co-ordinates
- Strength can be indicated by using symbols:
  - s = Strong, m = Medium, w = Weak, dn = Don't know

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Slide 25

### Examples of actor linkage matrix

	CBO's	NGOs	Private seed cos	Donors	Farmers
NARO	→Seed →Train farmers	→Seed for dissemination ←Feedback	→ Breeder seed ← Provide feedback	←Funds	→Training farmers →Seed ←Feedback
CBO's (Organized seed group)		→Sell seed			→Sell seed
NGOs			←Sell seed	←Funds	→Seed →Train farmers ←Sell seed
Private seed companies				←Funds	→Sell seed
Donors					

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Slide 26

- ### Advantages of actor linkages matrix
- Can deal with complex situation and more actors
  - It has a cell for every possible linkage — explore all possibilities
  - Helps to pinpoint significant links — more useful for planning, implementation, monitoring, and evaluating change
  - Enable users to condense and store a lot of information about linkages
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Slide 27

- ### Actor linkage maps and matrices
- Which linkages are most critical?
  - Are they all existing now?
  - If yes, how can they be strengthened?
  - What other linkages need to be built?
  - Who will play the linkage facilitation role?
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Slide 28

## Actor determinant diagram

- Similar to problem tree
- A group discussion tool to analyse the nature of a particular linkage
- The starting point is a linkage in the map — one that is particularly significant, needs to be strengthened, weakened, or learnt from
- Diagram maps weakening and strengthening focus on the linkages and helps a group to identify possible areas of intervention
- Often carried out with key actors who would be involved in the 'implementation' of suggested actions



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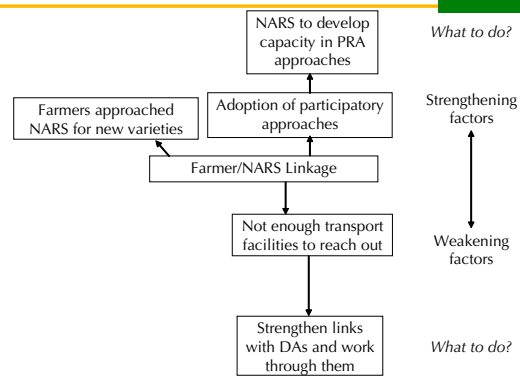
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Slide 29

## Actor determinant diagram



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Slide 30

## Actor time lines

- Lists key past events in the evolution of an innovation
- Key question: which actor made key important decisions at what time in the past
  - Who?
  - What decision?
  - When?
  - Where?
- Establish causal effect relationship



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Slide 31

## Actor time line (cont'd)

- It is a learning and reflection tool to guide future action
- Representation
  - List of events with dates
  - Figure with a sequenced bar chart of actor event over time




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Slide 32

## Actor time line — an example

Time line of major phases in the spread of power tillers in Nepal




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Slide 33

## Innovation tree

- Purpose: to visualize and analyse the way in which innovation is spread over time between community members
- Help both outsiders and the community to understand some of the social and psychological dimensions that influence adoption
- Probing on personalities, to engage in a particular farmer-to-farmer extension activity




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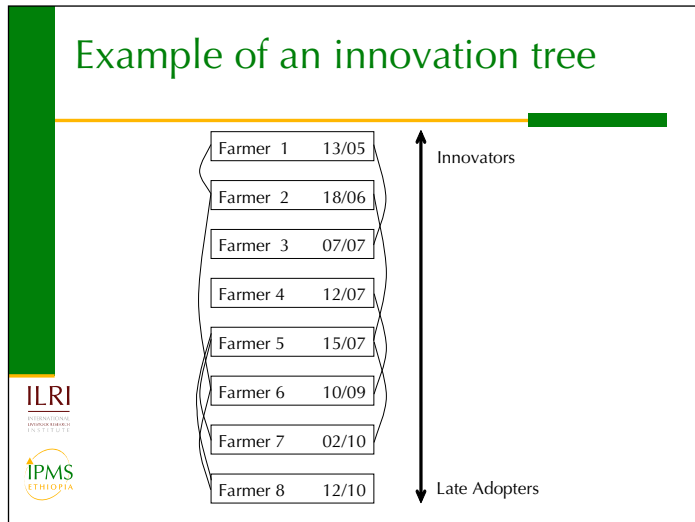


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Slide 34



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Slide 35

### Take home message...

- This is a comprehensive tool box
- A practitioner has to determine the purpose and the context and choose the appropriate tool(s)
- A number of tools can be used for the same purpose. For example, stakeholder analysis, network analysis, actor-linkage matrix, actor-linkage map etc. for the purpose of analysing interactive relationships in R&D. So, what you choose should be determined by the context, relevance, feasibility of use, resource availability etc.

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Slide 36

### Thank you!

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# Tools for applying ISP in agricultural R4D

## 1 Introduction

The past two decades have seen an increased recognition of the importance of participation by beneficiaries and a wide range of other stakeholders in decision-making. Experience has shown that participation improves the quality, effectiveness and sustainability of development actions. A number of approaches have been developed over the years to get the various stakeholders involved in the R&D processes. Participatory approaches such as Participatory Rural Appraisal (PRA), Participatory Assessment and Planning (PAP), Participatory Learning and Action (PLA), Participatory Farm Management Methods (PFM), Participatory Rural Communication Appraisal (PRCA), Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) and Participatory Extension Approach (PEA) are used for different purposes; and irrespective of the purpose, many of them use the same tools in the design, evaluation and implementation. Different tools are used for data collection, data analysis and presentation. This chapter attempts to provide a summary of the existing participatory tools that could be used while applying ISP in agricultural R4D.

*You have been exposed to the Innovation Systems Perspective, which is based on a certain basic philosophy. However, most of the participatory methods and tools, which you are familiar with, are equally useful for employing, understanding and analysing innovation systems. The participatory tools which are discussed in detail in this resource material can flexibly be used, with the necessary adaptation to suit a specific purpose.*

The most commonly used participatory tools discussed in the material can roughly be categorized into:

- Interview techniques
- Ranking and scoring methods/tools
- Matrices
- Diagramming
- Mapping

The chapter then goes on to describe in detail specific tools that can be used for innovation systems analysis such as actor-linkage analysis, network mapping and innovation tree.

## 2 Interviews

Interviews are among the most commonly used technique in agricultural R4D to obtain required information. The interviews can take the form of individual interviews, key informant interviews, community interviews, focus group interviews etc. This section presents different types of interview techniques a researcher can use.

### 2.1 Individual interviews

Structured individual interviews are often used in formal household surveys to collect data from randomly selected rural households. Although informal surveys can provide a lot of information in a relatively short period, there may be a further need for more specific information and quantitative data. Under these circumstances, a follow-up formal survey may be appropriate.

A survey uses a sequence of focused, predetermined questions in a fixed order, often with predetermined, limited options for responses. Surveys can add value when they are used to identify development problems or objectives, narrow the focus or clarify the objectives of a project or policy, plan strategies for implementation, and monitor or evaluate participation. It is important to keep in mind that this formal/verification survey is different from the traditional farm management survey. The distinguishing characteristics of a formal survey are:

- Uses standardized or structured questionnaire;
- Collects uniform set of data;
- Engages, as much as possible, a random sample of farmers to collect information;
- Enumerators are often used to administer the survey; and
- Carries out problem-focused verification.

Since the formal survey collects standard information from a sample of farmers, it enables statistical analysis of information collected to draw inference and conclusion about the population. Formal surveys are recommended in one of the following cases:

- When quantitative data are required to complement qualitative data obtained from RRAs/PRAs;
- When detailed information on individuals or households is sought rather than general information on target group;
- To compare before/after situations and the changes in farmers' conditions over time (baseline and adoption studies);
- To conduct in-depth studies of specific subjects and to test hypotheses that have emanated from informal surveys.

The interview schedule/questionnaire are structured and standardized in such a way that the data to be collected meets the objectives of a researcher and the way the researcher would like to analyse the data. Such an approach to data collection and analysis is common, particularly in quantitative research (positivist paradigm), and the dataset is more amenable to statistical manipulation.

## 2.2 Semi-structured interview

These are also called *conversational interviews*, interviews that are partially structured by a flexible interview guide with a limited number of preset questions. This kind of open-ended guide ensures that the interview remains focused on the development issue at hand while allowing enough conversation so that participants can introduce and discuss topics that are relevant to them. These tools are a deliberate departure from survey-type interviews with lengthy, standardized questionnaires.

Using a guide or a checklist, a multidisciplinary team poses open-ended questions and probes topics as they arise. The output is usually in the form of qualitative information, but can also be quantitative. The steps to follow in a semi-structured interview are summarized in Box 1. There can be sequencing and a chain of semi-structured interviews, which can be repeated as and when required. Semi-structured interviews can be conducted with different groups in a village or community.

### Box 1. Semi-structured interview—steps to follow

#### Before survey

- Select the multidisciplinary survey team;
- Analyse secondary data;
- Prepare checklist for the interview (this should be a team exercise);
- Prepare the logistics for the survey;
- Inform farmers in advance;
- Establish note taking procedure before entering the village; and
- Decide whether group discussion and/or individual in-depth interviews are more appropriate.

#### During a group meeting or individual interview

- Introduce yourself and the purpose;
- Be aware of the local culture and language;
- Respect farmers as equal partners;
- Do not use checklist as a questionnaire—use it as a means to stimulate discussion;
- Build questions to be asked around a list of subtopics;
- Use guidelines for probing: who? why? what? when? where and how?;
- Take notes during the interview but not excessively.

#### After the interview

- Finish the discussion politely;
- Make sure to thank the respondents, mention the follow-up;
- At the end of the day have a brainstorming session, complete notes and prepare for the following day's work;
- Establish report writing procedures as well as responsibilities among team members.

## 2.3 Community interview/group interview

At times, in community development oriented activities, one useful tool that can be used is a community interview. The objectives of this type of interview are:

- To gather descriptive data on community and village;
- To assess community needs/problems and priorities; and
- To assess the attitude/commitment of the community with respect to planned intervention.

The advantages of community interviews are:

- It permits interaction with large group of people within a short period of time, i.e. it is efficient in terms of cost and time;
- In a non-threatening environment, participants tend to complement/correct/verify each others' input, thus improving the quality of the information collected.

However, there are a number of limitations to this approach. They include:

- The local leaders and powerful community members may dominate the deliberations;
- The group may not be homogenous; and
- The facilitator should have considerable practical knowledge about the problem/issue that needs to be explored.

## 2.4 Focus group interview/discussion

Focus group interview is another form of group interview that addresses specific topics/issues confronting a group. Typically 6–8 people under the minimum guidance of a facilitator discuss a particular topic in detail. When the ideas and opinions of people at the grassroots level are needed about a specific problem or intervention, then a focus group interview is the most appropriate technique to use. This type of discussion may reveal the perspective, attitude, understanding and reactions of beneficiaries/local group.

The group interview is cost effective, can be carried out quickly, and can stimulate diverse thinking. The moderator of this exercise should not be biased, must possess good theoretical and practical knowledge of the problem/issue being discussed. (S)he should be fluent in the local language and should have previous experience in conducting focus group sessions.

The potential dangers are that the formal/informal leaders and influential individuals may dominate the discussions. If the issue under discussion is controversial and sensitive, then the group situation may inhibit rather than stimulate individuals' response. Focus groups are not intended to reach consensus, make decisions or agree on specific action.

## 3 Ranking and scoring

Ranking and scoring methods require informants to assess the relative importance of different items. Ranking usually involves placing items in order of importance (1st, 2nd, 3rd etc.) whereas scoring methods assign a value or a score to a specific item. This is usually done by using counters such as seeds or stones, nuts or beans to attribute a specific score to each item or indicator.

Proportional piling and scoring techniques can be used to assess the relationship between two or more given variables. For proportional piling informants are asked to distribute one hundred counters amongst the different variables or indicators, with the largest number of counters being assigned to the most important indicator, and the smallest number of counters being assigned to the least important indicator.

### Before and after scoring

'Before and after' tools are an adoption of scoring methods which enable a situation before a project to be compared with a situation during or after a project. Definitions of 'before,' 'after' or 'during' can be obtained from time-lines which provide a useful reference for establishing agreement between the investigator and assessment participants on these different points in time. With 'before' and 'after' scoring, rather than simply scoring items against indicators, each score is further subdivided to give a score 'before' the project and a score 'now' or 'after' the project.

Specific methods in ranking include simple ranking, pairwise ranking, matrix scoring and wealth and wellbeing ranking, among others.

### 3.1 Simple ranking

As the term implies, simple ranking involves asking participants to categorize or grade items in order of importance. In this example, pastoralists were asked what benefits they derived from different livestock. They were then asked to rank them in terms of the overall benefits they provided. The exercise was done with both women and men's groups to ensure that any gendered differences were captured. In this

example, the only variation was that women ranked sheep higher than goats as they fetched a higher market price. The men valued goats slightly higher than sheep as they are more resilient to drought.

**Table 1.** *Ranking of community livestock assets*

	Women		Men
Cattle	1st	Cattle	1st
Sheep	2nd	Goats	2nd
Goats	3rd	Sheep	3rd
Camels	4th	Camels	4th
Donkeys	5th	Donkeys	5th
Horses	6th	Horses	6th

### 3.2 Pair-wise ranking and matrix scoring

Matrix scoring is primarily used to compare several items against a set of different indicators. It involves three main stages—a pair-wise comparison followed by the scoring of items, and finally ‘interviewing the matrix’.

It is a tool used to elicit the relative importance attached to a list of problems, solutions and technological options by farmers. Farmers’ preferences and decision-making criteria can be learnt during the pair-wise ranking exercise with the help of probing questions. Preference ranking can be used to learn about differences in priority between social categories (men/women, young/old, rich/poor etc).

#### Example of a ranking and matrix scoring of food source preferences

The following example describes how a pair-wise ranking and matrix scoring exercise was used to assess food source preferences in an integrated livelihoods project in Niger. The project had several components; these included re-stocking of small ruminants and the establishment of cereal banks, and vegetable gardens.

During a focus group discussion, participants identified their existing food sources as follows:

- Own farm production (millet)
- Vegetable production
- Purchased food (excluding cereal bank)
- Livestock production (milk and meat)
- Cereal bank (millet) purchases

They were asked to individually compare or rank each food source against each of the other food sources in terms of overall preference. The participants were asked to give reasons for their preferences. The name of the food source that ranked highest was then entered into the appropriate cell in the pair-wise matrix (Table 2)

**Table 2.** *Pair-wise ranking showing food source preferences*

Food source	Millet	Vegetables	Purchases	Cereal bank	Livestock
Millet (own production)		Millet	Millet	Millet	Millet
Vegetables (own production)			Vegetables	Vegetables	Vegetables
Purchases				Cereal bank	Purchases
Cereal bank					Cereal bank
Livestock					

An overall preference score is then calculated by counting the number of times each food source was ranked highest and thus recorded in the matrix:

Score:	
Rainfed cereal production	4
Vegetable production	3
Cereal banks	2
Purchases	1
Livestock	0

From these discussions it transpired that the overall preference for millet from own production was largely attributed to the volume or quantity of food that is produced from this source. The assessment team also asked participants what sources provided the most nutritious or healthy foods as opposed to just the largest quantities. Based on the discussion during and after the exercise, the assessors and participants agreed on four broad categories of food preference indicators:

1. availability (quantity/volume)
2. accessibility (easy to come by/grow/cheap)
3. income earning or savings potential
4. nutritional/health value

Participants were then asked to score the five food sources against each of the four food preference indicators identified. This was done using visual aids to represent each food source. A millet stem was used to represent rain-fed millet production, a broad green leaf was used to represent vegetable production, a handful of coins was used to represent food purchases (excluding cereal bank purchases), a bottle top was used to represent livestock production (milk and meat), and a small bag of groundnuts was used to represent cereal bank purchases. After carefully explaining what each visual aid symbolized, the assessors asked the participants to score each of the food sources against the first food preference indicator using 50 counters. The exercise was then repeated for each of the other three food preference indicators. The physical distribution of counters was done by one volunteer, but this was based on group consensus.

**Table 3.** Matrix scoring of different sources against indicators of preference

	Millet	Vegetables	Purchases	Cereal bank	Livestock
Availability (quantity/volume)	15	12	5	13	5
Access (easy to come by)	22	8	3	13	4
Income earning and savings potential	12	13	0	8	17
Nutritional value	6	17	6	6	15
Total	55	50	14	40	41

Although livestock ranked lowest on the food source preferences during the pair-wise ranking exercise, against specific indicators such as income potential and nutritional value, it ranks much higher than some of the other food sources. Against the four indicator categories shown here, livestock comes out with the third highest overall score, illustrating how matrix scoring can be a valuable tool to measure against different indicators, and capture important information that otherwise may be overlooked.

### 3.3 Wealth ranking

Wealth ranking is a tool for identifying and ranking the relative wealth status of a group of farmers. This is based on the assumptions that there are inequalities and differences in wealth in every community and these differences influence or determine people's behaviour and coping strategies including adoption of technologies. This is also known as wellbeing ranking or vulnerability analysis, and is a technique

for the rapid collection and analysis of specific data on social stratification at the community level. Use of such a tool minimises literacy and language differences of participants as they consider factors such as ownership of or use rights to productive assets, lifecycle stage of members of the productive unit, relationship of the productive unit to locally powerful people, availability of labour and indebtedness.

Wealth ranking allows the team to investigate perception of wealth differences and inequalities in a community; discover local indicators and criteria of wealth and well-being and; establish the relative position of households in a community. It is based on the assumption that community members have a good sense of who among them is more or less well off. There is a need to maintain confidentiality, not to cause bad feelings within community. This is often done by involving key informants by a facilitator.

Steps in wealth ranking:

1. Choose the community for wealth ranking;
2. Define the unit of ranking (normally household);
3. Define and understand the local concept of wealth;
4. Identify criteria and indicators for wealth ranking;
5. Make a list of all households—assign numbers;
6. Identify at least three key informants;
7. Ask key informants to sort cards independently, using their own criteria—use baskets or boxes;
8. Establish criteria used and differences between piles.

The result for each key informant is tabulated and a score for each household is given depending on its grouping. For instance, if the first key informant divided the community into four wealth groups and placed Household 9 in Group IV (the lowest group) then Household 9 is given a score of  $\frac{1}{4} = 0.25$ . If the second key informant divided the community into five wealth groups and placed Household 9 in Group V (the lowest group) then Household 9 is given a score of  $\frac{1}{5} = 0.2$ .

Households are then ranked according to the total scores received and divided into overall wealth grouping. At least 3 key informants are recommended for every 100 households. Table 4 gives a hypothetical example in which 3 informants sort 15 households into, respectively, 4, 5 and 4 wealth categories, arranged in descending order from left to right.

**Table 4.** Analysis of wealth ranking of 15 households by three key informants

Households	Informants			Total score	Group
	1	2	3		
9	0.25	0.20	0.25	0.70	IV
11	0.25	0.20	0.25	0.70	
12	0.25	0.20	0.25	0.70	
2	0.25	0.40	0.25	0.9	
1	0.50	0.40	0.50	1.40	
7	0.50	0.40	0.50	1.40	III
4	0.50	0.60	0.50	1.60	
6	0.50	0.60	0.50	1.60	
3	0.75	0.60	0.50	1.85	II
15	1.00	0.80	0.25	2.05	
14	0.75	0.60	0.75	2.10	
5	1.00	0.80	0.75	2.55	I
13	0.75	0.80	1.00	2.55	
8	1.00	1.00	1.00	3.00	
10	1.00	1.00	1.00	3.00	

## 4 Matrices

A matrix is a table with certain rows and columns which can be used for data collection, data analysis and presentation. Matrices serve different purposes in participatory R4D. This section provides examples of some commonly used matrices.

### 4.1 Stakeholder Analysis Matrix (SAM)

Stakeholder analysis also describes the stated or unstated interests of actors *vis-à-vis* the intervention as well as the degree of their influence or organizational ability to mobilize behind a common purpose. The SAM matrix summarizes this information succinctly.

**Table 5.** *Stakeholder Analysis Matrix (SAM)*

Stakeholder categories	Relevant stakeholders	1. Characteristics (social, location, size, organizational capability)	2. Interests in relation to the intervention (effects on/effects of policy)	3. Influence on outcome (H = High, M = Medium, L = Low)
Government policymakers				
Implementing agency staff				
Intended beneficiaries				
Adversely affected persons				
Organized interest groups (e.g. business associations, trade unions)				
Civil society (e.g. NGOs, CBOs, religious organizations), donors				
Other external/international stakeholders				

### 4.2 Access and control profile matrix

Access and control profile is related to asset control and realization of benefits. This tool is used to specify access to and control over the resources and benefits by different community groups and, especially by gender. The objective is to identify resources women and men require for their work and benefits they gain; identify who has access to or control over these resources and benefits; analyse the implications of men and women participating in the interventions; find solutions to address barriers related to access and control over resources and benefits. The access and control profile could be general or sectoral.

#### Procedure

- Group farmers by sex;
- Explain the purpose of the tool and the exercise;
- Prepare a sheet for recording information;
- Ask participants to identify the major types of resources and assets;
- Ask who has access and who controls these resources and assets;
- Ask what the sources of benefits are, who receives it and uses it—if possible establish purpose.

#### Key questions on resources

- What resources do men and women require for their work?



- Who has access and control over these resources?
- How will access to and control over the resources affect men's and women's participation in interventions?

Key questions on benefits

- What benefits do women and men obtain from their work?
- Are the benefits commensurate with their work?
- Who controls these benefits?
- How will access and control of benefits affect men's and women's participation in interventions?

At the end of this exercise, the group should be able to complete Table 6.

**Table 6.** Format to elicit access and control profiles

Resource/assets	Who has access	Who controls	Benefits		
			Source of benefit	Who receives	How used by whom?
Land					
Irrigated land					
Draught animals					
Dairy animals					
Small ruminants					
Poultry					
Farm implements					
Manure					
Irrigation water					

### 4.3 Participatory budget

This method seeks to quantify the use of resources while avoiding the limitations of traditional farm management methods. To prepare participatory budget, a row of holes in a board or on the ground can be used. Stones, beans or any seed can be used as a counter to measure the quantity of resources used. The time period is represented by each hole and the resources are indicated by different coloured beans and different rows. The monthly labour input for the activities are represented by the number of beans. Each enterprise is represented by a row. Different colours can represent the different type of labour (hired, family, male, female etc.). Figure 1 presents an example of a participatory budget for a maize enterprise.

The potential benefits of participatory budgets are:

1. It improves communication between farmers and researchers, farmers and extension staff, as well as among farmers;
2. The tool helps analyse past activities;
3. It helps plan and assess the feasibility of planned activities;
4. It explores the implications of using new technologies;
5. It helps compare two or more enterprises;
6. It assesses the risk involved; and
7. It gains information on resource use, which is important to the farmer and this varies with time.

Two limitations of participatory budgets are:

- Participatory budgets are not appropriate for a group of farmers since resources of a particular farmer must be used in preparing the budget. May work well with individual farmers.
- It is time consuming, hence costly.

Months	Activities	Number of people	Number of days	Number of animals	Number of days	Money spent	Outputs	'Cash balance'
Aug.		1	1			20		
July		2	10	2		200	2000 2000 2000 2000	
June		2	10					
May		2	20					
Apr.		3	10				2000	
Mar.		2	10				2000 2000	
Feb.		1	10					
Jan.		1	20	2	10			
Dec.		3	10	2	10			
Nov.		3	10	2	10			
Oct.		2	10	2	10	2000 2000		20000
Sep.		3	10	2	10	200		

= \$100      = \$10      = 1 tonne

Figure 1. Example of a participatory budget for a maize enterprise, Buhera District, Zimbabwe (with annotations).

## 5 Diagramming

Diagramming, mapping and other visualization tools can play a valuable role in the participatory research process, from problem diagnosis and planning to M&E. They allow complex information and processes to be presented in a simple, easily understood format. Both literate and illiterate people can participate and make meaningful contributions.

Many people find images easier to understand and remember than text (i.e. they are 'visualizers' rather than 'verbalizers'). Drawing a diagram shows the relationships or linkages between different concepts or variables more clearly and immediately than is possible with text. Establishing the relationship of new information to that already assimilated is considered to be one of the most important cognitive processes in learning. Drawing diagrams therefore stimulate thinking about a situation.

When diagrams are constructed as a group process, they aid brainstorming, analysis, communication and a common understanding of a situation. Most communication is mediated by language. Often, concepts are difficult to explain or appreciate in another language, but can become clearer when visualized as an image or diagram. When working with people of different cultures or different languages, diagrams can therefore help overcome the language barrier. Also, people that are considered to be 'illiterate' (because they cannot read or write) can often show considerable analytical capability when they can express themselves in diagrams in an environment and using materials with which they are familiar. Getting people to analyse the current situation as expressed in a diagram is a good way to initiate a discussion of what could be changed, the impact these changes would have, and hence what sort of future could be possible. Diagrams thus facilitate 'visioning' of alternative futures by rural people.

The diagrams that are commonly used are summarized in Box 2. Some of the most commonly used diagrams are described in detail in this section.

### Box 2. Commonly used diagrams

Dimension	Diagram
Space	Transects
Time	Seasonal calendar, daily activity calendar, time trends, historical profiles
Relation	Flow diagram, Venn diagram
Decision	Decision tree, innovation tree
Constraints	Problem tree

### 5.1 Flow diagrams

Flow diagrams show causes, effects and relationships between key variables. There are many variations of flow diagrams. The most commonly used is a problem causal diagram, which is very useful in problem analysis.

Steps in building problem causal diagram:

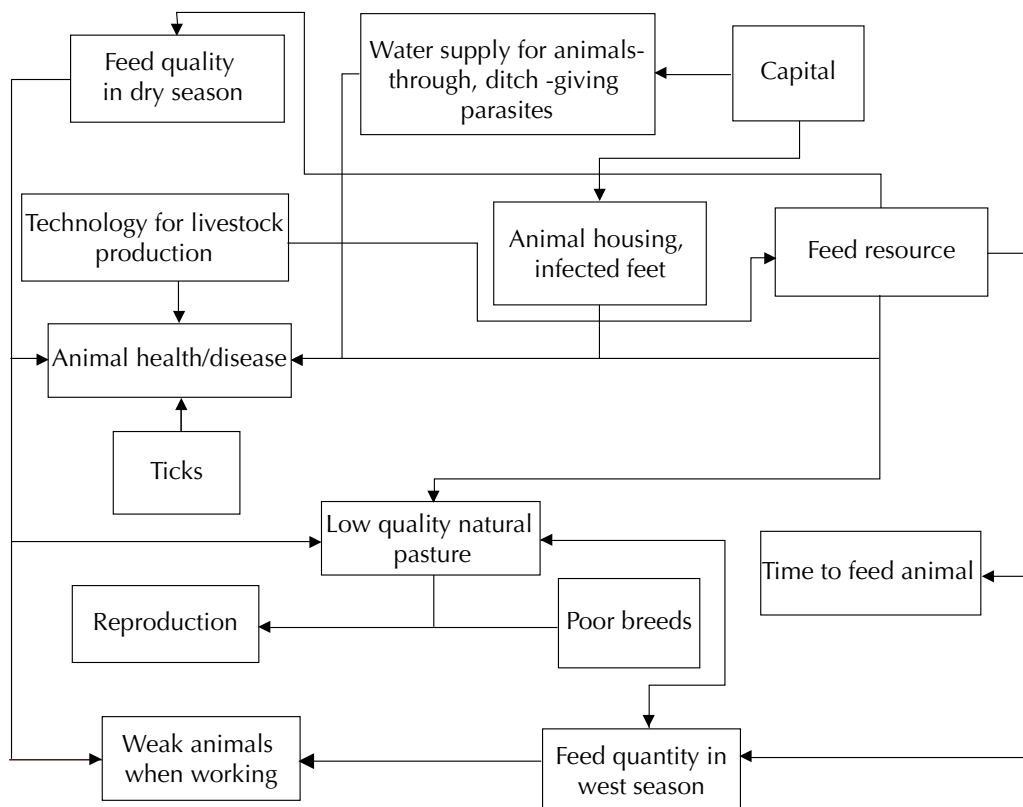
1. Identify the problems to be analysed;
2. Consider one problem at a time;
3. Put the problem at the centre and circle it;
4. Explore the causes of this problem;
5. Write each cause on a separate card;

6. Discuss and probe until no more causes can be identified;
7. Place causes cards in correct relationship to the problem; and
8. Draw arrows to show the cause-effect relationship.

Farmers in M'Drak, Vietnam came up with the following problems with their livestock system (Cramb and Purcell 2001):

- Lack of capital
  - Climate
  - Draught power is poor
  - Feed availability
    - Dry season
    - Wet season
  - Feed quality
  - Genetics and breeding
  - Poor grass species
  - Lack of grazing land
  - Slow live weight gain
  - Animal housing
- Animal health
  - Labour availability
  - Poor management knowledge
  - Low reproduction
  - Thin animals
  - Lack of supplements
  - Ticks
  - Lack of veterinary supplies
  - Lack of drinking water

The diagnosis was conducted in 6 villages (separately) with group size ranging from 30–60 farmers depending on the village size; and took about 10–15 minutes for each village, including ranking exercise. With the help of probing questions, the farmers conducted problem analysis and developed a flowchart of livestock problems to show or demonstrate the interrelated nature of the identified problems (Figure 2).



Source: Cramb and Purcell (2001).

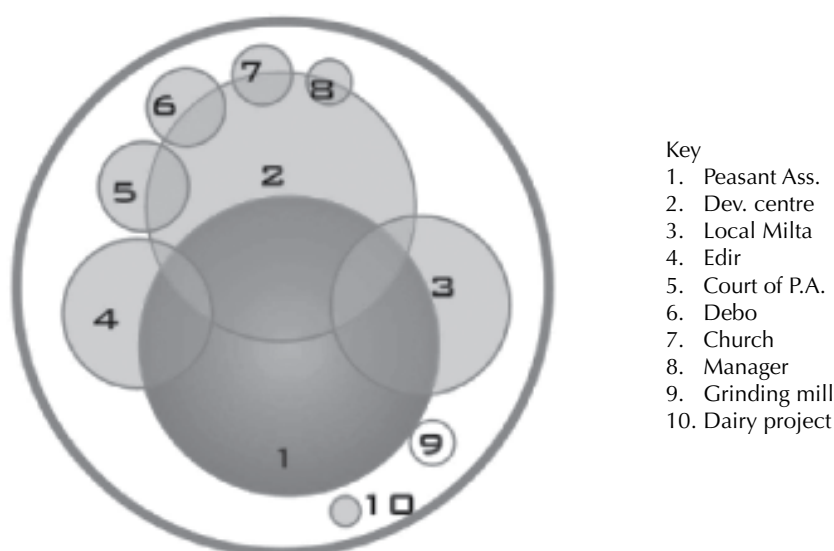
**Figure 2.** Farmers' flowchart of livestock problems

## 5.2 Venn diagram/'Chapati' diagram

A Venn diagram shows the key organizations and individuals in a community and their relationships and importance in decision-making. These are drawn to help understand the current formal and informal institutions in the area under study and the extent or overlap of decision-making and cooperation. They highlight gaps between organizations, opportunities for better communication and cooperation, conflicts and sometimes the need for a new organization. In particular, they identify the locally perceived role outside agencies play in the village. Venn diagrams are very useful in identifying collaborative partners in a rural setting. The source of information is the community.

Keys to the Venn diagram:

- Separate circle means no contact;
- Touching circle means information passes between institutions;
- Small overlap means some cooperation in decision-making;
- Large overlap means considerable cooperation in decision-making;
- Size of the circle indicates importance or scope;
- The distance of the circle from the centre indicates the relative importance of the agency/ organizations to the subject under investigation.



**Figure 3.** Venn diagram of institutions in Anokere Development Centre, 1998.

## 5.3 Trends/calendars

Calendars are diagrams showing the timing and/or importance of events over a period of time—be it a year, production season or a day. Some commonly used calendars are:

- Seasonal calendar—main activities during seasons and off-season;
- Rainfall patterns—annual rainfall distribution;
- Crops/livestock, different practices—enterprise calendar;
- Labour calendar;
- Water sources for livestock during the year or season;
- Labour migration;
- Prices of products—seasonal;
- Daily activity clock for men and women, winter and summer, cropping season and off-season etc.

## 5.4 Seasonal calendars

Seasonal calendars are a useful tool for charting major events and village activities on an annual timetable. Issues to be recorded will vary and should be discussed. Typical examples are climate, crops, pest and diseases, water use, labour availability and demand, livestock fodder, prices, income, debt, migration, health, diseases and so on. Such diagrams highlight the times of constraints and opportunity, which can be critical information for planning and implementation. They help determine labour availability, timing of project activities, times of diseases and food shortage etc.

It is a useful tool to understand and discuss with community how seasons affect village life and how daily routines are organized. The calendars can be drawn for different groups according to types of farmers/ agro-ecological zones, age, gender etc. An example of a seasonal calendar is provided in Figure 4.

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kunowa (Maize)						X	XX	X				
Kulonga (Maize)						X	XX					
Mebele				X	X	XX	XX	X				
Kutema Mebele												
Kujjima Mebele											XX	X
Kubingla					XX	X	X	X				
Kunowa							X	XX	X			
Kulonga									XX			

**Figure 4.** Seasonal calendar for non-bee keeper men.

## 5.5 Time trends

Time trends show quantitative changes over time of the same variable. Trend lines visualize significant changes of key issues in the community over time. Topics for trend lines often reflect themes that the people consider important like yields, cultivated area, livestock population, prices, migration, population size and number of households (HH), birth and death rates and malnutrition rates. A time trend is different from a historical profile or a timeline in that a time trend is more precise in giving indication of change (increase or decrease) about a particular item whereas historical transects or timelines show broad movements of different aspects of village life rather than their precise shifts.

## 5.6 Historical profile/time line

A time line is a list of key events in the history of the community that helps identify past trends, events, problems and achievements in the people's life. The time line should go back as many generations as villagers can recall and record details of significant events. It reveals important information that aids better understanding of the current situation in the community. Understanding the past of a particular community is often necessary to analyse present conditions, and to try to forecast how present conditions may evolve in the future. The time line helps the community to understand what local, national and international events they consider to be important in their history, and how such events have affected their lives. Knowing past events might show how and why individual and community activities have been shaped.

The time line can be done with a group of elderly villagers, knowledgeable about their village, by asking them to provide a historical account of village conditions or with different tribal/cultural/economic groups. It can be done separately with males and females to bring out differences in perspective. The profile helps to be informed about major events and changes in conditions that have taken place in the past, e.g. changes in cropping patterns, changes in vegetation, traces of environmental degradation, infrastructural changes, adoption of technology etc.

Timeline summarizes a complex process of change and enables stakeholders/actors to understand the context in which change has occurred and to appreciate the range of different factors that have given rise to the current situation (see Figure 5).

Historical time line (agriculture)	
1947	Drought and the introduction of yellow 'Kenya' maize meal
1953	Another drought but not as serious as the 1947 one
1962	Marketing of produce began at Hughes' (Huzzze) store or Matigimu's @ \$6/91 kg bag
1967	Drought
1976–81	Marketing at GMB Masvingo
1979	Use of fertilizers amid fears that they destroy the soil
1982/83	Serious drought, Kenya
1986–90	Marketing at Masvingo Co-operative Union; poor pricing policies
1990–present	Marketing at Nyika growth point
1991	Talk of dam began and surveys carried out
1992	Devastating drought; food hand outs; widespread livestock deaths
1992/93	Construction of dam and other ancillary irrigation infrastructure

Figure 5. An example of a timeline.

## 5.7 Resource flow diagrams

Resource flow diagrams are widely used to analyse the flow of resources/nutrients in sustainable agricultural systems. This technique involves the drawing of a farm map on the ground and adding arrows to show the flows of resources between on-farm activities (see Figure 6). Flows to and away from the farm can be also added: once again the quantity of resources is indicated by the number of beans, and different resources are represented by different colours.

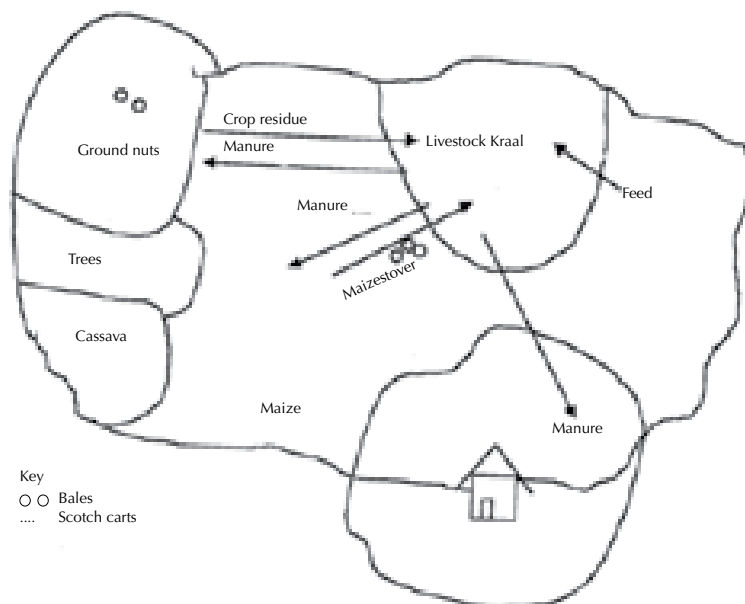


Figure 6. Example of a resource flow diagram.

## 6 Mapping

Mapping is a generic term for gathering baseline data in pictorial form on a variety of indicators. This is an excellent starting point for participatory work because it gets people involved in creating a visual output that can be used immediately to bridge verbal communication gaps and to generate lively discussion. Maps are useful as verification of secondary source information, as training and awareness-raising tools, for comparison, and for monitoring of change.

The different types of maps drawn include village map, village social map, village resource map, mobility maps and transect map. Maps show the geographical arrangement of key features of an area including individual fields, farms, villages/communities/districts, physical infrastructure, social infrastructure, cropping system, water sources, woodlands, major physical features, land tenure system and, grazing areas depending on the purpose of the map.

The procedure for participatory mapping includes the following steps:

1. Decide on what sort of map needs to be drawn;
2. Find people who know the area and understand the process of the mapping exercise and are willing to share their knowledge;
3. Choose a suitable place (ground, floor, paper) and medium (stick, stones, pins, pencils) for the map;
4. Explain clearly and carefully the purpose of the map;
5. Help people get started but let them draw the map by themselves; be patient, do not interrupt;
6. Keep a permanent record of the map, including the names of the mappers; do give them due credit.

While mapping, a few points need your attention.

- Participants might need to be separated into different groups in order to obtain unbiased view of the subject. Ideally, the group size should not exceed 15 members.
- As mapping takes time, choose a comfortable location which is reasonably free from distraction.
- Use local material as much as possible (sticks, stones etc.), but also take material like coloured chalk to use on cement floors or coloured pens to be used on paper.

### 6.1 Transect map

A transect is a diagram of main land use zones in a community or a village. It compares the main features, resources, uses and problems of different zones. Transect maps are particularly useful when there is a range of land use systems in one community. A transect walk is a simple technique used to build transect maps. This ensures that the team fully explores the spatial differences in the area under study. This might be a region, catchment, village or field. The team walks through to the periphery, observing trees, livestock, availability of water and so on. The transect diagram produced is a stylized representation of a single or several walks by the team. The importance of a transect lies not only in knowing the agro-ecological zones in rural areas, but also in getting an in-depth account from the participating villagers from such zones in the village, their uses, problems and opportunities. A transect walk can be supplemented by other walks so as to enable the outsiders to learn more about any village and clarify doubts.

Steps in doing a transect:

1. Identify community members who are knowledgeable and willing to participate in a walk through their village and surrounding areas;



2. Discuss the different aspects to be indicated in a transect map (crops, land use, trees, soils) and which route to take;
3. Walk the transect;
4. Observe, ask questions and listen;
5. Discuss problems and opportunities;
6. Identify the main natural and agricultural zones and sketch distinguishing features including soils, crops, livestock and problems/solutions/opportunities;
7. Draw the transect map;
8. Crosscheck the transect map with key informants.

While doing a transect walk and the map, a few points need your attention:

- The route must be planned with the villagers;
- The route should pass through the main land use system;
- Stop when interesting issues arise that are important;
- Divide responsibilities among team members' crops, land tenure, soil types etc.;
- Prepare the diagram as soon as the walk is completed;
- Probe on the farming system, severity of the constraints and degree of consensus amongst villagers.






					
Land use	Grazing Natural resources [Veld products]	Residential Natural resources [Veld products]	Natural resources [Veld products]	Residential Natural resources [Veld products] Kraals	Grazing Natural resources [Veld products]
Vegetarian	<i>Grass truffles,</i> <i>Grevia flava,</i> <i>Grapple, Acacia,</i> <i>Erioloba, A.</i> <i>Merifera, Setusbo,</i> <i>Mothajwa,</i> <i>Dikgalo, Mongune,</i> <i>Leafa,</i> <i>Motshulo,</i> <i>Motjiddi,</i> <i>Monna-montshu</i>	<i>Grevia flava,</i> <i>Acacia hebaclata,</i> <i>A. Erioloba,</i> <i>Konkwane</i>	<i>Grevia flava,</i> <i>Seluka,</i> <i>Konkwane</i>	<i>Grevia flava,</i> <i>Acacia erioloba,</i> <i>Konkwane</i>	<i>Mokha,</i> <i>Acacia</i> <i>erioloba,</i> <i>Grevia flava,</i> grass, grapple
Soil	Fine red sand	Fine light sand	Hard black crust, [Ved products]	Greyish sand	Fine red sand
Socio-economic indicators	Veld products	Weaving, business, beer brewing, leather tanning	Grazing	Veld products, business, beer brewing, road	Veld products
Water			Water pump, sunk borehole		
Problem	Over utilisation, plants are all seasonal, decreases in trees				

Figure 7. Example of a transect map.

The following sections describe specific tools that can be used while applying ISP in AR4D.

## 7 Actor analysis

Actors are all those people who have a stake (or share) in a particular issue or system. Stakeholders can be groups of people, organizations, institutions and sometimes even individuals. Other terms sometimes used in a similar way to stakeholders are 'actors' and 'interest groups'. The word 'actors' stresses that stakeholders are active and interact with each other. The use of the words 'interest groups' indicates that people can be grouped according to a common interest. In this document, we use the terms 'actors' and 'stakeholders' synonymously.

Actors can be at any level or position in society, from the international to the national, regional, household or intra-household level. Actors include all those who affect and are affected by policies, decisions or actions within a particular system.

Why is an actor perspective important?

Agricultural development often fails because the actors are not given enough consideration. Each actor has a different interest in the situation. Actor analysis is becoming more common in project settings. It attempts to deal with actors' multiple and often conflicting views, interests and objectives.

The term actor analysis was first used in management science for identifying and addressing the interest of different actors in business. Nowadays, actor analysis is frequently used for:

- policy formulation,
- project formulation,
- implementation and evaluation, and
- understanding and analysing complex situations in natural resource management.

Actor analysis is a way of understanding a system through its actors. It looks at their interest, objectives, power and relationships. Actor analysis will also show existing patterns of interaction between actors. It will show conflicts and can help find ways to resolve them. By understanding the system, it is possible to facilitate change.

In a project setting, actor analysis can help to improve performance:

- By helping to identify trade-offs between different actors objectives, and the conflicts between them. As a result, project efficiency and effectiveness can be improved.
- By helping to evaluate policy and project impacts, e.g. the distributional, social and political impacts of policies and projects. It can highlight the needs and interest of powerless people.

In considering actors, it is sometimes helpful to consider their importance and influence.

- Important actors are those whose needs are important to a project or study.
- Influential actors are those who have the power to control decisions in an activity or who can influence others in the decision-making process.

Importance and influence are not the same. For example, rural women farmers might have been identified as an important actor for equality purposes, but they may have traditionally little influence in decision-making processes.

Actor analysis responds to the question: which and whose interests matter in agricultural R&D intervention? It sets the domain of people, groups and organizations that should be taken into account when planning intervention by examining their interest and potential impact on them. The basic output is the identification and description of actors that an intervention is explicitly designed to help, as well as those whose involvement is required to make the intervention work. The identification process disaggregates these actors in different characteristics, including:

- Structural: gender, age, geography (location or rural/urban), occupation
- Economic: employment sector, firms or business associations
- Political
- Social

Identifying actors is an iterative process. New actors are often identified by existing ones. To avoid missing important actors, it is important to review this regularly. Some actors will be important at the beginning of the process but not at the end. Others may not be important at the start but become more important later. The final selection of actors depends on the people responsible for the assessment. They have to develop criteria for identifying who should be considered actors.

Actor analysis uses groups like: communities, government or private sector. They are considered to be quite homogeneous. Obviously they are not. Communities are socially diverse—with individuals being differentiated by gender, caste, wealth, age, occupation etc. All these give social identity but divide people and cut across 'community' boundaries. The researchers and the actors themselves should determine which groups need to be subdivided, as and when the different interests become significant to the research questions or project.

While secondary literature is an important resource, actor analysis *cannot be carried out without key informant interviews* that identify specific actors relevant to the sustainability of the intervention. While some important information may be quantifiable, other information is inherently more subjective. Accordingly, the reliability of findings—especially on influence and importance—depends on direct interaction with diverse actors. Limiting interviews to a narrow group, such as government officials or big businesses, can generate a highly distorted picture of interests, intentions and influence.

For actor analysis, actor identification matrix, actor role matrix, actor perception matrix, information needs matrix, actor benefits matrix, actor importance and influence matrix and, septagrams can be used.

It should also be noted that the use of these tools by themselves does not make a process 'participatory'. The information can be gathered on a consultative basis, analysed and acted upon by a research team; or the matrices can be drawn up, analysed and acted upon by the actors themselves (albeit with an outside agency acting in a facilitative role). Whether a process is participatory depends not on the tool, but how it is used.

## 7.1 Actor identification matrix

### Uses of an actor identification matrix

The actor timeline gives an initial indication of the various actors that were involved in the innovation process. This will be further enhanced by using an actor identification matrix. The actor identification matrix helps to bring clarity and transparency to the process of identifying the actors in the problem situation. It also makes a first assessment of the relative importance of the different actors for the functioning of the system or problem situation. Actor identification can contribute to the planning and implementation of a successful project. One contribution lies in the more rigorous decisions about which actors to invite in the planning and implementation of projects. A further contribution comes from the improved understanding of whose interests are to be analysed.

### Steps to make an actor identification matrix

#### Step one—List potential actors

Working from secondary data, case study or other documents, actor time line list out all the persons, groups, organizations who might be actors in an innovation process. Working from interviews with key informants add to this lists other actors who play a significant role relative to system under study in policymaking, knowledge generation, utilization and exchange of information. In this early stage the team should not focus too narrowly: try to think beyond the classical triangle research–extension–farmers, but if relevant include the market, private sector, NGOs, and others. When in the field, try to include the actors themselves as much as possible in the assessment about the relevance of other actors.

#### Step two—Differentiate and group actors

Working from the long list of potential actors try to identify clusters of actors that might be grouped as one because they pool resources together or talk about the issue of concern in the same way. Sometimes it might be necessary to differentiate subgroups within an actor group. For example ‘farmers’ or ‘communities’ are not homogeneous entities but can be differentiated based on gender, age, tribe or cast, or economic class. Finalize a list of potential actors.

#### Step three—Brainstorm who are the key actors and why

Through short brainstorming sessions with key informants or focus groups of relevant actors discuss the importance of each actor. Generate as many ideas as possible, do not try to limit them too much in this phase. The ideas can be clarified but not criticized in such brainstorming sessions. The ideas should help make choices about who is important for improving the functioning of the system and why. The session should not just identify which actors are considered key but take note of the reasons why an actor (and/or his/her contribution) is considered important or not! The actor identification table could be used for summarizing the results of the brainstorming sessions. It is also important to realize that at this stage you do not have all the information yet, and that you always can come back in a later stage to the issues this tool is dealing with. Actor analysis, is an iterative process.

## 7.2 Actor role matrix

### Uses of an actor role matrix

The analysis of actor roles assists understanding of who does what in relation to the ‘system of interest’, so that gaps and overlaps in roles can be identified and acted upon. Looking at actor roles assists in identifying weaknesses due to duplication of effort, competition or just poor task performance. Such an analysis assists in the negotiation of desired improvements in the performance of roles.

### Steps to make an actor role matrix

**Step one**—From the actor identification matrix, pick the relevant actors who affect, or are affected by, decisions taken that affect the problem situation

Discuss with (representatives of) the key actors which roles/tasks (e.g. policy formulation, participatory research with farmers, on station research, extension, input supply) are performed by which actors and draw up the actor by roles matrix.

Actors	Roles	Performance
Farmer groups		
Extension		
Co-operatives		
Actor	Do you consider this person, group or organization a key actor?	Why or why not?
Research		
Etc.		

### Step two

—Assess performance in each role

Do the current roles meet users’ expectations? First agree on the criteria for scoring whether users are satisfied or not. The following is a simple illustration of user scoring. Then ask each user to score each actor on role performance. Moving from one role to the next fill out the matrix for all actors. At this time users can be asked which roles they would like to see each actor play in the future. By comparing the current roles with those preferred in future, recommendations can be made for improvement.

++/Good	Fully involved with all users satisfied with role performance
++/Moderate	Fully involved but not all users satisfied with role performance
+/Good	Partly involved and in a satisfactory way
+/Moderate	Partly involved but not all users are satisfied
+/Poor	User takes up the role but performs poorly
–	User is not involved

### Step three

—Identify gaps and overlaps

Improvements to the current situation can also be made through an analysis of gaps and overlaps in roles, and to which extent users consider these gaps and overlaps problematic. User opinion can be summarized in a table of gaps/overlap in actor roles. Such analysis often asks:

- Is there a co-ordinated effort in managing the various roles to develop synergy among actors?
- Is there a need for this?
- What factors and actors could improve the performance of particular roles?

Such questions often lead to recommendations for improvement:

Gaps in roles	Overlaps in roles	Users concerned	Recommendations

However, the analysis of actor roles is usually hard to plan because some actor roles need more discussion than others. Moreover, it is not easy to predict which users will have a lot to say about which actors or roles.

The team could also look at changes over time by comparing the roles matrix of the present situation with one illustrating the past as well as the future. Ask yourselves and other actors why these changes happened to understand the reasons and influences behind these changes.

The information obtained through actor analysis then has to be analysed. It is important to note, while analysing, that the roles are important (including importance of demonstration sites, provision of necessary equipment etc.), actors can change.

- Which are the most critical and necessary roles?
- Are these being fulfilled by the existing set of actors?
- If not, which actors can fill the gaps?
- Look at actors who are also important for women?
- What are the future roles required to enhance market-oriented production?
- Who are the potential actors who could play this role? (*Think out of the box—think of new actors like private entrepreneurs etc.*)

### 7.3 Actor perception matrix

#### Uses of an actor perception matrix

An ‘actor perception matrix’ can assist in:

- Discovering the range in perceptions of the different actors of the problem situation
- Identify conflicting and shared perceptions of problem situation
- Design strategies to provide necessary information if some misperceptions need to be cleared and trust in innovation built

#### Steps to make actor perception matrix

Step one—Address the following questions:

- How do the actors perceive the problem situation?
- What do the actors see as possible reasons (or causes) for the problem situation?
- What do actors see as promising ways to deal with the problem situation?

You can summarize your findings by using the matrix:

Actors	Perception of the causes of the problem	Perception of solutions for the problem situation

### 7.4 Information needs matrix

#### Uses of an information needs matrix

Analysing information needs in relation to the system of interest gives an indication of relevant information that is (made) available to the actors and what information is not offered because of a lack in the system or because of poor relationships among actors. Moreover, based on the insight on relevant information that is currently missing or not well offered might give indications for new roles of research.

## Steps to make an information needs matrix

### Step one—Identify the key actors

Start by identifying relevant actors who affect, or are affected by, decisions taken in the system of interest.

### Step two—For each actor list their information needs

What information do the various actors need to bring about the desired transformation as stated in the system of interest? Think of information on, e.g. new varieties, new soil conservation techniques, marketing information, policy information etc.

### Step three—For each actor check whether actors receive the information they are in need of

For each actor check whether they receive the necessary information to bring about the desired change. If this is not the case, analyse why. It might be because the information gap is unknown in the system or just because of poor relationships among actors. So, what do you recommend on the basis of your findings in order to contribute to bringing about the desired change in the system of interest. With the information gathered, a matrix can be constructed to summarize the information.

Actor	Information need	Does the actor receive the information?	If yes, from which source?	If not, what are the possible sources?	How can the actors be linked to these sources to receive the information?

It is important to interact with various actors to find out their information needs, rather than relying on bunches of few actors to assess other's information needs.

## 7.5 Actor benefits matrix

### Considering/attributing impacts/benefits of other related interventions

#### *Uses of an actor benefits matrix*

Not all actors, or all of the intended beneficiaries of a project will in fact benefit equally. Some will gain more than others. Some may even lose out or be disadvantaged. An actor benefits matrix can help explore which actors will gain or lose from a specific innovation or change, and hence screen different options for social equity. Project beneficiaries and managers can then weigh the social costs and benefits together with other types of costs and benefits (e.g. economic and environmental benefits/costs).

### Steps to make an actor benefits matrix

The information required to prepare an actor benefits matrix can be obtained through one or more or all of the following means.

- Secondary data
- Key informant interviews
- Group brainstorming sessions
- Quantitative surveys

The matrix can be prepared both by the research team and/or by any of the key groups of actors following the steps detailed below:

## Step one—Identify the main actors affected

List down the side of the matrix the actors in the R&D work starting at the top with the different groups of actors or beneficiaries (perhaps identified using a typology, or through an analysis of different livelihood systems).

Actor affected	To what extent?	How/potential impact?
Actor type 1	++++	
Actor type 2	–	
Actor type 3	+++	
Etc.		

## Step two—Indicate the likely gains or losses

For each cell of the matrix, indicate the degree to which that actor will gain or lose should that specific R&D option be taken. One might use up to four pluses to indicate high gains and four minuses to indicate heavy losses. Indicate where you do not know (with a question mark, for example).

Of course, with this as with other tools where judgment is involved, different actors may have different opinions about who will gain and who will lose with the different innovations or changes being considered. A group of researchers, even if they have had a great deal of contact with different social groups in a village, will likely come up with different values for a matrix than will the villagers themselves. The important point is for researchers to work with the different actors and discuss any differences of perception; in such cases the act of constructing the matrix should lead to improved understanding of the different perceptions about likely impacts of development activities.

It is important to interact with various actors to find out their information needs, rather than relying on bunches of few actors to assess other's benefits.

## 7.6 Actor influence and importance matrix

The actor influence and importance matrix or the Septagrams can be used to assess the influence of actors involved in the innovation process.

### Uses of an actor influence/importance matrix

Knowing the power that actors have to influence a project or development activity helps identify relative risks posed by these actors and potential coalitions. Actors with much power and influence can easily divert project resources from important intended beneficiaries with little power or influence. Similarly, knowing the importance of a particular actor group as a beneficiary helps ensure that the voice of these actors is heard.

The matrix showing relative positions of actor influence and importance can inform project design. Typically, actors of high importance but little influence may need special project activities or measures to ensure decision-making control. Such structures, especially over the allocation of project resources, can then be designed into the project at its inception.



## Steps to make an actor influence/importance matrix

### Step one—Identify the relevant actors

Working from the actor analysis done so far, determine who the relevant actors that need to be considered are. Of primary concern here is to identify those actors who are important to the project and those actors who can influence the project's outcomes.

### Step two—Determine actor influence and importance

Using key informants from each actor group, determine both the influence they have over the project or area of concern and how important they are to the project or concern.

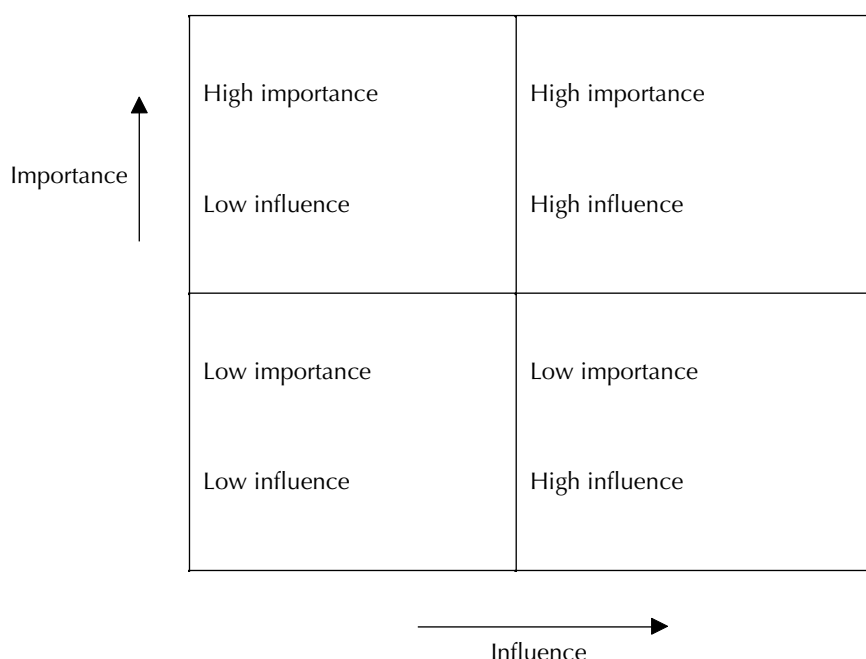
Influence refers to the power actors have over a project or area of concern to control what decisions are made, facilitate its implementation or exert influence that affects the project negatively. Influence is in fact the extent to which the actor is able to persuade or coerce others into decision-making and/or implementation of actions. Many variables may affect an actor's relative influence:

- Administrative or legal hierarchy (command and control, budget holders)
- Authority of leadership (charisma, political)
- Control of strategic resources for the project (e.g. suppliers of hardware or other inputs)
- Possession of specialist knowledge
- Negotiation position (strength in relation to other actors in the project).

Importance refers to the priority given by intervention agency (e.g. donor, government, project, farmer organization) to satisfy actors' needs and interests. Importance is distinct from influence. Some actors, e.g. women, upon which the intervention agency project places great priority, might be considered important but have a very limited power to influence key decisions.

Questions that can be used to assess the 'importance' of actors include:

- Which actors do the intervention agency regards as priority, in terms of meeting their needs, interests and expectations?



- Which actors' interests converge most closely with the intervention agency's objectives?

### Step three—Fill out the matrix and identify recommendations for improvement

Working from the understanding of importance and influence gained position actors in a two by two matrix of high and low importance and influence. Within each cell of the matrix actors can be placed in upper or lower halves to further suggest relative positioning. Indeed, the whole matrix can be viewed as a plot along continuous axis from low to high.

The results of identifying the position of the various actors can be used to develop a strategy on how key actors should participate in the project. Actors of high importance to the system, but with low influence may need special initiatives to protect their interests. Conversely, actors with high influence but with low importance need careful monitoring because their interests are likely to be affected by the intervention and so they could be a source of significant risk to achievement of project objectives. Lastly, build good working relationships with actors with a high degree of influence and a high importance to ensure an effective coalition of support for the project.

## 7.7 Septagrams

Actors influence interactions within the system in different ways. For example, policymakers design and implement policies and regulations, market actors influence prices, donors finance certain programs, research stations offer certain technological solutions, consumers choose certain products, agro-industries favour relationships with particular producers and producers may favour specific techniques. Each actor therefore has their own influence on the social interactions within the system. However, some actors may exert more influence than others, so that coalitions appear around these 'prime movers'. They may exert strong leadership on the way the knowledge system functions, and hence on the type of outputs and impact the system achieves. This tool focuses on identifying these prime movers/drivers of change and the degree to which they effectively steer the system in a given direction.

### Expected outputs

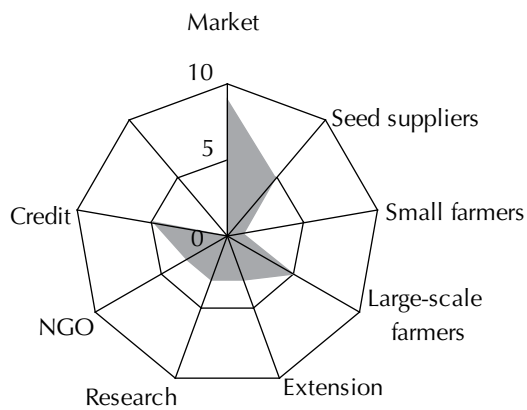
- Identification, based on actors' perceptions, of the 'prime movers'—those who give the leadership and have the most influence on what happens within the system.
- A picture in the form of several septagrams, of the influence and/or leadership of each of the prime movers as seen by different subgroups/actors.

### Relevant questions

- Who do different actors see as the prime movers in the system?
- Which of these prime movers exert the strongest influence?
- Who could change the situation and would be interested in doing so? Why?

### Steps:

1. In the group of actors you are interviewing, ask each actor or group of actors to identify the major/important actors in the innovation system
2. Then ask them to say how strong an influence each different type of actor (internal or external) exerts upon the functioning of the innovation system
3. Make the discussion visible by asking the interviewee to fill in a blank 'septagram sheet' consisting of a circle and one line for each type of actor in the system.



4. Each type of actor is assigned a line—ask about each actor separately
5. Let them decide where to place a sticker on the line representing this particular type of actors
6. The stronger (the more controlling) the influence of this type of actor, the further away from the centre the sticker is placed. The weaker (the more ‘following’) the influence, the closer it is put to the centre
7. There may be more than one prime mover in the centre.

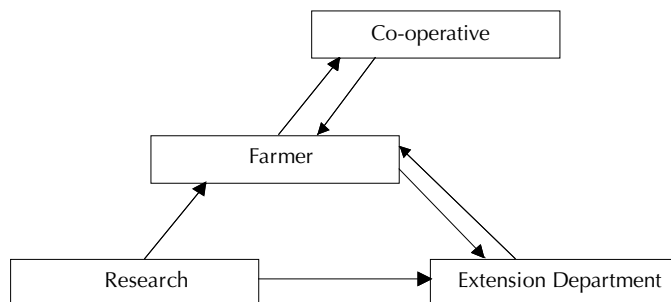
10=100% controlling, 1=100% following.

**Figure 8.** Example of a septagram.

The tools discussed in this section are time and location specific. In a development situation the context determines what is useful to be used when. It is important also to note that analytical frameworks and tools are generally adopted and changed as the work proceeds.

## 8 Actor linkage analysis

In undertaking any intervention, the first step is to identify the key actors who bring about or prevent change in an innovation system, i.e. identifying the actors who are the actual drivers or hindrance to change. The breadth of analysis may vary depending on the context and focus. The emphasis is on identifying specific social groups or actors in a specific location at a given point in time. In actor analysis it is the people who make decisions which define the groups. For example ‘research’ does not happen; it is the people who do research, so the category would be ‘researchers’. The common tools used to analyse actor linkages are: actor linkages map, Actor Linkage Matrix (ALM), actor determinant diagrams and, actor time line. These tools are briefly discussed in the following sections.



## 8.1 Actor linkage map

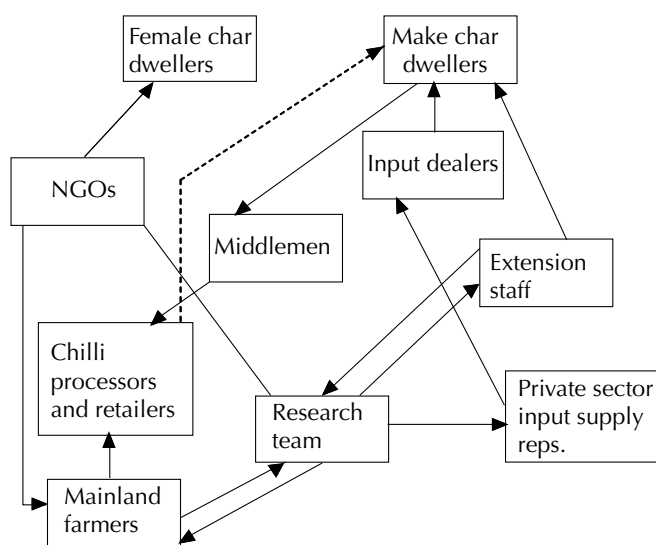
This is a useful starting point for discussing relationships and flows of information in an innovation system. The key actors are shown on a map with arrows between them indicating flows of information. In an actor linkage analysis there is always an arm going in each direction. Note that single two-headed arrows are never used, as one of the main points of the mapping is to examine power relationships in the control of flows of information on different directions. The intensity of these flows can be illustrated by the width of the arrows. See Figure 9 for illustration. It is important to make sure that these maps need to represent actual flows of information. The map will be used as a guide to discussions of formal and informal mechanisms used to transmit and control information.

**Figure 9.** Example of an actor linkage map.

The actor linkage maps could be done individually with each of the actors. We could do what are called 'ego based maps'—where we look at individual actors and see who they link up with. All the ego-based maps can be synthesised to come up with the innovation system map.

For an ego-based map, we place the actor we are talking to in the centre and ask them to identify key actors they have linkages with and draw them up. We could ask them to distinguish whether the linkages in their perception are strong or weak (use strong and dotted lines to represent them). We could even use different maps for past, current and anticipated situations, where relevant. This would help us understand the changes in/dynamics of the system.

Map showing key actors in a Bangladesh chilli innovation system



### Creating an ego-based linkage map

Maps can be drawn up by one actor or in a group.

- Put the name of the actor we are talking to in the centre of the page.
- Ask the actor who they link with for different aspects of their enterprise.
- Use arrows to show direction of flow of information or services.
- Use thick or thin arrows to indicate the importance of the link.

The actor linkage maps are particularly useful when focusing on one actor and his or her linkages

with other groups. As the number of actors increases, however, the map can become too complicated. At this point it may be useful to work with maps of part of the system or move to an actor linkage matrix.

Source: Biggs and Matsuert (2004).

**Figure 10.** Actor linkage map.

## 8.2 Actor Linkage Matrix (ALM)

ALM identifies all the actors and shows the links between major actors in an innovation system. It complements the actor linkage map. In a matrix this is represented by listing actors along the vertical and horizontal axes. The cells in the matrix represent flows of information from the actors in the rows to actors in the columns. In the matrix all cells can be identified by their co-coordinators (numbers for rows and letters for columns are shown in the box below).

		A	B	C
Actors		Researchers	Farmers	Manufacturers
1	Researchers		1	
2	Farmers			
3	Manufacturers			2

Source: Biggs and Matsuert (2004).

The matrix basically plots the same information as the map, but has additional advantages such as:

- It can deal with more complex situations and more actors (maps get very messy)
- It has a cell for every possible linkage, and so encourages one to explore all possibilities
- It has a useful role in helping to pinpoint particularly significant links, e.g. strong links, coalition groups, weak links etc. This makes it more useful than the map for planning, implementation, monitoring and evaluating change
- It enables users to quantify the strength of linkages using symbols in each cell, e.g. pluses and minuses, or telling such as s (strong), m (medium), w (weak), dn (do not know)
- It enables users to condense and store a lot of information about linkages in the spreadsheet ALM (each cell reference can be linked to a text). Therefore, it is a useful tool for documenting a given situation or the outcome of an event.

The actor linkage matrix is best used with a small group, with people familiar with the technique or after a discussion to summarize findings. We could do the actor linkage matrix with each of the actors, but we can also do it with the synthesis map.

Creating a linkage matrix:

- Use a spreadsheet programme, e.g. MS Excel.
- Plot key actors on vertical and horizontal axis
- Now each cell in the matrix represents the flow of information from the actor on the vertical axis to the actor on the horizontal
- Use symbols or shading to show information flowing from one actor to another. Use an agreed code and fill in for each actor linkage.

Each cell in the matrix can be linked to a piece of text describing the linkage and explaining the ranking given.

Actor linkage matrix used to monitor partnership building

		A	B	C	F	H	I	K	L	M	N	P	Q	R	S	U
		Male char dwellers	Female char dwellers	Local leaders	Local middlemen	Dealers	Local government staff	Bank staff	Local NGO staff	National government staff	Researchers	National middlemen	Chili processors and retailers	Input suppliers	Media	Project team
1	Male char dwellers	d	d					a	a	a		a				11
2	Female char dwellers	d	d					a	a	a		a				11
3	Local leaders															C
6	Local middlemen															13
8	Dealers															14
9	Local government staff															3
11	Bank staff															3
12	Local NGO staff															2
13	National government staff															4
14	Researchers	a	a				a	a	a	a						1
16	National middlemen															5
18	Chili processors and retailers															10
19	Input suppliers															8
20	Media															6
21	Project team	11a	11a	c	13	14	3a	3a	2ab	4a	1ab	5	10	9	6	

- As with the actor linkage maps, a separate matrix can be used to represent past, present and possible future situations.
- For planning and monitoring purposes, symbols can be used to indicate linkages which are targeted for interventions or which have been impacted by a particular activity.

### 8.3 Actor determinant diagram

This is similar to a problem tree. It is intended as a group discussion (or individual thinking) tool to analyse the nature of a particular linkage. The starting point is a cell of the actor linkage matrix or a linkage in the map. Normally, this would be the one that is particularly significant (and might need to be strengthened, weakened or learnt from). The diagram maps weakening and strengthening forces on the linkages and helps a group to identify possible areas of intervention.

Source: Biggs and Matsuert (2004).

**Figure 11.** Actor linkage matrix.

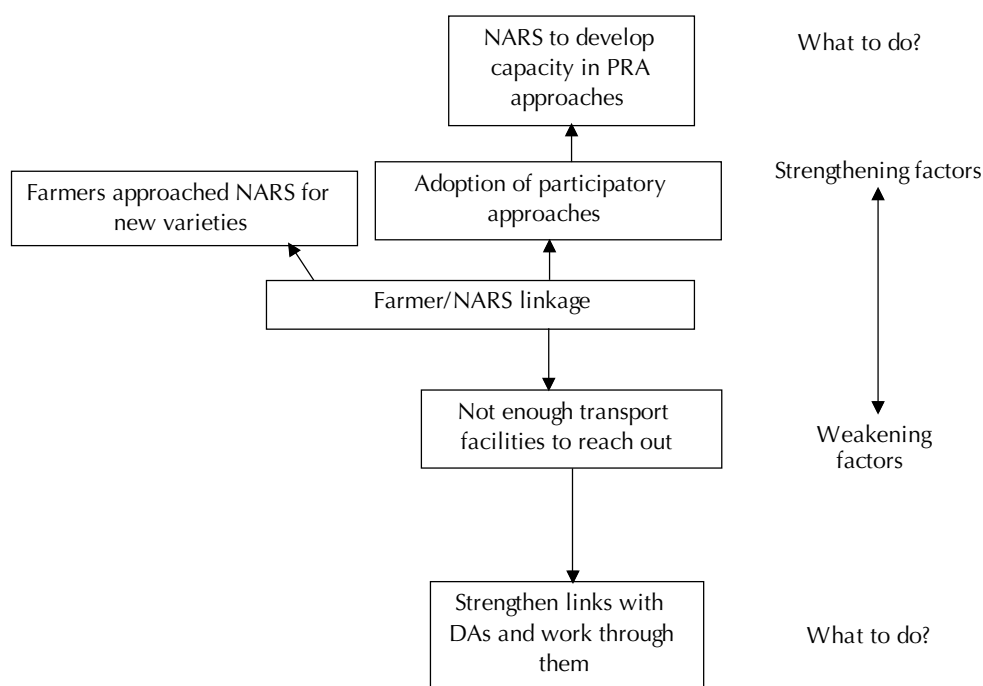
This tool helps us to open up a discussion about the feasibility of different actions within the current social and political context. It is a useful tool for building an action plan from the analysis of a particular situation. Therefore, it is often carried out with the key actors who would be involved in any future 'implementation' of suggested actions.

Maps and matrices only show the relative strength of relationships and do not give an indication of issues of control, transparency, relative satisfaction with links etc.

The determinants diagram leads from analysis of a particular situation to the development of action plans. For this reason it is most usefully used with key actors who would be involved in any future implementation of suggested actions.

Steps to build a determinants diagram

- We have to identify linkages on our matrix which look particularly important or significant. We have to choose only those which we think are most critical.
- The group must decide which links to focus on.
- We have to work with groups of actors to look more closely at this link (could be a mixed or single actor group, depending on how well we think the group dynamic will work).
- Write the linkage in the centre of a flip chart. Ask the group to start by discussing the strengths, examples of successful linking, good experiences etc. Mark these in the area above the link.
- Discuss any problems experienced with this link. Mark these in the area below the link. For each problem, try to get to the root cause, before going on to discuss the next.
- Now for each root cause look for potential solutions. Try to encourage the group to make these active solutions (not things other people should do for them).
- For each strength, look at how this could be built on to further improve this linkage.
- The final result will be a list of ideas for action. Obviously some 'areas for intervention' (what



to do) will be more possible to implement than others. The exercise helps open up a discussion about the feasibility of different actions within the current context.

## 8.4 Actor time lines

An actor time line is a listing of key events in the evolution of an innovation system. Getting a group of key actors to construct an actor time line of key past events for a particular innovation system can build a more comprehensive understanding to past change processes and a better understanding of the current situation. The key question to be answered is which actor made key decisions at what time in the past? Once again the emphasis is on human action, it is important to specify who took what

decisions, when and where. This will enable us to understand the actual causal effect relationship in a particular innovation system. It also gives a feeling for the dynamics of an innovation system and where it is currently heading.

**Figure 12.** Actor determinants diagram.

It is important to note that actor time lines are used here more as a learning and reflection tool, a way to establish new common ground in a coalition of partners, and as a tool to guide future action. The time line can either be given as a list of events, with dates alongside as a figure with a sequenced bar chart of actor events over time, sequencing and the path of causation of past events.

Time lines can be generated through a review of literature, individual interviews (particularly with people with a long association with the innovation system) and group discussions. Usually a combination of all these will get you the fullest information. Group discussions with knowledgeable people in the sector are useful to analyse and discuss the implications of the timeline, e.g. trends and new directions.

For the group discussion, use a flip chart or blackboard.

- Start with the earliest recorded memory in this innovation system
- Now mark key innovations since that time

Time line of major phases in the spread of power tillers in Nepal



- On the time line these can be linked to key events in local or national history, e.g. independence, the year of the big flood etc.
- For each innovation marked on the line, note actors who created or helped the spread of this innovation. These are the key actors.
- Discuss implications: How has this innovation system changed? Where is it heading now? Who have been the key actors in the past and present?

## 8.5 The innovation tree

A new PRA tool, the innovation tree, has been developed to help people to visualize and analyse the way in which innovation is spread over time between community members. It has been claimed that the tool is not only useful to distinguish between innovators, early and late adopters, but also to help both outsiders and the community to understand some of the social and psychological dimensions that influence the adoption of innovation within that community.

Source: Biggs and Matsuert (2004).

**Figure 13.** Example of an actor time line.

## Why analyse innovation adoption process

Mele and Zakaria (2003) argued that visualizing the innovation adoption process could help in:

- Provoking community reflection and raising awareness about the dynamics of the process



- Providing insights in the social and psychological dimensions underlying the innovation adoption process



- Probing which people, or more specifically personalities, to engage in a particular farmer-to-farmer extension activity.

## How to develop an innovation tree

In order to develop an innovation tree, we need facilitator(s) and participating farmers involved in the technology development and dissemination process. Material requirement includes A4-size cards and crayons.

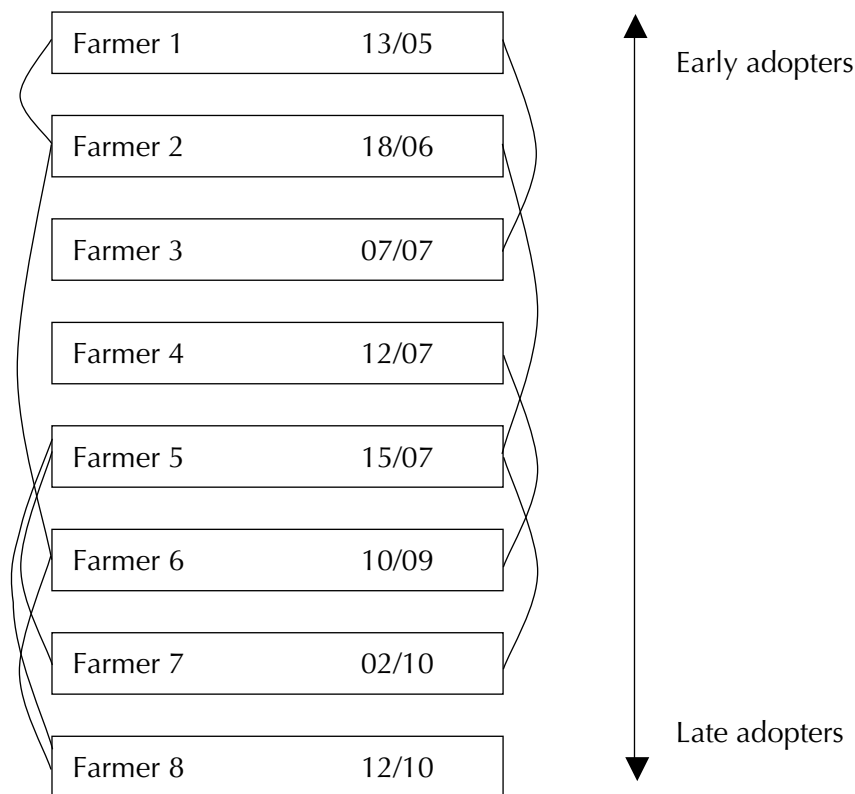
Steps in the process:

1. Invite households who have adopted or adapted a technology, explain objectives of the exercise and provide cards and marker.
2. Ask the individual farmers to write their name on the card along with the date on which they adopted the technology. If the farmers are illiterate, the facilitator can assist. (Picture of the participating household may also be useful.)
3. Draw a line and re-arrange cards according to the date at which they have adopted the innovation.  
When this exercise is completed then the innovators should be at one end, while late adopters at the other. One could use the floor for this purpose.
4. The person or household who first made the innovation is asked to take the floor and explain who or what inspired her/him to do this. One facilitator can guide the process, while another records all the comments.
5. In a chronological order all the others were asked to indicate who inspired them to adopt the idea of innovation. Lines can be drawn between farmers. The facilitator tries to find out what exactly convinced them to do it, and what other than personal factors were involved in the decision-making process. An example of an innovation tree transferred to paper is presented in Figure 14.
6. Facilitate group discussion and stimulate reflections to identify the technical, economic, social and psychological dimensions contributed to the adoption of the technology. During the process the facilitator should try to draw on the insights gained from the exercise and explore who could contribute in which way to scaling-up the innovation adoption process, i.e. farmer-to-farmer extension. In selecting extension workers, not only the technical but also the facilitation skills are important criteria.

Note that farmer decision-making in adopting a technology is influenced by institutional, economic, cultural, social and psychological characteristics. The social and psychological factors enhancing or inhibiting the actual adoption can be analysed directly with community through the innovation tree. Mele and Zakaria (2003) identified a list of social and psychological factors that could influence the adoption process (both positively and negatively) (see Table 7).

**Table 7.** *Some social and psychological characteristics influencing adoption*

Social factors		Psychological factors	
Stimulating adoption	Inhibiting adoption	Stimulating adoption	Inhibiting adoption
Personal communication network	Opposition in the farming community	Innovation proneness	Complexity of technology



Social participation	Social isolation	Risk taking ability	Risk avoidance
External pressure	Poverty	Extravert	High level of stress
Common need for solving a problem		Overall knowledge	Lack of knowledge on the technology
		Self-fulfillment	Lack of motivation
		Pride of ownership	Mistrust of project staff
		Level of aspiration	

Source: Mele and Zakaria (2002).

It is worth noting that this is an emerging tool and is useful to distinguish between different types of innovators, and if properly executed will enable us to understand the psychological and social dimensions underpinning the decision-making process; which would be difficult to disclose in other ways. This may also yield valuable information about which people or more broadly personalities (and even institutions) to engage in a particular scaling-up activity, i.e. farmer-to-farmer extension. However, in order to gain a better understanding of the adoption process, this tool need to be complemented with other tools such as semi-structured interview, personal observation, adoption survey etc.

**Figure 14.** Example of an innovation tree.

## 8.6 Network mapping

Innovation is a process leading to a productive use of knowledge for economic and/or social purposes. Innovation process is an interactive, non-linear social process; and social actors rarely innovate in isolation. The central proposition of the innovation systems approach is that the innovative capability depends on the quality and density of relationships among producers and the relationship between producers or producer groups and enterprise (market) and supportive services—public and private organizations. Thus, knowledge networks, resources linkages and partnership are crucial to understand

and analyse innovation systems. Network analysis has been developed to understand these relationships in a specific social context (Clark 2006).

Rural households' and social groups' ability to access resources, goods and services depends on their membership and position in networks. Information is one of the crucial resources that flow through networks. Network analysis, among other things, helps to identify both information flows and bottlenecks, which can inform the design of a strategy to encourage horizontal sharing of information in the existing social systems.

More often than not we find a number of actors—community-based organization, NGOs, public and private organizations—engaged in development activities and interactions at the local or higher levels. Visualizing community level and organizational networks can help to understand actors, interactions between actors and identifying the most influential actors. Network analysis can be used as a diagnostic tool during planning development projects to identify similar initiatives to avoid duplicating efforts and facilitate linkages and interactions among actors; identify the drivers of change, possible conflict of interest, or power struggle. Network analysis is a good entry point for enhancing coordination of multi-stakeholder governance; and network maps are used for monitoring progress, with respect to improvements in relationships among relevant actors. The visual graphic are able to capture the attention and imagination of rural actors who are usually illiterate. The process of participatory network mapping in itself facilitates group discussion, reflection and group visioning on ways to improve linkages and quality of interactions among relevant actors and ensuring inclusiveness.

## Drawing a network map

Network map is an interview-based mapping tool that helps people understand, visualize, discuss, and improve situations in which many different actors influence outcomes (Schiffer 2007). Network map helps to determine:

- What actors are involved in a given network,
- How they are linked,
- How influential they are, and
- What their goals are.

A step-by-step guide to using the network map method (adapted from Schiffer 2007, 7–18)

## Preparation

Before you start using Net-Map and interviewing participants, make sure to clearly define the overarching issue you want to tackle. Do you want to know who can influence the success of a specific project that you are planning? Or do you want to generally map out the network environment of your organization? Are you interested in a specific conflict and how the network actors prevent or support conflict resolution? Are you examining a defined group of people (for example, all members of a working group) or do you simply want to find out who belongs to the network (for example, all those who can influence the course a reform will take)?

## Pre-testing

Discuss the overarching issue you wish to examine, the defined links, and the goals with someone who is knowledgeable about the social environment you want to research. Using the guidelines

presented below, draw your own influence network map of how you see the situation to determine if your framework needs to be modified. You can continue the pre-testing process by interviewing and drawing maps with people similar to those you want to participate. You can also use these pre-testing activities to discuss your choice of words: should you use the terms 'power', 'influence', 'authority', or a descriptive phrase like 'someone whose word has weight'?. If you call one link 'giving support', do people think it means 'giving words' or 'giving money', or is the term may be limited to the context of party politics? It is important to adapt the terminology to your experience.

### Tips:

- Limit relationships in the map to four.
- Use small 5 cm by 5 cm Post-it notes for drawing the nodes.
- If you are dealing with only one project in the workshop, and you are working with a group of more than eight participants, then split them into four groups and get each group to draw the map for just one relationship (e.g. one group draws the funding network, another does research etc.)
- Use poker chips/checkers pieces for the influence towers.

### Question 1: Who is involved?

Place a mapping sheet in front of your interviewee and ask him or her to name all individuals, groups, and organizations that can influence the issue you are examining. The questions could include: Who can influence the restructuring of our organization? Which groups and individuals are involved in this inter-community conflict? Who has influenced this change of policy?

Encourage your interviewee to mention every actor that comes to mind, not only those who have formal decision-making capacity in the process. Write every actor on an actor card and distribute the cards on the map. Give your interviewee time to think this through properly and allow him or her to add actors throughout the interview. Before going to the next question, read out loud all actors, since this might make the interviewee think of other actors to add. In some cases, you might insist that the interviewees add themselves to the actor list. If you are working with illiterate interviewees, let them pick figurines for each actor and place them next to the actor cards; this way, it will be easier for them to remember who is who. You might choose different colours of cards for different groups of actors (use pink cards for all governmental actors, for example, or green ones for all non-governmental actors). This also helps to visually structure of the map more clearly.

### Question 2: How are they linked?

You have defined the links you want to look at through your preparation and pre-testing. Explain to your interviewee that you want to find out how all these people and organizations are linked to each other. You will connect the actor cards with arrows indicating that something, (such as information, command, or money, for example) flows from one actor to the other. In cases where the actors exchange something, two arrows pointing to opposite direction are used. In cases where two actors exchange more than one thing, you can draw a link that has a number of arrow heads of different colors. Present the kinds of links by colour and explain what each colour represents. For example, red represents money, black represents command, green represents advice, and blue represents information.

It makes sense to start with the link that you expect to be the least common, finish this colour, and continue with the next. In this way the picture will develop slowly and the process will be less messy. With complex maps, you might need to guide your interviewee through the process and make sure

that he or she does not forget a link, though it is important you do not push the interviewee to link actors just to please you. Make sure your interviewee understands that you are not looking at how links should or will be, but at how they currently are.

### Question 3: How influential are they?

To avoid misunderstanding, it is important that both the interviewer and the interviewee share the same understanding of the term 'influence'. In your pre-testing and discussion, you will have developed a commonly agreed-upon definition of 'influence'. *It is important that the interviewee understands that the question is about the ability of the actor to influence a specific issue, and not about formal hierarchies.* The question is: how much influence does this actor have in this specific field/activity/organization—and not in a more general sense. For example, chief administrator of a region will be seen as more powerful in a general sense than administrator of a district or head of a district office of agriculture and rural development. However, when it comes to influencing the implementation of a specific intervention relating to agriculture, the latter tends to have much more impact than the administrators.

Emphasize that the sources of influence could be diverse, ranging from legitimate decision-making capacity, through giving advice or incentives, to bending or breaking the rules. Once this understanding of 'influence' is established, the interviewee will be asked to assess who has what amount of influence on the given issue. Choose one actor figurine for every actor and put it on an influence tower. This tower might consist of a certain number of influence pieces according to how strongly this actor can influence the issue at stake. Explain the following rules to your interviewee: The more influence an actor has the higher the tower. The towers can be as high as the interviewee wants. Two actors can have towers of the same size. If an actor has no influence at all, the figure is put on the ground level without any influence tower.

After setting up the influence towers, verbalize what you see, starting with the highest tower. For example: You have given the chief administrator of the district the highest tower with a height of five tower pieces, followed by the head of district office of agriculture and rural development on towers of four, and DAs with two towers, and finally you say the resource poor subsistence producers have no influence at all—no tower. Encourage the interviewee to adjust anything if he or she has second thoughts. This is especially necessary in complex influence networks. If you change one tower, make sure to adjust the others accordingly. Once the interviewee is content with the whole set-up, note the height of the influence towers next to the actors' names on the network map.

Starting with the most influential actor, you now begin to ask the interviewee about the sources and effects of influence. Your questions will vary according to your general goal and to the overarching issue you are exploring. As you become more familiar both with the tool and the situation you are analysing, you will see that it becomes easy to see at first glance what is special, strange, or noteworthy about a specific influence network map. Your questions may include: I see you have put this actor on the highest tower. Why? Where does his/her influence come from? You say that these two have the same level of influence. What happens if they disagree? Is their influence based on the same grounds? Does it have the same range? I have heard there is a conflict between these three actors. Could you explain to me what it is about? You have linked this actor to so many others, but you say he does not have much influence—why is that so?

## Discussion

Now you have completed one influence network map. Discuss the result with your interview partners. Depending on the goal of this specific mapping process, you might ask your interviewees to think strategically about the network and develop ideas to improve the situation in the future.

### How can we draw network maps using software?

We use two programs to draw the network maps. First we put the information from the workshop-drawn network maps into a text file which are then imported into UCINET. UCINET puts the text file into matrix format which we then plot in NetDraw.

## 9 Conclusion

It is important to note that this chapter is like a tool box. A practitioner is not expected to use all the tools at the same time. S/he has to determine the purpose and the context and choose the appropriate tool(s). A number of tools can be used for the same purpose. For example, stakeholder analysis, network analysis, actor-linkage matrix, actor-linkage map, and other tools can be used for the purpose of analysing interactive relationships in R4D. Thus, it is entirely up to the individual to choose the most appropriate tool or set of tools.

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## Exercise 4 & 5. Understanding the project cycle (Group work)

1. Form four groups and have each group elect a rapporteur (5 minutes)



### Phase 1 Group work (4 hours )

2. Using the intervention/project that you are working with presently, try to respond to the following questions in the group (four hours). (You are expected to discuss this based on the presentation made in session 4)
  - List the broad target groups that your organization is currently working with?
  - How were these target groups selected?
  - What is the intervention being implemented?
  - How was this intervention identified?
  - Who are the stakeholders involved? Develop an actor linkage matrix indicating information flows.
  - What are the objectives and goals?
3. In implementing this project if you are wearing an innovation cap what changes you would make?

### Phase 2 Reporting and discussion (one hour)

4. The trainer invites rapporteurs from the groups to present the results to the audience (50 minutes)
5. At the end, the trainer asks feedback on this exercise and closes the session (10 minutes).

# Trainer's guide

## Session 6 Partnerships and networks

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Purpose	The purpose of this session is to illustrate and emphasize the need for effective partnerships for enhancing the innovation processes
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"><li>• identify and explain the difference between partnerships and networks;</li><li>• describe the partnership and network cycle;</li><li>• list key considerations and 'success' factors in partnership building; and</li><li>• identify and explain key issues and challenges in promoting public-private partnership.</li></ul>
Resources	<ol style="list-style-type: none"><li>1. Flipcharts</li><li>2. White board</li><li>3. Flipchart and white board markers</li><li>4. Copies of handouts 6.1, 6.2, 6.3 and 6.4 for each participant</li><li>5. Computer and LCD projector</li></ol>
Time needed	Two hours and 10 minutes

### Session structure

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Activity		Time required	Remark
Presentation	<ul style="list-style-type: none"><li>• Distribute handout 6.1 (presentation slides) before you start your presentation</li><li>• Give a presentation on partnerships and networks</li><li>• Allow some time for discussion to make sure that participants understand what is presented</li><li>• Distribute handout 6.2 (presentation text) to supplement your presentation</li></ul>	30 minutes	
Exercise	<ul style="list-style-type: none"><li>• Distribute handouts 6.3 &amp; 6.4 for exercise 6 on partnership and networks</li><li>• Ask a volunteer to read the exercise</li><li>• Ask participants to answer the questions in the exercise in group</li><li>• Remind them the time allotted to the exercise</li></ul>	Two hour and 15 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

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# Session 6: Presentation slides

Slide 1

Session 6

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Partnerships and networks

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INSTITUTION FOR  
LAND-USE RESEARCH  
AND TRAINING

IPMS  
ETHIOPIA

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Slide 2

Objectives of the session

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- Understand the difference between partnerships and networks
- Describe the partnership and network cycle
- Understand the key considerations and 'success' factors in partnership building and
- Understand the key issues and challenges in promoting public-private partnerships

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Slide 3

A recap...

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Systems analysis emphasizes:

- Systems elements and structures
- Systems environment
- Systems linkages and interactions
- Systems performance

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Slide 4

## ISA emphasizes

- Actors
- Their actions and interactions
- Institutions
- Context

Partnerships and networks become an integral part of IS



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Slide 5

## What is a partnership?

An alliance in which different individuals, groups or organizations agree to:

- A common goal
- Work together
- Share resources
- Share the risks as well as the benefits
- Review the relationship regularly
- Revise their agreement as necessary



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Slide 6

## What is networking?

- Networking is a process by which two or more organizations/stakeholder groups/individuals collaborate to achieve common goals
- Various forms
  - Information sharing
  - Research networks
  - Special purpose networks
- Aims to exploit comparative advantage and maximize spillover effects
- Relatively less formal than partnerships, have broader objectives and, try to build social capital



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Slide 7

## Why do we need N&P?

- Jointly address complex issues that cannot be effectively addressed by any one partner
- To improve the effectiveness and efficiency of resource use
- To avoid duplication of efforts, exploit complementarities and synergies



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Slide 8

## Note

- Combined strengths and skills will enable the individual entities and the society to function more effectively and successfully
- Main motivation is to maximize mutual benefits on issues of common interest
- Partnership should be seen as a means for generating innovation and not as an end in itself



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Slide 9

## Factors contributing to increased partnerships and networking

- Changes in the R&D paradigms
- Increased use of participatory methods
- Evolving pluralistic systems
- Changing funding scenario and funding arrangements
- Changing organizational landscapes



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Slide 10

### Key phases, steps and skills required in partnerships development and management

Phase/Stage	Steps/activities	Skills and tools
Pre-partnership phase	<ul style="list-style-type: none"><li>- Context/needs analysis</li><li>- Stakeholder identification</li><li>- Determine if a partnership is right for your situation</li></ul>	<ul style="list-style-type: none"><li>- Rich pictures for contextual analysis</li><li>- Stakeholder/actor analysis tools</li><li>- Partnership readiness Questionnaire</li></ul>
Partnership initiation phase	<ul style="list-style-type: none"><li>- Selection of partners</li></ul>	



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Slide 11

- ### Determine if a partnership is right for your situation
- Access specialized resources, add or augment like resources, add complementary resources
  - Reducing duplication
  - Increasing service integration
  - Improving access to the end user
  - Expanding capabilities
  - Gain legitimacy
  - Foster or facilitate information exchange
  - Spread risk
  - Mutual learning
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Slide 12

- ### Criteria for selecting partners
- Strategic fit — a common understanding of the business rationale among the partners
  - Capability — the necessary skills that go into enhancing the value of the partnership
  - Compatibility — the complementary strengths of the partners that is mutually beneficial, including the match of organizational cultures
  - Commitment — a strong motivation to sustain the partnership in terms of furthering its prospects and solving its problems
  - Control — potential for having an effective means of governing the partnership
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Slide 13

## Foundation elements for partnership formation

- Compelling vision
- Strong, participatory leadership
- Shared problem definition and approach
- Power equity
- Interdependence and complementarity
- Mutual accountability




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Slide 14

## Key phases, steps and skills (cont'd)

Partnership formation phase	<ul style="list-style-type: none"> <li>• Develop vision and strategic direction based on shared problem definition and approach</li> <li>• Agree on partnership principles (or code of ethics)</li> <li>• Develop mutual understanding and knowledge</li> <li>• Agreement and understanding upon necessary leadership roles and responsibilities</li> <li>• Creating a partnership covenant or MoU</li> <li>• Work plan preparation</li> </ul>	Conducting effective meetings Facilitation skills Interpersonal skills Leadership skills Management skills
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Slide 15

## Key phases, steps and skills (cont'd)

Implementation management Phase	Organizing the partnership Develop governance structures Develop M&E systems Establish communication linkages Decision-making Trust, respect and commitment	Interpersonal skills Leadership skills Management skills M&E tools (including process monitoring)
Post-partnership phase	<ul style="list-style-type: none"> <li>• Evaluation</li> </ul>	Evaluation tools




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Slide 16

## Key questions

- How does the relationship develop over time?
- How it will be evaluated?
- What is the strategy for dissemination of findings?
- What is the strategy for scaling up and scaling out of findings?

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## Principles for resolving differences

- Always proceeding with respect for the other party
- Clarifying underlying issues
- Identifying options for resolving the disagreement
- Being inclusive, not exclusive, of stakeholders who might be able to propose solutions
- Agreeing at the outset on a procedure for resolving the disagreement
- Agreeing on time limits with which the problem should be resolved

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## Ingredients of an effective partnership

- Common interest
- Joint planning
- Mutual benefit
- Clear roles and responsibilities
- Communication linkages
- Firm commitment: political and resources
- Good understanding and in-depth knowledge about the aims, ethos and working procedures of various partners

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## Ingredients of an effective partnership

- Attention to process
- Explicit decision-making process
- Trust, mutual respect, commitment
- Credit and recognition
- Better understanding of the choice of investment, risks, transactions costs
- Openness, flexibility and willingness to listen to other partners
- Internally driven
- Stay on purpose and course

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## Public Private Partnership (PPP)

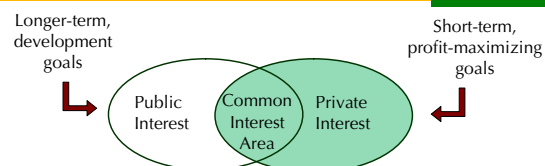
- In the recent past, in many developed countries private enterprises have become important players in AR4D
- Limited PPP in developing countries
- Casual interactions
- Many partnerships induced by competitive funding
- Successful PPP are always context specific
- Great diversity in arrangements

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## Main assumptions of PPP



“Positive viewpoint” considers this common interest space as given: PPPs will evolve if benefits outgrow Research & Development and interaction costs

When the space of common interest is not evident, facilitation is required.

Source: modified from Vernoica Gotrett's presentation

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## Factors contributing to successful PPP

PPPs are often successful when:

- developed as a long term flexible partnership between trusted partners
- used for capacity-building and development of marketable technologies
- common objectives and common interest space have been clearly identified
- readiness for institutional learning and change exists
- used for enhancement of social capacity led by a facilitator



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## Key challenges in promoting PPP

The key challenges:

- High transaction costs — management intensiveness
- Demand for human resources and operational funds
- Resistance to institutional change
- Complex operational setting, including disconnect between international and national laws
- Farmer and civil society involvement in technology development



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## How can we enhance PPP?

- Great efforts to foster openness and clarity, minimize risk and uncertainty and reduce red tape
- Including facilitator and/or facilitation organization
  - Reduces transaction costs
  - Bring clarity to the process
- Supporting policy measures IPR



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Slide 25

## How can we enhance PPP? (cont'd)

- Source of synergetic R&D rather than as a means to supplement public sector funding
- Greater participation of farmer groups and other stakeholders
- Increased capacity strengthening
  - Accumulate social capital
  - Develop cooperation skills
  - Analyse needs of particular value chains
- Should include technical, institutional, managerial and policy level collaboration

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## Framework for analysing partnerships

- The collaboration process in partnerships and networks
- Generation of expected and relevant results in an effective way
- Strengths and weaknesses of the partnerships and networks in areas related to trust, administration, management, leadership and the synergy it creates
- Mechanisms to monitor collaborative processes and take course correction measures
- Value of the collaborative process to partners, donors and the community
- Responsiveness to partners and the broader community
- Involvement of agents in the leadership and management of the partnership

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## M&E systems for assessing partnerships

- Action-reflection
- SWOT analysis (strengths, weaknesses, opportunities, threats)
- Results-based management
- Logical framework analysis
- Outcome mapping
- Appreciative inquiry

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## General consensus

- Partnerships are not a panacea for all development challenges
- Partnerships can create valuable synergies through knowledge sharing, joint venturing, scale economies, resource pooling and risk sharing
- More knowledge and information is needed to determine how partnerships can be organized and managed efficiently and effectively



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## General consensus (cont'd)

- Partnerships are key, but are often narrowly conceptualized
- Getting the institutional context right for partnerships is much more demanding than is generally assumed
- Coordination matters
- Strong governance is important
- Stimulating demand is as important as generating the science and technology



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Slide 30

## Agenda

- Continued dialogue on the opportunities for and impediments to pro-poor partnership
- Identification of immediate opportunities where partnerships are appropriate — scientific research, innovation



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Slide 31

## Agenda (cont'd)

- Greater emphasis on:
  - developing tools for monitoring and evaluation of partnerships
  - analysing partnership performance and outcomes
  - research on policy options and organizational mechanisms to manage risks and distribute costs and benefits



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## *Thank you!*



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# Partnerships and networking

## 1 Introduction

Actors in an innovation system and their interactions shape the innovation processes, their sustainability and the outcomes thereof. Partnerships between actors form the bedrock of innovation. This session elucidates the importance of partnerships in innovation systems, describes what partnerships and networks are, what factors influence formation of partnerships, various stages of partnership formation and management, the importance of developing M&E systems for assessing partnerships. It dwells into the nuances of research and public–private partnerships.

## 2 Importance of partnerships and networking in innovation system

Innovation systems are about exploiting available and new knowledge for socio-economic use. Innovations emerge from systems of actors through a social process, in which networks of actors (players from the public, private, civil society, research, enterprise and policy sectors—entire supply chain) play a crucial role. Innovations are a result of co-operation and are determined by interaction between them. Each actor in the system can initiate the innovation process.

Partnerships form the core of the innovation systems and have primary purpose of knowledge sharing. This knowledge could be about constraints, opportunities, technology, production contexts and market conditions among others. This interaction and knowledge exchange leads to learning, development and deployment of new products and processes and ultimately, social and economic change. Therefore, very important in this process is how patterns of relationships, habits and practices either nurture or hinder knowledge flows, sharing and process of learning (learning by doing or by interacting).

The processes of acquiring knowledge and learning are interactive often requiring extensive linkages with different knowledge bases. These knowledge-bases may be scientific and technical, but equally they can be a source of other forms of knowledge, both tacit and codified.

Four sets of issues are critical to capacity development and partnership for knowledge generation:

- All agents in the economy are involved in a continuous process of learning and the notion of knowledge ‘producer’ and ‘user’ has limited conceptual and policy relevance.
- Organizations do not innovate in isolation; they do so within a network of other actors in a supportive environment.
- Learning is a process of trial and error that takes place over a long time and possesses a systemic and incremental character. Therefore, S&T policy design for development must be re-conceptualized in ‘systems terms’ and take historical forces into account.
- The role of knowledge has become increasingly central to the analysis of both economic progress and institutions. Institutions define the complexity and sophistication of the knowledge that is generated, and are at the same time they are shaped by this knowledge.

The efficiency with which knowledge is created and diffused depends on the variety of institutions promoting innovation. In terms of S&T partnerships, it is clear that technological knowledge is crucial to development. However, designing the right social institutions to absorb, retain, advance, and sustain

knowledge has turned out to be much more challenging. The failures to reap the promises of partnerships are often due to failed institutions and to our assumptions that institutions are neutral.

Most often S&T partnerships have been shaped by a common view of science and technology and the role both play in development. Knowledge was seen as scientific knowledge generated in a laboratory. No account was paid to the modes and mechanisms of diffusion. This view, which influenced the design and implementation of many S&T projects, was unable to tackle the question of how new knowledge and skills would fit into existing systems. It was totally ill-equipped to address the scope of parallel organizational and institutional changes that were required to facilitate the commercial use of the resulting scientific and technological knowledge.

Analysis of S&T partnerships in Africa shows that partnerships that are designed to work as self-contained activities are insulated from the very system they seek to influence. This gap between science generation and its 'market' is rooted in old thinking that equates science and technology generation (through formal research) with innovation. This conventional view promoted the mistaken notion that scientists and technology specialists, through their research organizations, were the innovators and producers of new knowledge. Furthermore, this knowledge would then have to be transferred to users in a linear process from basic research, to applied research and development, to the market.

In reality, to transfer knowledge, producers and users must be connected through a layer of agents working to diffuse this knowledge. In many S&T initiatives in Africa, the role of other services and actors outside the sphere of research and education has received little emphasis. This is particularly true for the role of the private enterprises that make commercial use of new technologies. This linear technology-transfer model has failed, and a systems conception of the process is advocated (Oyelaran-Oyeyinka 2005).

### 3 Defining partnerships and networks

This section tries to describe what partnerships and networks are and how they differ.

Partnership is an alliance in which different individuals, groups, or organizations agree to:

- a common goal
- work together
- share resources
- share the risks as well as the benefits
- review the relationship regularly
- revise their agreement as necessary

The purpose of a partnership is joint problem solving, learning and innovation. This may involve a formal contract or Memorandum of Understanding. Partnerships have a focused objective and a defined project/intervention (Hall et al. 2006).

Networking is a process by which two or more organizations and/or individuals collaborate to achieve common goals (Waring 1997). Theoretically a network consists of two things: nodes and links between those nodes. In social network analysis the nodes of concern are people, groups and organizations and the links may be social contacts, exchanges of information, political influence, money, joint membership in an organization, joint participation in specific events or many other aspects of human relationships (Davies 2003).

Networks in agricultural innovation can be seen as groups of agents with restricted membership. Network members choose each other; agree explicitly to co-operate in some way and to depend on each other to some extent. Often the members aim at exchanging information and knowledge that is of limited availability; however the members pursue individual objectives which in the context of the network are likely to result in mutual gains. The difference between partnerships and networks can be found in the different degree with which the collaboration is formalized: partnerships are often more formal sometimes, involving written contracts and agreements, whereas networks can range from very informal to formal arrangements. In this respect, partnerships can be seen as a formal type of networks (Hartwich 2005).

Networks may be informal or formal, but the main objective is to facilitate information flows. They also build social capital, confidence and trust and create preparedness for change, lowering barriers to forming new linkages and thus have broader objectives (Hall et al. 2006).

With respect to networks, Powell (1990) elaborated the following salient points:

- Networks seek to gain from pooling resources, but involve the dependence of each party on resources controlled by others;
- They are based on the agreement to forego the right to pursue one's own specific interests at the expense of that of others;
- In their evolution, they operate through the exercise of voice rather than exit;
- Their focus is on mutual orientation and on reciprocity emphasizing indebtedness and obligation;
- They seek to build trust within a long-term perspective—operate within Axelrod's notion (1984) of 'the shadow of the future';
- The information passing through networks are 'thicker' than that obtained in markets, and 'freer' than that communicated in hierarchies;
- Finally, given the potentiality of conflict at each point of contact within the network, networking is a contentious process in which both centrifugal and centripetal forces are at work.

Networking has been in existence from the day that people began to create organizational structures. Networks and networking continue to serve as a means of sharing information for competitive and cooperative reasons among organizations and individuals with common interests. According to Creech and Willard (2001), there has been a surge of experimentation with network models for fast-tracking sustainable development in the last 10 years with emergence of information and communication technology being a significant driver.

Networking to support small farmer development is not a new issue. Networking has in fact received substantial attention and resources, with a mixed record of success. There have been ebbs and flows over time in the importance attached to networking. Interest now appears to be on an upswing. This is because new information and communication technologies are improving opportunities while reducing the costs of networking. Governing decentralization, adoption of ISP, growing role of farmer organizations, NGOs and private sector in the R&D are also contributing to a resurgence of interest in networking.

Interest is also increasing in developing organizational partnerships to tackle the challenges of small farmer development. Multi-organizational partnerships—based on common objectives, interested decision-making, resource sharing and formalized reciprocal obligations—have a potential for tackling a broader range of issues at more scales of action than is possible for any organization working

independently. However, the process of developing organizational partnerships supporting small farmer development is not well understood nor is there a record of success allowing easy or quick judgement.

## 4 Typology of partnerships and networks

Partnerships and networks could be categorized into various typologies based on different criteria. How we categorize them and what classification is used depends on the purpose of analysis. This section will give a flavour of what the various typologies that are of interest for R&D practitioners interested in innovation could be, but will not go into much detail about each of them.

### 4.1 Partnership and network typologies:

#### 4.1.1 Based on actors

Partnerships could involve actors/organizations from various domains such as public sector, private sector, NGO, civil society organizations (CSO) and, community based organizations (CBO).

#### 4.1.2 Based on purpose/objectives

##### *Research partnerships*

Research partnerships are defined as an innovation-based relationship that involves, at least partly, a significant effort in R&D (Hagedoorn et al. 2001). The nature of research partnerships could vary among basic research, strategic research and, adaptive research.

Oyelaran-Oyeyinka (2005) made three observations with respect to R&D partnership:

- research partnerships are simply part of a broader set of collaborative partnerships created to enhance innovation
- the process of joint innovation is not only confined to formal arrangements; it involves significant elements of informal collaboration, learning and exchange of knowledge between individuals in different organizations
- the motivating force behind the creation of these collaborative relationships is the compelling need to innovate jointly.

##### *Innovation networks*

'Innovation networks' is a term used to capture the impetus behind the immense web of collaborative relationships created between business and non-business entities.

'Networks involve a wide range of collaborative activities including joint ventures, research corporations, joint research and development (R&D), technology research agreements such as technology sharing, cross-licensing, mutual second-sourcing), direct investment, customer-supplier relations, R&D contracts, one-directional technology flow agreements (e.g. licensing, second-sourcing), manufacturing agreements, and so forth. ...Innovation networks also often involve informal collaboration and knowledge exchanges across individuals in different organizations and systemic learning ...' (Okamura and Vonortas 2004).

Various other forms of networks are: information sharing networks, research networks, and special purpose networks. Networking in research suggests mainly lateral interaction—that is, interactions between institutions engaged in similar activities, although, of course, activities of different organizations may be (partially) complementary in nature. Inter-organizational learning between research institutions is an example of these types of interactions.

According to Farrington et al. (1994), a network with a sectoral (e.g. agriculture) or subsectoral (e.g. irrigation or crop processing) mandate generally operates more closely with ultimate beneficiaries (like those deriving livelihoods from agriculture) than those concerned with generic or cross-cutting themes such as method of agricultural research or extension.

## 5 Rationale for partnerships and networks

Partnership and networks can improve the development and delivery of innovations that directly affect the livelihoods of resource-poor or vulnerable households if structured appropriately. Challenges of today's complex society are such that individual agencies and programs cannot succeed in delivering results on their own any longer. A collaborative effort that reaches across agencies, across levels of government, and across the public, non-profit, and private sectors is needed to achieve results. The key tools for doing this are partnerships and networks. Communities are built on connections and better connections create an economic opportunity (Krebs et al. 2002).

Several recent studies illustrate the need for partnerships and networks to support the development and delivery of agricultural innovation. Studies of agro-industrial firms and agro-industrial opportunities for instance, suggest that there is high demand for technologies to enhance the quality of value-added agricultural processing, for new marketable products, and for institutional and infrastructural improvement to enhance supply chain efficiency (Hall and Yogandand 2002; Chema et al. 2003). To meet these demands, the studies recommend further investment in partnerships and networks to improve strategic, managerial and institutional capacity in the agricultural sector (ASARECA 2003; NARO 2003).

The overriding rationale for networks in agricultural research and innovation is the interdependence among organizations which enables mutual reliance upon one another to accomplish their joint goal as well as their individual objectives. The potential for synergy within networks enables actors to achieve more through cooperation than they would if they were alone. Knowledge creation through networks may better respond to the demands of agriculture in developing countries, which is characteristically riddled with complexity, uncertainty and risks (Chambers et al. 1989).

Different studies indicate that it is worth investing in networking of different actors in the society because their contribution to learning and innovation for sustainable development is tremendous. Moreover weak linkages among research, education and extension institutions result in systematic bottlenecks in national agricultural technology systems and limit their effectiveness to contribute to development (Crowder et al. 1997). As increasing number of players entered the field it is evident that a synergy would be created by working in partnership (Bigg 1989).

Networking is also a means of giving greater regional, national or international impacts to the activities of community-based organizations. There is evidence to suggest that partnerships and networks are playing an increasingly important role in addressing global issues such as health, environment, finance and governance (World Bank 2002; UNF/WFE 2003). In the international agricultural R&D community,



there is a similar interest in promoting greater collaboration among diverse actors in the sector, including key international organizations (CGIAR 1998; World Bank 2003; GFAR 2003), leading agricultural research firms (Barry and Horsch 2000; Richer and Simon 2000; Shear 2000), and non-governmental organization engaged in agricultural science and technology (James 1996).

## 6 Factors influencing and considerations in forming partnerships and networks

In the previous sessions, we have talked about the emerging challenges expected to be addressed by agricultural R&D and the resulting changes in paradigms to respond to the ever increasing complexity of the development challenges. All these have necessitated the need for partnerships and networking to promote innovation.

The following factors are contributing to increased partnerships and networking:

- changes in the development paradigms
- increased use of participatory methods
- evolving pluralistic systems
- changing funding scenario and funding arrangements
- changing institutional landscape
- separation of financial issues and implementation of research
- presentation of adequate legal framework and mechanisms for sharing benefits.

Networks potentially offer opportunities for taking advantage of economies of scale and scope as well as for developing capabilities necessary to respond to old challenges of underdevelopment and new challenges of climatic change, civil strife, diseases such as HIV/AIDS, and other crises. Networks aim to exploit comparative advantage and maximize spillover effects. The primary objectives of networks are:

- Jointly addressing complex issues that cannot be effectively addressed by any one partner/institution;
- To improve the effectiveness and efficiency of resource use; and
- To avoid duplication of efforts, exploit complementarities and synergies.

In networking and partnership, the combined strengths and skills will enable the individual entities and the society to function more effectively and successfully. The main motivation is to maximize mutual benefits on issues of common interest. Furthermore, partnerships should be seen as a means for generating innovation and not as an end in itself.

Hartwich et al. (2004) outlined some considerations in entering partnerships, as follows:

- common interest–space condition
- the cost–benefit condition
- one enters into partnership when the perceived benefit > investment cost + costs of interaction (benefits including both tangible and intangible benefits)
- the synergy through collaboration condition

One enters into partnership when the perceived benefits are higher than those from equivalent investments in non-partnership arrangements. Synergy results from economies of scale in the use of R&D resources (knowledge, funding, and infrastructure) which could not be obtained otherwise,

from mixing complementary R&D resources (e.g. bringing knowledge about production and market together), from the effects of joint learning from reduced costs in seeking and exchanging information

- the no-conflict condition

One enters a partnership when the generation of benefits does not substantially conflict with other interests. Partnerships may be very beneficial in terms of cost–benefit ratios that do not take account of externalities (social and environmental conflicts)

- the proportional benefit conditions

One enters a partnership when one’s own perceived benefits are not disproportionately lower than those of partners. Proportionality also takes into account the inputs partners provide and therefore goes beyond fifty–fifty benefit sharing solutions.

## 7 Key steps in designing, implementing and managing networks/partnerships

Partnerships go through various stages during their evolution and operations. Each of these phases has a specific set of activities/steps that have to be undertaken. And these in turn require specific sets of skills and tools. This section outlines these phases and steps, while identifying the skills and tools needed.

### Key phases in partnerships

The key phases in partnerships and the corresponding steps/activities in each of these are summarized in Table 1.

**Table 1.** *Key phases, steps and skills required in partnerships development and management*

Phase/stage	Steps/activities	Skills and tools
Pre-partnership phase	<ul style="list-style-type: none"> <li>– Context/needs analysis</li> <li>– Stakeholder identification</li> <li>– Determine if a partnership is right for your situation</li> </ul>	<ul style="list-style-type: none"> <li>– Rich pictures for contextual analysis</li> <li>– Stakeholder/actor analysis tools</li> <li>– Partnership readiness questionnaire</li> </ul>
Partnership initiation phase	<ul style="list-style-type: none"> <li>– Selection of partners</li> </ul>	
Partnership formation phase	<ul style="list-style-type: none"> <li>– Develop vision and strategic direction based on shared problem definition and approach</li> <li>– Agree on partnership principles (or code of ethics)</li> <li>– Develop mutual understanding and knowledge</li> <li>– Agreement and understanding upon necessary leadership roles and responsibilities</li> <li>– Creating a partnership covenant or MoU</li> <li>– Work plan preparation</li> </ul>	<ul style="list-style-type: none"> <li>Conducting effective meetings</li> <li>Facilitation skills</li> <li>Interpersonal skills</li> <li>Leadership skills</li> <li>Management skills</li> </ul>
Implementation/management phase	<ul style="list-style-type: none"> <li>Organizing the partnership</li> <li>Develop governance structures</li> <li>Develop M&amp;E systems</li> <li>Establish communication linkages</li> <li>Decision-making</li> <li>Trust, respect and commitment</li> </ul>	<ul style="list-style-type: none"> <li>Interpersonal skills</li> <li>Leadership skills</li> <li>Management skills</li> <li>M&amp;E tools (including process monitoring)</li> </ul>
Post-partnership phase	<ul style="list-style-type: none"> <li>– Evaluation</li> </ul>	<ul style="list-style-type: none"> <li>Evaluation tools</li> </ul>

## 7.1 Pre-partnership phase

### a. Context/needs analysis

It is important to define the problem that the organization is embarking on addressing and understand the context around it. This would lead to defining the needs whether and what kinds of partnerships are required. A rich picture would be a useful tool to provide a visual of the problem context.

### b. Stakeholder identification

Based on the context analysis, the organization should identify the key stakeholders and actors involved in the problem context. Stakeholder and actor analysis tools would help identify the key actors and stakeholders, their objectives and interests, their attitudes and behaviours, their relative importance and influence etc. This would aid in drawing up a long list of potential actors/stakeholders to partner with.

### c. Determine if a partnership is right for your situation

Partnerships are not a panacea to address all problems and might not be suitable for all contexts. So it is important to identify whether the situation/needs warrant partnerships. Usually organizations seek to form partnerships to:

- Access specialized resources, add or augment like resources, add complementary resources
- Reducing duplication
- Increasing service integration
- Improving access to the end user
- Expanding capabilities
- Gain legitimacy
- Foster or facilitate information exchange
- Spread risk
- Mutual learning
- Consolidating competitive position in the market

Although there are many reasons why partnerships could add value, prospective partners should carefully consider several issues before plunging ahead.

Firstly, examine your strategic motives.

Ask some important questions:

- Considering all that we know and have read about partnerships, why do we think this form of structure could be the best way to get the results we want?
- What are our strategic motives?
- What organizations might be a good fit for this partnership? (strategic fit can be defined by partners' skill/knowledge contributions, their underlying motives, their ability and willingness to commit resources, and their organizational culture)
- What are the resource implications of forming a partnership?
- Is our own organization 'partner ready'? Do we have the motivation and partnering skills to champion this partnership?

Secondly, determine if your organization is 'partner ready'.

Although partnerships offer compelling opportunities to achieve desired results, they also demand resources and require a good deal of leadership and management attention. Thus the decision to embark upon a partnership is not one to be taken lightly. Ask a few questions before making such decisions.

- Does your organization have the resources (financial, human, and technological) that the partnership venture requires?
- Does it have the willingness and ability to cooperate, share control, share credit/recognition, and collaborate with other organizations making up the partnership?
- Does it have the commitment to devote the required resources to this effort? Would the effort be a valuable part of the organization's portfolio? Would senior leadership be willing and able to provide necessary support and nurturing required for success?

A partnership readiness questionnaire can be useful to do this.

## 7.2 Partnership initiation phase

### a. Selection of partners:

Once an organization makes a decision to partner and clarifies why it wishes to partner, the next key decision is to choose the partner(s) one would collaborate with.

Good partners have much in common. Mutuality and adaptability are central to the wellbeing of partnership relation. Willingness of the partnering parties to reach out to others in an effort to share competencies rather than imposing conditions on each other is vital for a healthy relationship.

Some questions to ask while selecting partners:

- Does this partner possess the resources (financial, human and technological) necessary to contribute to partnership?
- Does this partner overlap with our primary work or pose potential threatening competition?
- What are the weaknesses this partner might bring to the partnership?
- What do we know about this partner's previous experiences with partnerships? Did the organization meet its commitments? Was the work of good quality? Was the organization seen as a cooperative partner?
- How culturally compatible would this organization be with our own? Do we have goals and values in common? Are our work practices and styles compatible?
- Will this organization be willing and able to devote the resources required for successful implementation? Will the organization deliver what it promises?
- Does this partner's senior management support this particular partnering effort? Will they give effort the attention it requires?

Seeking answers to these questions will require thoughtful information gathering. Partnership conversations must occur at several levels so that you and your potential partner have plenty of opportunities to discover if there is a strategic and compatible fit between you.

Metcalfe (1997) identified the following set of criteria for selecting partners:

- Strategic fit—a common understanding of the business rationale among the partners
- Capability—the necessary skills that go into enhancing the value of the partnership
- Compatibility—the complementary strengths of the partners that is mutually beneficial, including the match of organizational cultures

- Commitment—a strong motivation to sustain the partnership in terms of furthering its prospects and solving its problems
- Control—potential for having an effective means of governing the partnership.

Bronder and Pritzli (1992) emphasized the importance of strategic synergy among the partners. They emphasize three factors in picking up a right partner.

- Fundamental fit: complementary activities and expertise in a way that increases value potential
- Strategic fit: harmony of business plans
- Cultural fit: the readiness of partners to accept the geographically and internally grown culture of the partner.

The criteria noted above on how organizations choose a partner illustrate some of the difficulties inherent in establishing partnerships between public and private organizations. There is usually less strategic fit between public and private organizations than in the case of private–private or public–public couplings. This is because public organizations principally pursue production of public goods and private organizations pursue private goods. There are also major cultural differences between public and private organizations.

When a public–private partnership is a necessity the challenge is to find a common objective that can serve as the backbone of partnership. If the fundamental differences between the organizations eliminate the possibility of reaching a common ground, the only option available would be to enter into an agreement using market norms.

### 7.3 Partnership formation phase

The first step after selecting your partners would be to convene them for an exploratory meeting.

The first meeting is exploratory. Generally the partner that is initiating the partnership will take this step. The goal is to build trust and commitment. When contemplating an initial meeting with the partners consider the following:

- Who convenes? It is important to identify an organization or individual that is well regarded by all parties. The convening individual or group needs to have credibility with all prospective partners.
- Who attends? It is also important that those with appropriate organizational responsibility and position attend the meetings. Oftentimes, such meetings require attendees possessing clear authority to speak on behalf of their organization.
- Where? The actual meeting location must be considered. For an initial few meetings, it may be best to identify neutral grounds. This prevents the meeting from being perceived as under one organization's control, some circumstances may require that participation by one or more members be by teleconference or electronic conferencing.
- Who moderates? The convener often fills this role. If choosing a moderator for the initial meetings, find a facilitator who allows partners to raise issues without getting bogged down in unproductive discussions.
- What is discussed? An agenda for the first meeting might just focus on two things: personal and organizational introductions and a sharing of viewpoints about the common cause or issue that has brought a partnership together. If the organizations have not had a history of interaction, the meeting might appropriately end with only a summary of viewpoints written for distribution. If the meeting members already know each other, they might move directly to determining their collective vision of the problem and its solution. It would be important to discuss the following:

- What is/are the problem/s to be solved, and what value added might we achieved if we worked together?
- What would each organization want and expect to get out of a partnering effort?
- What might be the downsides of being a part of this partnership for each organization?
- What strengths do each of our organizations bring? what weaknesses?
- What lessons learned do each of us bring from previous partnerships?
- In what ways are our organizational practices and styles compatible? Incompatible?
- How compatible are our organization's longer term strategic ambitions?
- How would the work of this partnership fit into the larger priorities of our respective organizations?
- What roles do we see each organization playing?
- What should be our next steps?

The next step would be **setting direction**. A subsequent meeting could be planned to help achieve this.

Partnerships often encourage looking at old problems in new ways, bringing energy and creativity along with shared solutions. This happens mostly if the members begin with a shared understanding about the nature of the problem and ideas about possible solutions. The steps involved in setting direction are:

- **Defining the problem:** Successful problem definition involves identifying a meaningful junction of the interests and needs of partners. Bringing representatives of all interested parties to the table is highly desirable.
- **Brainstorming solutions:** Noting the importance of having the beneficiaries' support, describe each member's stake in the problem and identify solutions to it (without getting bogged down in tasks, resources, personalities and histories). This is the time to clarify the vision of the partnership, its goal and strategic objectives, and establish a climate of hope and a willingness to work together.
- **Identifying local allies:** There are often local level organizations already active in solving the problem. They may already be working in partnership with other public or private entities. In the public sector, different agencies at various levels of government often collaborate to address a particular issue, based upon their mandate, interests and resources. In business, joint ventures, trade associations, and federations are common and in civil society, NGO coalitions are often formed around common issues or relationships to more effectively use resources. Some questions to answer in this case are:
  - What are the local organizations active in solving the problem (and who are the key actors in these organizations)?
  - Are these organizations with capacity to become implementing partners?

For advancing the partnership, in subsequent meetings, further develop goals and objectives. Key questions to be considered are:

- How should actions be implemented? Open lines of communication are vital, as are clearly defined planning rules. The implementation of major action plans may involve recruiting new implementing partners who may have not been part of the earlier problem-solving discussions.
- How will resource allocation take place? Each member has distinct financial, human resource and technology capabilities. This issue often becomes a sticking point during the implementation process. Partners need to discuss resources continuously—who's providing what and when—in order to ensure that the issue remains well understood from the outset.

- How can partners implement detailed plans in ways that respect their particular interests? Action planning may bring out further points of difference between the partners. It is important to respect these differences at all times. Differences exist in every partnership and accommodating them is a necessary component of successful partnerships.

*A note on joint planning:*

There is no formula for a successful joint planning process.

- It can take place on-site or off.
- It can involve all partners or only key partners.
- It can start with only the vaguest notion of what can be done, or with a well-articulated proposal developed by one or more potential partners.
- It can follow a systematic structured process or evolve in a more *ad hoc* fashion.

The crucial ingredients are a willingness to consider a range of ideas, a clear-eyed view of each partners' objectives, an ability to identify where there could be overlapping areas of interest, and time to allow for problem solving by and among partners as the process proceeds.

## 7.4 Partnership implementation/management phase

Organizing the partnership:

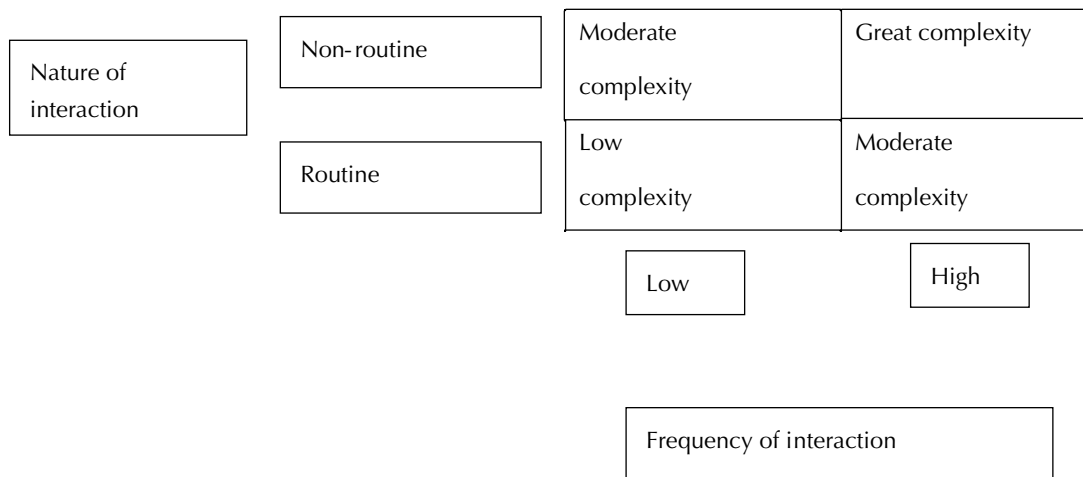
According to Killing (1988), two critical factors have to be considered while organizing a partnership: Organizational Complexity (OC) and Task Complexity (TC). OC is high when interaction among partners is non-routine (when task uncertainty is high and inputs from many partners are needed simultaneously) and the partners interact frequently. When OC is low, simple structures which require little co-ordination are sufficient. When complexity is high, there is a need for structures with complex co-ordination and integration components.

Factors affecting task complexity:

- *Scope of the partnership activity:* depends on partnership objectives, number of functions and products involved and the duration of the partnership
- *Degree of environmental sensitivity:* stability and predictability of operational environment (markets, policies, technology, customer preferences etc.) in which the partnerships would function. This influences the degree of uncertainty attached to the tasks the partnership would carry out.
- *Relevant partner resources and skills:* physical and technical assets that the partners bring. If there is mutual understanding of the comparative advantages and commitments of the partners, carrying out tasks jointly becomes more complex.

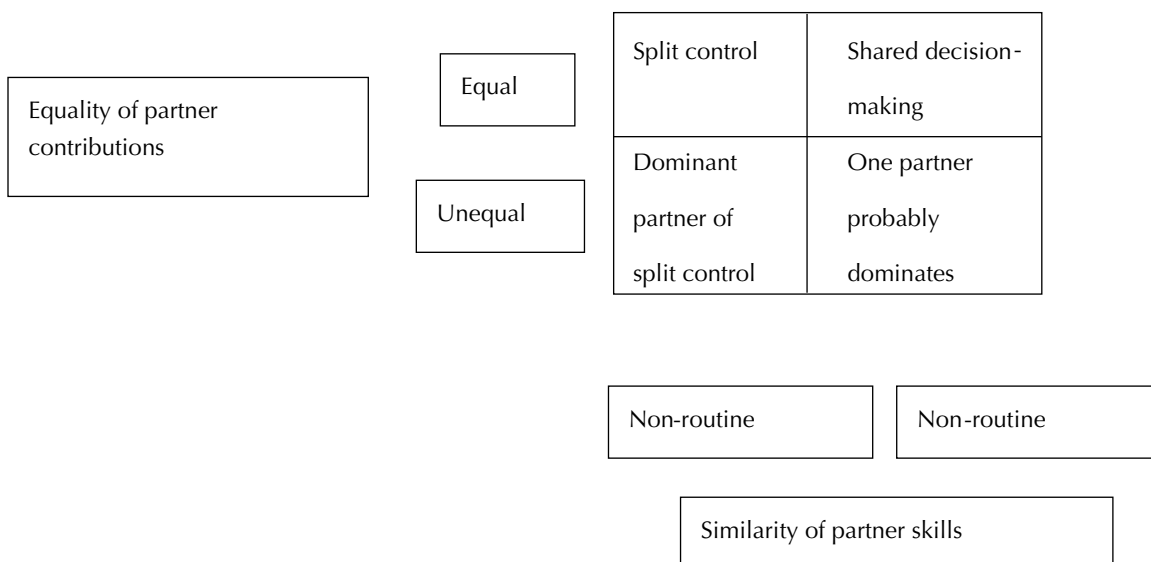
Organizational Complexity depends on Task Complexity. Tasks requiring complex sequencing or coordination would call for organizational forms that would ensure efficient flows and integration arrangements. It also depends on:

- *Number of partners:* the more the members, the higher is the complexity. Ensuring participation while seeking simplicity of co-ordination is a perennial challenge in partnerships.
- *Nature and frequency of interactions among partners:* determined by nature of tasks and expectations/demands.
- *Level of trust:* lack of trust results in dysfunctional interaction which complicates the relationship.



**Figure 1.** Interactions and levels of complexity in partnerships.

There are also three organizational models proposed based on skills that partners bring and their contributions. This is illustrated in Figure 2.



**Figure 2.** Organizational models based on partner skills and contributions.

The form the partnership organizational model would take should follow the function.

### Developing governance structures

Management of a partnership will be greatly facilitated when the basic governance structure established by the MoU is clearly defined. It can be assumed that the partners have achieved a high level of trust and have a shared commitment to achieving results. They can maintain openness and accountability to one another by establishing clear agreements on governance procedures. At a minimum, it is desirable to address the following areas:

- Specific roles and responsibilities of partners as well as their relevant supporting units.
- Key elements of governance such as frequency of meetings, decision-making processes, participants, need for working groups, outreach to stakeholders/beneficiaries, monitoring systems etc.



- How to resolve differences should these arise.

Addressing governance issues in writing, at the outset of the partnership, will prove invaluable as partner personnel rotates during the life of the partnership, or as new partners are brought in. It should be a living document, to be amplified or modified as the parties gain more experience working together.

While defining roles and responsibilities, the following key questions have to be asked:

- Who are the principal players? Who is authorized to make decisions, convene meetings, address implementation issues, and provide substantive technical information? It is a good idea to provide a formal list of names, contact information, and level of authority to all relevant participants.
- Who has a supportive role, and how should they be kept in the loop (and by whom)? Decisions should be made on the mode and frequency of participation in or information on partnership issues.
- Partners should agree on and practice direct communication on all aspects of partnership implementation, at executive and working levels. It may be important to inform each other on the relevant internal processes of each partner, and any changes therein.

Clear 'rules of the game' make it easier for partners to focus on their role in implementation.

Other questions that could be addressed include:

- What is the frequency of meetings of the principal governing body of the partnership? Are teleconferences acceptable?
- Who convenes and who participates (actively or with observer status) in meetings? Should there be working committees (if so, what are their specific responsibilities)? Should periodic open meetings be convened for information sharing and gathering purposes with parties relevant to partnership progress (including beneficiaries)?
- Who is empowered to make binding decisions? Will decisions be made by consensus, by vote?
- Who is responsible for the agenda, preparing minutes and circulating them? Should minutes be signed by the principals?
- In partnerships where partners are pooling their funding, what is the process for making funds available? The level and timing of funding needs should be discussed, as well as the likely burn rate of the activity.
- How will partnerships work with beneficiaries and potential new partners? To what extent will partners inform each other when they have separate contacts with such groups? A voluntary code of conduct is one way partners signal commitment to partnership perceptions.
- What kind of public outreach is relevant? Should the partnership develop a joint approach? Does each partner prefer to publicize its efforts separately? Should outreach be aimed at informing, garnering public support?
- How will partners monitor and report partnership progress? Is there a limited set of performance indicators, or 'metrics', that all partners are willing to adopt and use notwithstanding any additional indicators that they may wish to identify and track? Do partners have reporting requirements that the partnership can help them meet?

## Resolving differences

Conflicts among partners in a partnership must be anticipated. In the interest of good governance it is appropriate to address the issue and identify, at a minimum, principles that should be followed in the event of disagreement.

Such principles include: always proceeding with respect for the other party; clarifying underlying issues; identifying options for resolving the disagreement ; being inclusive, not exclusive, of stakeholders who might be able to propose solutions; agreeing at the outset on a procedure for resolving the disagreement; and agreeing on time limits with which the problem should be resolved.

## 8 Conditions for successful partnerships

Experience has shown that the following ingredients are essential for an effective partnership:

- Common interest
- Joint planning
- Mutual benefit
- Clear roles and responsibilities
- Firm commitment: political and resources
- Good understanding and in-depth knowledge about the aims, ethos and working procedures of various partners
- Mutual respect
- Better understanding of the choice of investments, risks and transaction costs
- Openness, flexibility and willingness to listen to other partners
- Internally driven
- Stay on purpose and course.

**Sustaining elements:** There are five critical elements that help maintain the energy, commitment, trust and enthusiasm the partnership needs to survive over time. These are the nourishing elements—process elements that sustain the relationship—reduce tensions, smooth out interactions, build trust.

1. Attention to process — agreement on guidelines that help the group deal with the following factors:
  - Communication among members
  - Decision-making
  - Agreement upon approaches
  - Cross-cultural and non-verbal communication
  - Conflict resolution
  - Power differentials
  - Feedback—both giving and receiving.
2. Communication linkages — necessary to create dense webs or links among partners at senior leadership and operational levels—to establish a climate of frequent and in-depth information sharing, increase understanding of the scope of talent and skill each partner can contribute, and allow for the exploration of other opportunities for future collaboration—nurturing inter-personal relationships and building rapport and interest in learning—better discover what new value can be created together.
3. Explicit decision-making process
  - Establish clear agreements on the way partners will make decision. Efficient decision-making process, allowing active participation and consensus building. Agreements should specify how much reporting and documentation needs to take place, who needs to be involved and how quickly decisions have to be made.
  - Factors affecting decision-making
    - Real or perceived power imbalances among members

- Decision-making practices and authorities of home organizations.
4. Trust, respect and commitment
    - Actions that can lead to this
      - People doing what they say they will do
      - Understanding and protecting the interests of all members
      - Listening with the intent to understand what others are saying
      - Being honest about what the partner organization can contribute to the effort (not hiding the limitations)
      - Sharing successes with others and taking responsibility for mistakes
      - Developing a shared set of values around both the expected output of the partnership and the processes for carrying out the work.
  5. Credit and recognition
    - Important for sustaining motivation and achieving quality results
    - Acknowledging and rewarding people for their successful efforts
    - Agreements at the onset about visibility, authorship, and IPRs.

## 9 Lessons learned

A review and synthesis of experiences in partnership formation and management for addressing development challenges in developing world highlights the following lessons:

- Partnerships are not a panacea for all development challenges.
- Partnerships can create valuable synergies through knowledge sharing, joint venturing, scale economies, resource pooling and risk sharing.
- More knowledge and information is needed to determine how partnerships can be organized and managed effectively and efficiently.
- The most critical weakness of structured networks is their vulnerability, when the key people leave or external financial support ends, the network generally collapses. At a minimum, organizations participating in such networks need to plan from the start for the sustainability of network activities and services.
- A second observation is that the resources devoted is the part of formal networks probably would have had, in many cases, greater impact if used to reinforce the informal networking which is going on constantly (Baker 1999).
- The third observation is that the scope of networking activities nearly always has been narrow relative to farmer needs and concerns. In effect, networking often contributes to developmental 'supply push'.

Insights from a review of diverse cases of partnerships in Africa by Oyelaran-Oyeyinka (2005) revealed that:

- Partnerships are key but are often narrowly conceptualized.
- Getting the institutional context right for partnerships is much more demanding than is generally assumed.
- Co-ordination matters.
- Strong governance is important.
- Capacity development is about building local systems for producing and using knowledge not just building stocks of infrastructure, trained scientists, or trained users.
- Stimulating demand is as important as generating science and technology.

## 10 Public–private partnerships (PPP)

Public agricultural research was the primary source of new technologies for agriculture during most of the 20<sup>th</sup> century. It is now recognized that there are many grey areas where R&D products are neither pure public nor private goods. In the recent decades at least in many developed countries, private enterprises have become important players in agricultural R&D and are active in the fields formally dominated by public research. A large number of public–private partnerships for agricultural and agro-industrial research have emerged exploiting resources and skill synergies from the two sectors.

In practice public–private innovations involve clusters or coalitions of organizations, including those from civil society, who together produce, adapt and use knowledge that drives innovation. These partnerships have usually emerged as a result of casual interaction between a private sector leader and a researcher, who know each other from the past giving them an initial level of trust that facilitates the start of a partnership. Recently, many partnerships have been induced by competitive grant schemes that condition funding on the existence of linkage between researchers, private producers or industries.

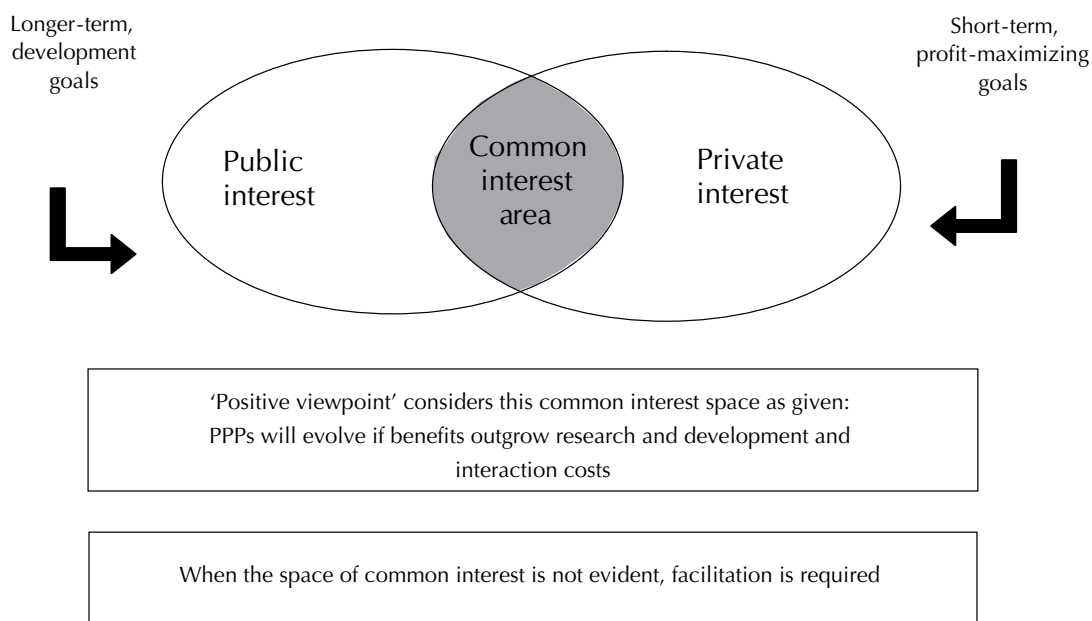
Research by IFPRI suggests that:

- Partners enter into public–private partnerships (PPP) when they perceive that the tangible and intangible benefits outweigh the costs of conducting research plus the transaction costs of collaboration among partners. Partnering is less likely when the innovations dealt with are controversial and when most partners perceive that one partner receives a share of the benefits larger than what the partner is entitled to.
- Partnerships for innovation evolve in a step-wise process leading from the identification of a common interest among partners; through negotiation of a formal or informal partnership agreement on the governance, funding and legal aspects of the partnership; to implementation, evaluation and the possibility of continuation or termination.
- Partnerships are usually built around long-term objectives and subsequently require reorientation from time to time, due to changes in the context that were unforeseen at the start. Sustainable partnerships are those characterized by a high degree of interaction, a strategic approach to problem-solving, good management practices and, in particular, extensive capacity in negotiation and conflict resolution.

It has been recognized that successful PPPs are always context specific. There is a great diversity of arrangements dependent on the context in which partnerships arise and the needs that trigger the partnerships. It has been also argued that recipes for PPP formation will probably be of limited use, but developing principles to guide the process will be helpful.

The main assumptions in PPP are summarized in Figure 3. PPPs have been most successful when developed as a long term partnership between trusted partners and when building capacity and developing marketable technologies. A number of case studies (ISNAR) indicate that the most appropriate basis for building PPP is the value chain, where the actors with common interest converge.

The other factors that contribute to successful PPP include enhancement of social capacity, flexibility, leadership from a ‘promoter group’ or a facilitator, clear identification of common objectives or a common interest space. The key issues and challenges in promotion of PPP are summarized in Box 1. Human resources and operational funds to facilitate partnership are also crucial especially when the actors are heterogamous. Effective partnerships generally require:



Source: Modified from Verónica Gottré's presentation.

**Figure 3.** Main assumptions in PPP.

1. a facilitating organization and a facilitator with a mandate and ability to promote PPPs
2. a visionary and innovative leader in the private sector with credibility and recognition within the sector
3. research organizations with good-will and recognition that offer knowledge and technological options relevant and responsive to the demands of the value chain and
4. researchers with a good knowledge of the value chain and available technological options and with an aptitude to relate to the private sector.

#### Box 1. Key issues and challenges in promotion of public–private partnerships (PPPs)

PPPs are often successful when:

- developed as a long term flexible partnership between trusted partners;
- used for capacity-building and development of marketable technologies;
- common objectives and common interest space have been clearly identified;
- readiness for institutional learning and change exists;
- used for enhancement of social capacity; and
- led by a facilitator.

The key challenges:

- high transaction costs, management intensiveness;
- demand for human resources and operational funds;
- resistance to institutional change;
- complex operational setting, including disconnect between international and national laws; and
- farmer and civil society involvement in technology development.

Source: Rajalahti et al. (2005).

In many instances the key constraints to PPP are of an institutional nature and require institutional change, particularly in public research systems, so that the new tradition of working together can emerge. Another key factor is the management intensiveness of the partnerships and the complexity of the rapidly changing international and national laws that govern intellectual property rights, technology transfers and regulation of plant varieties. The third factor is the transaction costs. These transaction costs are further increased with policies on competitive research grants that require capacity building beyond that provided by training on the identification of common interests, the negotiation of financial, governance and legal aspects and the design of partnerships.

## Enhancing PPPs

PPPs have much potential in agricultural R&D and in S&T in general, but have been slow to develop primarily because of a lack of clarity among partners. In addition, the private sector investment in agricultural R&D is the lowest in SSA. A number of things can be done to enhance the PPP.

- Greater efforts are needed from both the public and private sectors to foster openness and clarity, minimize risk and uncertainty and reduce red tape associated with partnerships.
- Including a facilitator and/or facilitation organization in the process can reduce the transaction costs and bring clarity to the process.
- Supporting policy measures such as intellectual property rights is vital to shape PPP.
- There should be a stronger emphasis on partnerships as a source of synergetic R&D rather than as a means of supplementing public sector funding.
- PPPs should allow greater participation of farmer groups and other stakeholder groups (consumer organization, NGOs, environmental groups etc.) to balance private sector influence and power over priority setting.
- Increased capacity strengthening efforts are needed to help innovation actors to accumulate social capital, develop co-operation skills and build capacity to analyse needs to their particular value chains.

Partnerships should not be considered for technical innovations only but should encompass institutional, managerial and policy level collaboration.

However, it should be noted that partnerships are neither appropriate to every R&D situation nor are a panacea to resource or capacity limitations in the public sector. However, effective and meaningful partnerships can create valuable synergies through knowledge sharing, joint learning, scale economies, resource pooling and risk sharing.

At a gathering of PPP practitioners in Washington (pro-poor public-private partnerships for food and agriculture: An international dialogue, September 2005), the participants generally agreed that more knowledge and information is needed to determine how partnership can efficiently and effectively be organized and managed. They emphasized:

- The need to identify common interests; agree on feasible outcomes; map complementarities; estimate potential costs, risks, and benefits; and calculate available alternatives early in a partnership;
- The need to promote partnerships on different levels (local, national, and international), with different actors (public, private, and civil society), and in different fields within the agricultural sector (crop science and agro-industrial research, market and product development, and dissemination and distribution);

- The need for consistent methods of monitoring, evaluation, and impact assessment to assess the value of a partnership, prior to, during and after the undertaking;
- The importance of effective mechanisms to manage risks associated with legal and regulatory frameworks, difficult political environments, volatility in donor or private financing, limited institutional capacity or infrastructure, overruns in cost and time, and human error or other idiosyncratic factors;
- The value of exploring organizational alternatives, such as non-profit 'hybrid organizations' to bridge the objectives and values of diverse partners, combine resources and competencies, and provide effective and independent management;
- The importance of establishing the credibility, legitimacy, and inclusiveness of the partnership, and to ensure a constant dialogue with all stakeholders involved;
- The need for business-like approaches to partnerships, including mechanisms to ensure priority setting, planning, accountability, transparency, flexibility, and, if necessary, termination of the partnership; and
- The distinction between partnerships for product development (e.g. drugs and vaccines or improved crop varieties) and those for sectoral development (e.g. integrating smallholders into value chains or private delivery of extension services).

A number of areas were identified for further action in order to promote pro-poor partnership in food and agricultural development.

These include:

- Continued dialogue on the opportunities for, and impediments to, pro-poor partnerships for food and agriculture in developing countries that include policymakers, public research organizations, the private sector, non-governmental organizations, and civil society groups;
- Identification of immediate opportunities where a partnership approach would be both an appropriate and efficient means of promoting specific agricultural research and innovation projects;
- Greater emphasis on developing tools for monitoring and evaluating partnerships, analysing partnership performance and outcomes, and conducting research on policy options and organizational mechanisms to manage risks and distribute costs and benefits in partnerships; and
- Specific analysis of the performance of partnerships within the CGIAR, and on the organizational and structural changes needed within the CGIAR to facilitate more opportunities for partnerships with the private sector and civil society.

Research issues under PPP that warrant further investigations are:

- How the benefits of innovation partnerships are distributed among actors in agri-chains?
- How partnerships can be evaluated with regard to their design, results and evolution?
- What policy options exist for local governments and donors to support partnership building efforts that address the needs for pro-poor development?

## 11 Monitoring and evaluation (M&E) systems for assessing partnerships

Partnerships and networking have implications for resources and are critical for innovation. It is therefore very important to monitor how they are functioning and evaluate if they are achieving the joint goals that were defined. As mentioned in the previous section, developing an M&E system is a crucial step in the implementation stage.

There are various methods/approaches/tools that can be used for assessing partnerships. Action-reflection is a model that helps a program, project or partnership to continuously improve based on the observation of the action of the planned program. The main idea behind the use of action-reflection is to learn from the experiences. Since the changing contexts affect some of the operations, it is expected that the partnership moves with a contingency plan to adjust to a changing situation. As a learning process, partners should take into account both internal and external contexts. The planned partnerships sometimes get affected by internal factors such as unwillingness of partners to carry out the planned activities, dropping out from the partnership due to change in occupation and project phase out. They could also be affected by external factors. The partnership has to be made flexible and proactive to make adjustment according to situation. It is important to critically note what is working and what is not. This information serves as an input for the next step planning. This continuous process of planning—putting into action—receiving reflection/feedback—revising plan—putting again into practice (action)—helps partnerships to move around the problems-solving orbit.

M&E in the context of public–private partnerships introduces some special considerations that should be taken into account in M&E system design.

First input-level monitoring has a particular importance in a public–private partnership. Partnerships rely on resources leveraged from multiple partners, and in many cases, these will not be documented in a legally binding obligating agreement. It will be important to build in a system to track the level of resources committed and disbursed to the partnership by each resource partner. This information is needed to provide assurance to all partners that each individual partner is meeting its responsibilities and there is an adequate flow of resources for meeting partnership objectives.

Second, output-level monitoring is more challenging in a partnership due to the need to separately track activities being carried out by each implementing partner and to develop common measures for similar activities being carried out by different partners to allow for a ‘summing up’ of the accomplishments of the partnership as a whole.

Third, assessing the intermediate results and development impact of a partnership is uniquely challenging. For one thing, rarely will partnership objectives completely overlap with the objectives of any one organization’s strategic plan. For another, different partners may define partnership success in different ways and hence be interested in tracing different partnerships ‘results’. All of these are legitimate measures of partnership ‘success’ that need to be incorporated in order to determine whether a partnership is meeting the distinctive objectives of each partners. The challenge is to knit these differing measures of success into an analytical framework that integrates each one into the strategic logic of the partnership as a whole.

As always in designing any M&E system, there is the need to strike a balance between the value of the information collected and the costs in time and money to collect it. The key consideration is what information is needed to:

- Effectively manage partnership resources, ensuring that partnership managers can get information they need to make mid-course corrections as appropriate;
- Properly account for use of taxpayer and shareholder funds; and
- Meet priority information needs of other stakeholder groups, such as host government or other donor officials engaged in related development programs, additional partners who may be sought in the future to sustain or expand the partnership, or others.



Determine what information is needed by whom and with what frequency and rigor will drive the design of any M&E system. Doing this in the context of a partnership requires intensive consultation with all partners. Once the scope of the desired system is defined, partnership managers then must agree on how M&E activities will be funded, who will manage them, and how widely the data and analyses will be shared.

Participation by the private sector partner in the design of a partnership M&E plan may introduce new approaches and create learning opportunities for all parties.

## 12 Framework for analysing partnerships and networks

There are a number of challenges for evaluating social and institutional impacts in a context in which partnerships and collaborative arrangements (especially between public and private sector entities) are critical to achieving program objectives. The pooling of resources, sharing of responsibilities and joint production and delivery of goods and services call for assessment methods to verify that collaborative mechanisms work as intended, do not produce perverse incentives and reduce rather than increase transactions costs. Good practices here involve assessing the collective vs. individual goals of partner organizations as well as their respective levels of institutional development, resource endowment and patterns of interaction and communication.

The five major elements of network performance and related indicators of success as indicated by Creech (2004) includes: effectiveness, structure and governance, efficiency, resources and sustainability, and life cycle. Some of the most common methodologies used (Willard et al. 2001) to assess the impact of a network are:

- SWOT (strengths, weaknesses, opportunities, threats) analysis;
- results-based management;
- logical framework analysis;
- outcome mapping; and
- appreciative inquiry.

The following framework could be used to systematically collect and analyse issues of partnerships and networks, to see if they are satisfactory in terms of their results and the way they manage their collaboration process.

- Understand the collaboration process in partnerships and networks and see how well it works;
- Assess, if the partnership and networks generate the expected and relevant results and if it does this in an effective way;
- Identify the strengths and weaknesses of the partnerships and networks in areas related to trust, administration, management, leadership and the synergy it creates;
- Learn how it can make its collaborative process work better, when it still has time to take corrective action;
- Document the value of its collaborative process to partners, donors and the community;
- Make the partnerships and networks more responsive to its partners and the broader community; and
- Get agents more involved in the leadership and management of the partnership.

## Indicators for analysing partnerships and networks

### Evaluation of R&D outputs

- What costs are involved in creating and running the collaboration?
- What products, results, and benefits (company and social) are obtained from the innovations to be generated in the partnership?
- How does the collaboration affect production, productivity and income of the agents in the agricultural sector?
- What is the perception of participating agents on the worthiness of the activities conducted in the collaboration?
- What minimal expectations on benefits do participating agents have with regard to the collaboration?
- How do participating agents behave strategically to insure that they attain benefits from the collaboration?

### Functioning of partnerships

- How are decisions made in the collaboration? Who takes them?
- Which governance models are used in the collaboration?
- Which financing arrangements assure the collaboration?
- Which unknown and conflicting actors' constellations did occur in the collaboration?
- Which legal rules apply in repartition of resources and redistribution of benefits?
- What obstacles loom in the partnership with regard to differences between the partners (language, culture, status, world view, bottom line)?
- What measures are in place to control use of funds and achieving of objectives?
- Which mechanisms of interaction and exchange of information exist in the collaboration? What information has been exchanged? How many agents have been contacted for how many times on what issues?

### Evolution of partnerships

- What reasons led or will lead to the collaboration? What did partners have in mind when entering the arrangements?
- How did the negotiations take place leading to the partnership contract?
- Which catalysing agents (internal and external) have been supporting the creation of the collaboration?
- Where did the initiative and the motivation for the collaboration originate from?
- What do agents expect from the other participating agents in the collaboration?
- What is the level of trust among the participating agents? Which mechanisms exist to create trust among the partners?
- Are there positive unexpected outcomes from the partnership?
- What are the companies and research organizations efforts to think on strategic market opportunities?
- Have the objectives of the partnerships changed or been redefined over time?
- Is there space for research teams in the partnership to involve in creative thinking on new product ideas?

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- Hartwich F. 2005. Framework for analyzing partnerships and networks in agricultural research and innovation.
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## Exercise 6 Investigating partnerships and networks (group work)

1. Form four groups and have each group elect a rapporteur (5 minutes)



### Phase 1 Group work (one hour and 30 minutes)

1. Using the intervention/project that you are working on presently try to respond to the following questions in the group
  - Who are the actual partners in this intervention/project?
  - How was the partnership/network formed?
  - What are the roles and responsibilities of each partner/network member(s) and how were these defined?
  - How effective is the partnership/network?
    - What went wrong and what went right?
  - Who are the potential partners that could be involved?
    - What lessons did you learn that could assist you in future partnership/networking activity?

The rapporteur writes down the results of the group work on the flipchart (5 minutes)

### Phase 2 Reporting and discussion (35 minutes)

1. The trainer invites rapporteurs from the groups to present the results to the audience (30 minutes)
2. At the end, the trainer asks feedback on this exercise and closes the session (5 minutes).

# Trainer's guide

## Session 7 M&E and impact assessment

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Purpose	The purpose of this session is to demonstrate the importance of M&E and IA in R4D	
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"><li>• Clearly describe and differentiate monitoring, evaluation, and impact assessment</li><li>• Discuss process, product/performance and, outcome monitoring</li><li>• Explain different types of evaluation in relation to the project cycle and the activities involved</li><li>• Explain different types of impact of R for D interventions and methods and techniques used to assess them</li></ul>	
Resources	<ol style="list-style-type: none"><li>1. Flipcharts</li><li>2. White board</li><li>3. Flip chart and white board markers</li><li>4. Copies of handouts 7.1, 7.2, 7.3 and 7.4 for every participant</li><li>5. Computer and LCD projector</li></ol>	
Time needed	Two hours	
Session structure		
<hr/>		
Activity		Time required Remark
<hr/>		
Presentation	<ul style="list-style-type: none"><li>• Distribute handout 7.1 (presentation slides) before you start your presentation</li><li>• Give a presentation on M&amp;E and impact assessment</li><li>• Allow some time for questions</li><li>• Distribute handout 7.2 (presentation text) to supplement your presentation</li></ul>	30 minutes
Exercise	<ul style="list-style-type: none"><li>• Distribute handouts 7.3 and 7.4 for exercise 7 on project cycle, M&amp;E and IA</li><li>• Ask a volunteer to read the exercise</li><li>• Ask participants do the exercise</li></ul>	130 minutes
Transition	Make closing remarks and transit to the next session	5 minutes
<hr/>		

# Session 7: Presentation slides

Slide 1

Session 7

M&E  
and impact assessment

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Slide 2

Objectives of the session

- Clearly describe and differentiate monitoring, evaluation, and impact assessment
- Discuss process, product/performance and, outcome monitoring
- Explain different types of evaluation in relation to the project cycle and the activities involved
- Trace the outcome and impact of interventions
- Explain different types of impact of R&D interventions and methods and techniques used to assess them

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Slide 3

Monitoring

- Continuous assessment of both the functioning of project activities in the context of implementation schedule and of the use of project inputs by the target population in the context of design expectations (traditional)
- Process monitoring, progress monitoring (in terms of performance) and impact monitoring (use against baseline/panel data)
- Is an internal management tool

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Slide 4

## What is a process?

- A series of steps and interrelated work activities, characterized by specific inputs, and tasks which add value, and make up a procedure for a set of specific outputs

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Slide 5

## Process monitoring

### What is it?

- Careful and systematic observation of activities
- Continuous process of observation, interpretation and institutional learning

### Assumption:

- There is an ideal way in which a process should develop
- There is an objective towards which the process ought to lead

### Why do it?

- Identify problems and bottlenecks
- Identify deviations from 'ideal' to tackle corrective action
- Institutional learning

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Slide 6

## Why process monitoring?

- Emphasis of the research on the *process* as part of an evolutionary adaptive system requires an action research orientation and the need to think about *progressive change*, where the different progressive stages need to be defined and redefined throughout the project

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Slide 7

## What is process monitoring?

- Focus on critical processes which are directly related to project objectives
- Continuous process of observation, interpretation and institutional learning
- Selection of activities and processes to be monitored is iterative
- Main focus is on qualitative indicators
- Information flows back and forth between field staff and management

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Process monitoring investigates processes within the community, project and wider socio-economic context  
Both internal and external processes

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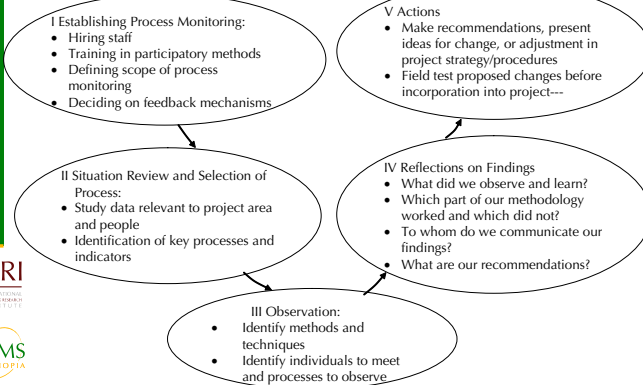
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Slide 8

## Steps involved in process monitoring



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Slide 9

## Key steps in process monitoring

- Break up the innovation process that we are seeking to address into a number of distinct monitoring domains
- Identify key processes and indicators that are closely linked to project objectives and project cycle
- Limited number of processes should be selected, include those which may prove to be bottlenecks during the course
- In each domain ask essential questions that need to be revisited as the project/intervention evolves

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Slide 10

## Useful tools for process monitoring

- Participant observation
- Participatory discussion (focus group)
- Semi-structured interview
- Process monitoring working groups
- Project planning meetings
- Special studies
- Topical sessions



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Slide 11

## To note...

- Ideally process monitoring methods and indicators should be effectively integrated into the project's M&E system
- Clear criteria for monitoring processes, with clearly defined roles, responsibilities, methodology, realistic time frame and resources for implementation
- Open mindedness and willingness to listen to the views of others
- Flexible and adaptive
- Should operate at all levels, focusing only on one level can be misleading by obscuring the impact of other forces on project effectiveness



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Slide 12



## Monitoring is closely linked to evaluation

Monitoring involves:

- Recording of data
- Analysis
- Reporting
- Storage

Data collected include:

- Physical and financial information
- Inputs and services provided } (Against baseline)
- Data obtained from surveys
- Socio-economic indicators



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Slide 13

## Evaluation

- Broader concept
- Aspects covered
  - Performance
  - Quality
  - Relevance
  - Efficiency

Impact: during priority setting, eventual effect on development objectives



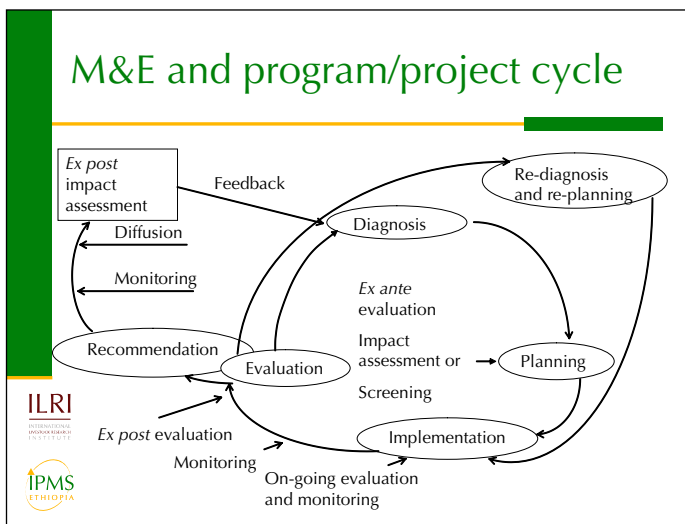
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Slide 14



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Slide 15

## Types of research evaluation

- Related to timing
  - Occurs before: *ex ante*
  - Occurs during: ongoing
  - Occurs immediately after completion: *ex post*
  - Occurs several years later: impact
    - At different levels



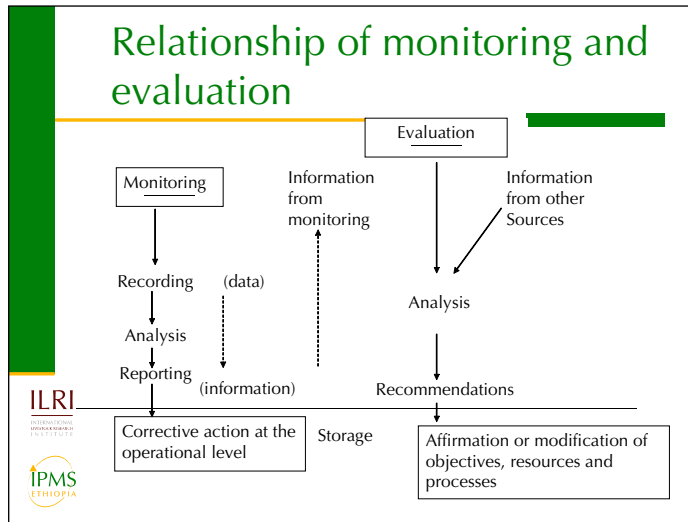
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Slide 16




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Slide 17

- ### Impact
- Special form of evaluation
  - Deals with effects of research output on target beneficiaries
  - Attempts to look at both intended and unintended effects
  - Basic concepts of impact assessment are:
    - Causality
    - Attribution
    - Incrementality
  - Impact begins to occur when there is behavioural change among potential users
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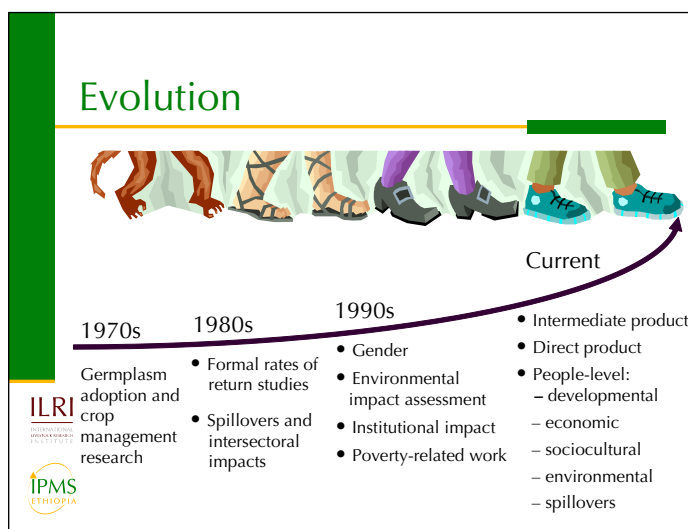


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Slide 18




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Slide 19

## Definition

- Means different things to different people
  - Direct product of the activity
  - Effect of the direct product on ultimate users — People-level impact
- People-level impact cannot be assessed without
  - Information on the number of users
  - Degree of adoption
  - Incremental effect on the production costs and outputs

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Slide 20

## Purpose of impact assessment

Purpose depends on when the assessment is done

- *Ex ante*
  - Study likely economic impact of proposed intervention
  - Identify optimal portfolio
  - Framework to collect information for *ex post* evaluation
- *Ex post* after completion of the program
  - To study the impact
  - For accountability purposes
  - Incorporate lessons learned in future planning
  - Establish credibility of public sector research
  - Justify increased allocation of research resources

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Slide 21

## Impact chain

- An impact chain is a tool used to trace the linkages between a given set of inputs and activities of a project or program to the most highly aggregated development results such as poverty reduction, food and nutrition security, environmental protection etc.
- Inputs => activities => output => outcome

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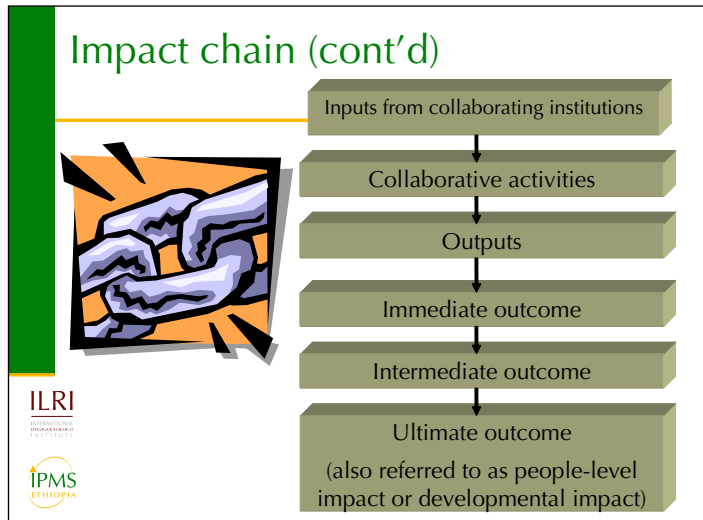
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Slide 22



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Slide 23

- ### Outcome mapping
- Methodology for planning, monitoring and evaluating development initiatives that aims to bring about social change
  - A tool to report realistically the achievements by tracking the connection between what was done and what happened
  - Enables project team or program to be specific about actors, its targets, the changes expected, and the strategies to be employed
  - Results are measured in terms of behavioural change
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Slide 24

- ### Outcome mapping (cont'd)
- Focus on change process and outcome
  - Development results (outcomes) are measured as changes in behaviour and relationships of actors with which the program interacts directly
  - Usually initiated through a participatory process at the design stage, include all boundary partners, using a facilitator familiar with the methodology
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Slide 25

## Outcome mapping (cont'd)

- Boundary partners — individual, groups or organizations with which program interacts directly and which the program happens to influence
- Intentional design — consensus on the macro-level changes it wants to influence and the strategies to be used



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Slide 26

## Outcome mapping (cont'd)

- Outcome challenges — description of the changes that the program intends to influence in the behaviour, relationships, activities and/or actions of a boundary partner
- Progress markers — a set of indicators of changed behaviour of the boundary partner



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Slide 27

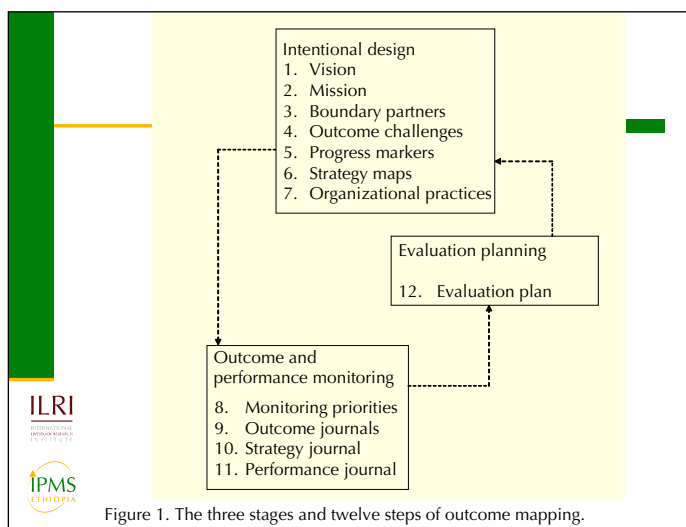


Figure 1. The three stages and twelve steps of outcome mapping.

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Slide 28

## Key steps

- Step 1: Intentional design
- Step 2: Outcome and performance monitoring
- Step 3: Evaluation planning



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Slide 29

## Stage 1 Intentional design

Deals with

- Why? — *Vision statement*
- How? — *Mission, strategy maps, organizational practices*
- Who? — *Boundary partners*
- What? — *Outcome challenges, progress markers*



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Slide 30

## Intentional design (cont'd)

- Consensus on macro level changes that the program would like to support and the strategies
- Long term goals act as reference points to guide strategy formulation and action plan rather than performance indicators
- Progress markers are developed for each boundary partner
- Will not help in identifying program priorities, appropriate once the strategic direction is chosen



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Slide 31

## Stage 2 Outcome and performance monitoring

- Provide a framework for monitoring action and the progress made by the boundary partners towards outcome/goals
- Data collection tools
  - An outcome journal — monitors boundary partners actions and relationships
  - A strategy journal — monitors strategies and activities
  - A performance journal — monitors organizational practices that keeps the program relevant and viable

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*Note: select only that information they can afford to collect. Reflect on the data collected and how it can be used to improve performance.*

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Slide 32

## Stage 3 Evaluation planning

- Outline main elements of the evaluations to be conducted
- 'Outcome mapping' and 'Results based management' are complementary and compatible
- Outcome mapping can contribute to
  - Support stakeholder learning in relation to the management of the program
  - Foster social communication as a basis for interactive participation
  - Strengthening local organizations and institutions

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Slide 33

## Collaborative activities — Outputs

### Collaborative activities

- Joint action undertaken by collaborators
- List activity, key collaborators, contribution by each group

### Outputs

- Goods and services produced by the set of activities
- Trained individuals, training materials
- Variety/breed or recommendations

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Slide 34

## Outcome

- Immediate
- Intermediate
- Ultimate
- Time element



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Slide 35

## Immediate outcome

- First-level effects of output — observed behavioural changes in those directly affected by the program
- Training
  - How did the training affect the trainee's behaviour?
  - Were changes made in the way of doing business?
  - Were the required skills applied?
- Research
  - Changes in extension recommendations
  - Adoption of technologies by participating farmers



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Slide 36

## Intermediate outcome

- Refers to benefits and changes resulting from the application of outputs
- Training — effects on performance of the individual and/or institution as a result of applying acquired skills
- Technology — effect at the farm household level: increased yield, reduced costs, reduction in post-harvest losses



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Slide 37

## Intermediate outcome (cont'd)

- Often immediate and intermediate outcomes can be measured and commented on directly
- Need to identify clients and how their behaviour is expected to change

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Slide 38

## Ultimate outcome = Impacts

- Refers to measurable effects of outputs and outcomes on the well-being of ultimate beneficiaries of R&D efforts
  - Poor, food and nutrition insecure, environment
- Related to developmental goals
- Time lag and use of proxies
- Attribution for various collaborators may be difficult
- Impact evaluation may be qualitative, quantitative, or a mixture of both
- Narrative summaries are essential components

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Slide 39

## In assessing the outcome and impact

- Focus analysis on all three levels:
  - Individuals directly involved in the program
  - Institutions/organizations involved
  - Ultimate beneficiaries
- Complement observations with expert opinion
- Available documentary evidence collected, analysed, and documented

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Slide 40

## Levels of impact

- Impact studies can include:
  - Innovation/technology/research program
  - Program plus complementary services
- Different level
  - Household
  - Target population
  - Regional and national level
  - Primary sector, secondary sector, or overall economy



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Slide 41

## Types of impact

- Production impact
- Economic impact
- Sociocultural impact
- Environmental impact
- Institutional impact



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Slide 42

## Impact checklist

- Institutional impact
- Changes in organizational structure
  - Change in number of scientists
  - Change in composition of the research team
  - Multi-disciplinary approach/improvement
  - Changes in funding allocated to the program
  - Changes (increase/decrease) in public and private sector participation
  - New technique/method



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Slide 43

## Product and income effect

- Risk reducing
- Yield increasing
- Cost reducing
- Reduction in inputs needed
- Employment creation
- Implication for other sectors of the economy



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Slide 44

## Socio-cultural impact

- Contributes to food security
- Poverty reducing
- Improves status of women
- Changes knowledge and skill level of people
- Creates (number and types of) jobs
- Destroys (number and types of) jobs
- Distributes benefits across gender and geographical locations
- Changes in resource allocation
- Changes in cash requirement
- Changes in labour distribution
- Nutritional implications



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Slide 45

## Environmental impact

- Erodes/degrades soil
- Silting
- Compacts soil
- Contaminates soil
- Contaminates water resources
- Changes hydrological regimes
- Effects on biodiversity
- Pollutes air
- Contributes to greenhouse gases



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Slide 46

## Spillover effects

- Effects on farmers outside the target area within a country
- Regional implications — SADC, ASARECA, CORAF
- International implications
- Cross-commodity effects
- Cross-sector implications




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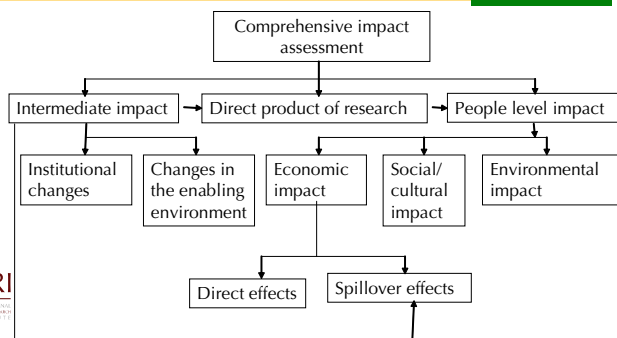
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Slide 47

## Comprehensive impact assessment



Source: Anandajasekera et. al, 1996




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Slide 48

## Impact types, techniques and methods

Impact type	Method	Technique
Intermediate impact <ul style="list-style-type: none"> <li>• Institutional changes</li> <li>• Changes in the enabling environment</li> </ul>	Survey, monitoring	Simple comparison/trend analysis
Direct product of research	Effectiveness analysis using logical framework	Simple comparison—target vs. actual
Economic impact Micro, macro, spillovers	Econometric approach Surplus approach	Production function Total factor productivity Index number methods and derivatives
Socio-cultural impact	Socioeconomic survey/ adoption survey	Comparison over time
Environmental impact	Environmental impact assessment	Various <ul style="list-style-type: none"> <li>• Qualitative</li> <li>• Quantitative</li> </ul>




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Slide 49

## In assessing the outcome and impact

- Focus analysis on all three levels:
  - Individuals directly involved in the program
  - Institutions/organizations involved
  - Ultimate beneficiaries
- Complement observations with expert opinion
- Available documentary evidence collected, analysed, and documented

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Slide 50

*Thank you!*

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# Monitoring, process monitoring, evaluation and impact assessment

## 1 Introduction

The process of monitoring, evaluation (M&E) and impact assessment is the primary means of collecting and analysing information, and is thus essential for good project management. In order to be used in a more positive manner, management and staff must have a common understanding of the importance of the process involved, and the contribution it can make to achieve the objectives of the technology development and transfer. To be effective, monitoring, evaluation and impact assessment should be participatory, and should be an integral part of project planning and implementation.

This chapter deals with the procedures to be used throughout the whole process from problem identification to diffusion of technology. The emphasis is on the process, not on individual project M&E.

## 2 Monitoring

Monitoring is a continuous assessment of both the functioning of the project activities in the context of implementation schedules and of the use of project inputs by the targeted population in the context of design expectations. The goals of monitoring are:

- To ensure that inputs, work schedules and outputs are proceeding according to plan, i.e. that project implementation is on course;
- To provide record of input use, activities and results; and
- Early warning of deviations from initial goals and expected outcome.

Thus, monitoring is a process which systematically and critically observes events connected to a project in order to control the activities and adapt them to the conditions. Key steps in the monitoring process are:

1. Recording data on key indicators, largely available from existing sources, such as time sheets, budget reports, supply records.
2. Analysis performed at each functional level management. This is important to assume the flow of both resources and technical information through the system.
3. Reporting, often through quarterly and annual progress reports, oral presentations organized by project staff.
4. Storage, whether manual or computerized, should be accessible to managers at different levels of the system.

Monitoring is an internal project management tool. Integrating monitoring into implementation increases the accuracy of the collected information, reduces the cost of acquisition, increases the focus (alertness) of the participating scientists and reduces the time lag for management corrections. Therefore, the emphasis is placed on simple methods. The various objectives of an M&E system are summarized in Box 1.

In the context of research, monitoring includes the periodic recording, analysis, reporting, and storage of data about key research and extension indicators. Data includes physical and financial information, details of inputs and services provided to beneficiaries, and data obtained from surveys and other recording

mechanisms. Monitoring primarily provides information on project performance and gives signals on whether an activity is proceeding according to the plan. Monitoring is essential for evaluation.

### Box 1. Objectives of M&E

#### Checking implementation

- Record inputs, activities and outputs
- Identify deviations from workplans
- Identify constraints/bottlenecks

#### Assessing performance, quality and relevance:

- Overall efficiency (cost effectiveness)
- Overall effectiveness (achieving objectives)
- Suitability of new methods and technologies under testing at the field sites
- Long-term impact (contribution to development objective)

#### Reflecting and learning

- Learning from achievements and mistakes
- Increase capacity to perform better in the future
- Take corrective action
- Communication
- Share progress and results with others

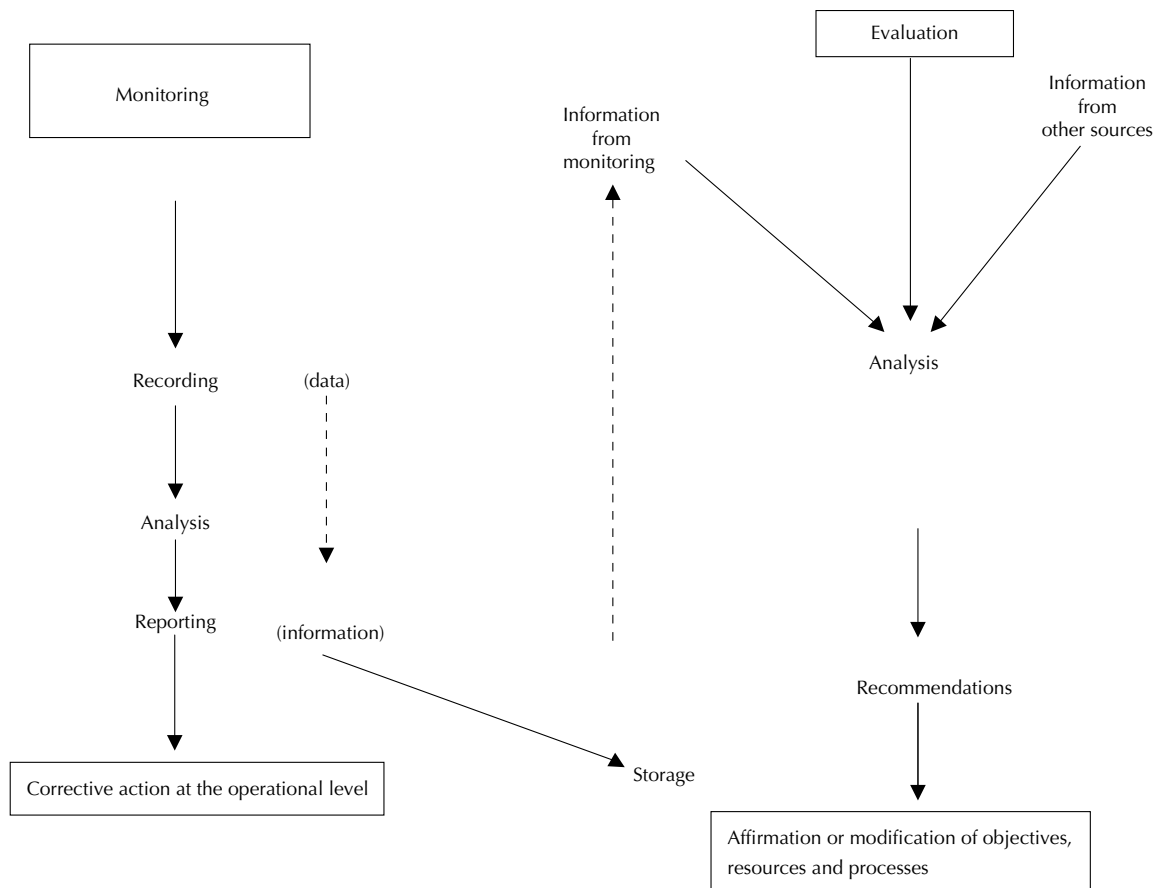
It can also provide information on the socio-economic indicators for *ex post* evaluation assessment. One could simultaneously monitor the resource use, i.e. of funds and personnel, as well as the process. Monitoring of the process may be accomplished through *inter alia* review meetings and periodic seminars. This permits management to compare the progress of work against planned activities, detect deviations, identify bottlenecks, and take corrective action while research is in progress. Monitoring and evaluation are closely linked (see Figure 1) and are an integral part of project cycle (see Figure 2).

### Process monitoring

In the recent past a distinction has been made between process monitoring and progress monitoring. Conventional progress monitoring focuses on physical, financial and logistical aspects of projects whereas process monitoring deals with critical processes which are directly related to the project objectives. An ideal M&E system should contain elements of both progress and process monitoring. The development of process monitoring was part of social science's response to the need for field research data relevant for decision-making within a learning process approach.

An underlying assumption of process monitoring is that there is an ideal way in which a process should develop; that there is an objective towards the process ought to lead. Process monitoring tells the project staff and management that what was being observed is close to ideal. If not, then what needs to be done to steer the process closer to that 'ideal'? Process monitoring is a continuous process of observation, interpretation and institutional learning. The core of process monitoring is addressing key project processes and identification of problems and bottle necks resulting from them.





**Figure 1.** Relationship of monitoring and evaluation.

**Figure 2.** M&E and program/project cycle.

## Key features of process monitoring

The difference between the conventional progress monitoring and process monitoring are summarized in Table 1.

**Table 1.** *Process monitoring and progress monitoring*

Process monitoring	Progress monitoring
Concerned with key processes for project success	Primarily concerned with physical inputs and outputs
Measures results against project objectives	Measures results against project targets
Flexible and adaptive	Relatively inflexible
Looks at broader socio-economic context in which the project operates, and which affects project outcome	Focuses on project activities/outcomes
Continuous testing of key processes	Indicators usually identified up front and remain relatively static
Selection of activities and processes to be monitored is iterative, i.e. evolves during process of investigation	Monitoring of pre-selected indicators/activities
Measures both quantitative and qualitative indicators, but main focus is on qualitative indicators	Measures both qualitative and quantitative indicators, but main focus is on quantitative indicators
A two-way process where information flows back and forth between field staff and management	A one-way process where information flows in one direction, from field to management
People-oriented and interactive	Paper-oriented (use of standard formats)
Identifies reasons for problems	Tends to focus on effects of problems
Post-action review and follow-up	No post-action review
Includes effectiveness of communication between stakeholders at different levels as a key indicator	Takes communication between stakeholders for granted
Is self-evaluating and correcting	Is not usually self-evaluating and correcting

Source: World Bank (1999).

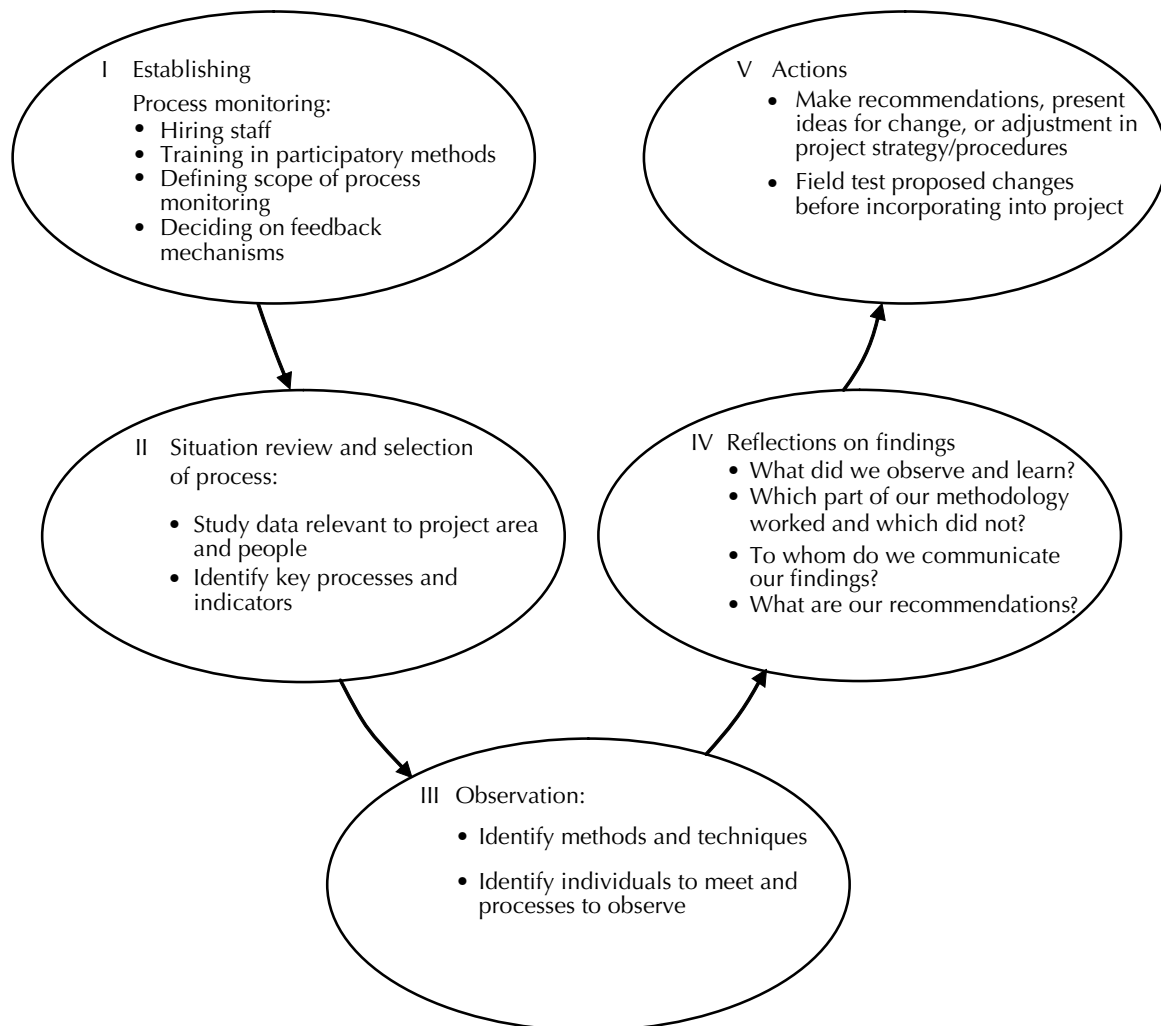
The salient features of process monitoring are:

- Process monitoring observes features of process in each project phase and provides feedback for management for making necessary changes;
- Process monitoring investigates processes within the community, project and wider socio-economic context;
- Process monitoring helps projects to learn from their own experiences and adapt to improve their effectiveness over time;
- Process monitoring looks at both internal and external processes;
- Process monitoring evaluates the quality and effects of project interventions and outcomes;
- It involves participant observation and critical assessment;
- It helps understand the motives, intentions and actions of different actors in a project;
- Process monitoring can be used at different levels (individuals, within project interaction between projects and other actors, wider institutional and socio-economic context) and to analyse the interaction between these levels;
- Process monitoring is also used to assess the impact of changes in project strategies, rules and procedures.

The key steps in the process are discussed in the next section.

## Key steps in process monitoring

The proponents of this approach identify five steps in implementing process monitoring as shown in Figure 3.



Source: World Bank (1999).

**Figure 3.** Steps involved in process monitoring.

These steps are:

- Establishing the process monitoring unit/team
- Situation review and selecting key project process and indicators
- Observing key processes
- Reflecting on/analysing findings
- Follow up action.

These steps are further discussed in the following sections.

### Step 1 Establishing process monitoring unit/team

This involves a number of steps such as recruitment of staff, defining the scope including documentation and information sharing.

### *Recruitment of staff*

The first step in the establishment of the unit/team is recruiting/identifying the staff. In forming the unit/team, make sure:

- That the individuals involved are experienced in community development and M&E;
- That they are trained in participatory methods, participant observation conflict resolution etc.; and
- To be effective gender balance is crucial.

The unit/team should be located within the project, but ideally have its own budget for transport, office equipment and communication. It is also important to develop working relationship with staff from other units.

### *Defining the scope of process monitoring*

It is important to define the scope of process monitoring from the very beginning. In defining the scope it is important to note that the process monitoring cannot be carried out independently of progress monitoring. Process monitoring should be an integral part of the projects own M&E system. The process monitoring activities should focus on project rules and procedures and communications between key actors and levels. The scope should define the objectives, boundaries, information recording as well as sharing of such information. In defining the scope:

- It is useful for process monitoring to be both 'internal' to project, but with 'external' linkages and independent reporting channels;
- Must establish channels and procedures for information flow to and from the unit;
- Information should be recorded and shared with key stakeholders; and
- Findings should be presented in an easily readable and usable form.

The ultimate test of the success of process monitoring is whether the information it generates leads to concrete decisions and actions to address critical issues to improve project performance.

## Step 2 Situation review and selection process

This step enables the unit/group to reach a common understanding of which processes are important and why. Primarily the step involves collecting data on projects, project area, beneficiaries, discussing issues with key resource people and stakeholders.

There are basically two approaches for selecting key processes for monitoring.

- Key processes should be closely linked to project objectives and the project cycle. Key indicators are then identified for each stage in the project cycle. The number of processes selected for monitoring should be limited.
- Process not previously identified for monitoring, but in which the project experiences problems and/or bottlenecks may be added to the key processes identified earlier.

The selection of processes to be monitored should be made in consultation with project management, staff, as well as beneficiaries and other relevant stakeholders.

## Step 3 Observing key processes

It is important to observe processes as objectively as possible. At times specialized training may be required to minimize biases in people's ability to observe objectively. Collection and analysis of

qualitative information also requires relevant skills and experience. Therefore, it is important that process monitoring staff receive appropriate training before they begin their work. In addition, a number of other questions also need to be answered in order to implement an effective process monitoring, such as:

- who makes the observation?
- what methods will be used for process monitoring?

The best methodology should be identified and agreed upon in the advance. If the issue deals with community processes then methods such as transect walks, participatory need assessment, participatory discussions, and participatory resource mapping are suitable. Some of the common tools used in process monitoring are summarized in Box 2.

#### Box 2: Useful tools for process monitoring

- Participant observation
- Participatory discussion (focus group)
- Semi-structured interview
- Process monitoring working groups
- Project planning meetings
- Special studies
- Topical sessions

#### Step 4 Reflections on analysing findings

When the observation is completed, it is necessary to assess the information collected. The team has to address a number of issues when analysing observations. These include:

- What turned out differently than expected?
- Which part of the strategy to gain insight into the process produced desired results and which did not?
- Was a cross section of views sought and accommodated?
- With whom do the findings need to be shared?
- In what form should these be presented?

It is crucial to document answers to these questions and communicate to the relevant stakeholders.

#### Step 5 Follow up action

Based on the observations and analysis the unit/group should make recommendations for project management/institution. It is also imperative to identify and discuss the implications of the proposed changes.

##### *Developing process monitoring indicators*

One of the crucial steps in the M&E process is the identification of relevant and critical indicators. Indicators are variables that describe or measure changes in an activity or situation over time. They are useful tools for monitoring the effects of a process intervention.

##### *Developing a set of indicators follow a three steps approach:*

- Defining project objectives
- Asking relevant questions (what? whom? when?)

- Identifying indicators.

#### a. Defining project objectives and activities

It is practically impossible to identify indicators and use them in the monitoring and evaluation process if the objectives, activities and output of the project are not clearly defined and understood by all stakeholders. Developing an 'objective tree' (based on the problem analysis/problem tree) and distinguishing priority immediate, intermediate and long-term objectives is a good way to start the process. A useful tool for defining objectives is the logical framework analysis.

#### b. Asking questions

Once the objectives are sorted out and agreed upon a number of questions need to be answered before identifying indicators.

- What do we want to know? (and how does it relate to the project objectives)
- What information do we need and for what purpose?
- What is the minimum number of indicators that will tell us that we have accomplished the objectives?
- How, when and by whom these information be collected?
- What are the cost (resource) implications?

Answers to these questions will help us to identify the indicators and establish an M&E system for the project/institution.

#### c. Identifying indicators

Identifying the final set of indicators should be done in a participatory manner. While identifying indicators it is worth noting that:

- Each objective or activity can be measured by different indicators
- Indicators may change over time as projects internal and external environment change and as the project activities change
- Developing useful indicators is a process sometimes involving negotiation between conflicting interests.

A final test for the indicators selected is to make sure that they are SMART (specific, measurable, attainable, relevant and timely).

Note:

- Ideally process monitoring methods and indicators should be effectively integrated into the projects M&E system
- There should be clear criteria for monitoring processes, with clearly defined roles, responsibilities, methodology, realistic time frame and resources for implementation
- An essential prerequisite for effective process monitoring is open mindedness and willingness to listen to the views of others. Process monitoring must be flexible and adaptive in response to changes
- Process monitoring should operate at all levels. Focusing only on one level can be misleading by obscuring the impact of other forces on project effectiveness.

## d. Evaluation

Evaluation is a much broader concept and is used to assess the following:

- The potential impact of research in priority setting and planning exercises;
- The performance and quality of activities in progress;
- The successful completion and relevance of activities; and
- The ultimate impact of results on the achievements of development objectives.

Any assessment, appraisal, analysis or reviews are in a broad sense evaluative. Evaluations result in a set of recommendations which may address issues of planning, such as a shift in program objectives or contents or program implementation. Information from an evaluation is used in the management of technical programs, personnel, and financial resources.

Evaluation in general addresses four important aspects of the program, namely: performance, quality, relevance, and eventual impact.

- Performance compares achievements with expected output. It is primarily concerned with the use of resources and the timelines of the activity and is determined mostly through monitoring and on-going evaluation. However, assessing the success or failure of research goes far beyond determining whether resources were used according to plan or activities were carried out on time.
- Quality deals with the adherence to accepted standards of scientific work and precision. The quality of research is determined almost exclusively through some form of peer expert review.
- Relevance of research at each level of the research investigates on research relevance to objectives, which ultimately reflect developmental objectives. Relevance is closely related to the problem being addressed and the target group under consideration. Relevance is primarily assessed through peer or expert review too.
- Impact deals with the effect of the research output on the ultimate users often referred to as 'people level impact.'

### Types of evaluation

Evaluations are most often categorized according to when they occur in the project cycle and their purpose.

- Occurs before the event (*ex ante*)—to assess the potential impact of research.
- Occurs during the event (on-going)—to evaluate the performance and quality of the research project in progress.
- Immediately after the event (*ex post*)—to determine the successful completion and relevance of research project.
- Several years after research results have been achieved (impact)—to assess its ultimate impact on development.

### *Ex ante* evaluation

*Ex ante* evaluation is a research planning process which includes a comprehensive analysis of the potential impact of alternative activities before implementation. As the name implies the evaluation is done prior to the initiation of the project, at this stage not too much is known about the proposed project and estimates of costs and benefits are sketchy and the values assigned to them are only 'ball-park' figures based on informal judgment.

Methods used are peer or expert reviews using checklists, scoring models, and even cost–benefit analysis. To make *ex ante* evaluation more effective, there should be participation from different disciplines and more comprehensive criteria must be applied. Through *ex ante* evaluation, one could define the baseline against which progress will be measured, set targets, and state the assumptions used in making the projections. The indicators to be monitored should also be specified in order to give assistance to the *ex ante* evaluation.

## On-going evaluation

On-going evaluations that are conducted throughout the technology development and transfer process are more useful for research management than *ex ante* and *ex post* assessments. Here on-going activities are reviewed at critical stages to determine if they should be continued, modified or aborted. They are used to analyse the use of resources, the quality of research, and the continuing relevance of research programs and projects. On-going evaluation is often conducted through peer reviews. On-going evaluation addresses problems associated with the day-to-day management of interventions and also can indicate the need for changes in project objectives and targets.

Monitoring is fundamental for on-going evaluation. It primarily tracks down the provision and delivery of inputs and services, the generation of information on the ability and deployment of staff, infrastructure, equipment, supplies, services, and funds for projects within a program. In on-farm research, the on-going evaluation is used to obtain feedback from the target group; and is largely accomplished through a series of meetings at the site with peers, farmers, extension staff and NGOs.

## *Ex post* evaluation (immediately after the completion)

An *ex post* evaluation, or final evaluation, assesses the project's performance, quality, and relevance immediately after the project completion. It attempts to measure the effectiveness and efficiency of a completed activity and includes an analysis of the original assumptions used in planning. A good *ex post* evaluation is linked to *ex ante* evaluation, and can best be conducted where a baseline has been originally defined, targets have been projected, and data has been collected on important indicators.

*Ex post* evaluation is analysed for the project from beginning to end, determining whether project objectives were attained, causes for discrepancies, costs, and the quality and relevance of the research. *Ex post* evaluation often considers such aspects as the cost effectiveness of research, its potential relevance to national development goals, the response of the research to an urgent and important problem, the acceptance of development agencies, and the results by farmers (end-users) contribution of the research to scientific progress.

Common criteria for evaluating scientific research are most notably number and quality journal publications and instances of citation (citation index). These are not comprehensive enough to consider the appropriateness of the technology or its value to development. Therefore, the classical criteria need to be broadened to include user (i.e. farmers') satisfaction.

The methods typically used for *ex post* evaluation are statistical evaluation, economic evaluation, agronomic assessment, and farmers/community assessment. Advanced preparation for *ex post* evaluation should include precise plans on documentation needed, people to interview and sites to visit. Some supplementary information may need to be gathered through surveys or interviews. Most



evaluations use a blend of interviews, field visits, observations, and report writing. *Ex post* evaluation also tries to clarify the internal and external factors affecting the outcome of the project.

*Ex post* evaluation can provide important insights into the research process and provide a basis for comparing alternative organizational methodological approaches. The lessons learned could be systematically incorporated into subsequent evaluations making the processes much more relevant and efficient.

## Impact evaluation

This is a form of *ex post* evaluation. Impact evaluation attempts to determine the extent to which technology development and transfer (TDT) programs have contributed to larger development goals, such as increased farm production, or improved food security etc. Typically, it is conducted several years after the results have been released making it less useful as a management tool than the other types of evaluation. *Ex post* impact assessments are often used to convince policymakers to allocate more resources to research.

If the project and program evaluations are to be used to support impact evaluations, this should be considered during *ex ante* evaluations and the necessary baseline data and an M&E system should be set up in advance to serve this purpose.

Impact evaluation must distinguish between the contribution research makes to national development from the contributions made by other factors such as existence of good extension services, agricultural inputs, adequate infrastructure, and favourable marketing and pricing policies. It has been shown that benefits are relatively easy to attribute in the case of single commodity technologies, such as high yielding varieties of rice under irrigation in Asia. It has proved more difficult to do this in more diverse and complex systems as seen in most of sub-Saharan African countries. The key concepts in *ex post* impact assessments are causality, attribution and incrementality.

*Ex post* impact assessments usually require extensive and often expensive data collection and a thorough analysis of socio-economic factors. The results of impact evaluations have broad implications for future priority setting, not only for research, but also for development support services. The types of impacts and methods used are discussed in the following sections.

The term 'impact' means different things to different people. In discussing the impact of any research program, one can identify two broad categories of interpretations (Anderson and Herdt 1990). In the first category, some people look at the direct output of the activity and call this an impact, e.g. a variety, a breed, or a set of recommendations resulting from a research activity. Most of the biological scientists belong to this category. The second category goes beyond the direct product and tries to study the effects of this product on the ultimate users, i.e. the so-called people level impact. The people level impact looks at how fit the program is within the overall R&D to discover facts (research) that have practical beneficial application (development) to the society. Impact begins to occur only when there is a behavioural change among the potential users. This second type of impact deals with the actual adoption of the research output and subsequent effects on production, income, environment, and/or whatever the development objectives may be.

The people level impact of any research activity cannot be assessed without information about the (extent) number of users and the degree (intensity) of adoption of improved techniques, and the

incremental effects of these techniques on the production costs and output. The adoption of any technology is determined by several factors, which are not part of the original research activity.

In any comprehensive impact assessment, there is therefore a need to differentiate between the research results and the contributions of research to development, i.e. the people level impact, and both aspects should be addressed. Impact assessment is directed at establishing, with certainty, whether or not an intervention is producing its intended effect. A program that has positive impact is one that achieves some positive movement or change in relation to its set objectives. This implies a set of operational defined goals and a criterion of success. There is also a need to establish that the outcome is the cause of some specified effort. As such, it is important to demonstrate that the changes observed are a function of the specific interventions and cannot be accounted for in any other way. As pointed out earlier the three basic principles to be observed in any impact study are causality, attribution, and incrementality.

### 3 Purpose of impact assessment

The purpose of impact assessments of agricultural technology development and transfer (TDT) activities depends on when the assessment is done. Impact assessments can be undertaken before initiating the research (*ex ante*) or after the completion of the research activity (*ex post*) including the technology transfer.

The purpose of undertaking an impact assessment prior to starting a research project/program is to assist the research manager/research team in planning and priority setting activities. This will enable one to:

- Study the likely economic impact of the proposed research activity/project;
- Formulate research priorities by examining the relative benefits of different research programs;
- Identify the optimal combination of research program; and
- In addition, an *ex ante* assessment can also provide a framework for gathering information to carry out an effective *ex post* evaluation.

Given the resource constraints confronting the research managers and researchers, *ex ante* impact assessment is becoming a powerful planning tool in research management.

The various purposes for conducting an impact assessment after the completion of the program (*ex post*) include:

- To study the impact and to provide feedback for researchers, research managers, planners and policymakers;
- Lessons learned can be used to improve the management and decision-making process with respect to priority setting, implementation, and management of research activities as well as technology transfer;
- For accountability purposes;
- To establish the credibility of the public sector research; and
- To justify increased allocations of research resources.

### 4 Types of impact

Impact studies can be carried out to study the impact of a particular innovation/technology, on a research program, or on a research program plus complementary services (such as extension, marketing etc.). Impacts can also be measured at the individual household level, target population level, as well as national and regional levels (primary sector, or secondary sector, or overall economy).

The direct product of an agricultural research project/program may be an improved technology (embodied or disembodied), specialized information, or research results (reports, papers and publications). See Box 3 for a discussion of the direct product of research. There is general consensus that an agricultural TDT effort in addition to producing the direct product of research could potentially lead to five different types of impacts (see Box 4), namely production impact, economic impact, social and cultural impact, environmental impact, and institutional impact. Institutional impact refers to the effects of TDT efforts on the capacity of the research and extension program to generate and disseminate new production technologies. These different impacts and the appropriate methods to measure them are discussed in the following section.

### Box 3: Types of research outputs

The major outputs of R&D activities may be an improved technology or improved set of information. Both types of output will eventually lead to improving the efficiency of agricultural resources.

#### Improved technology

##### On farm

An improved technology on-farm can be comprised of:

- New enterprise, e.g. a new legume crop species;
- Increased production, e.g. a new crop variety;
- Decreased production costs, e.g. a more efficient technology for the application of chemicals;
- Increased quality, e.g. reduced contamination, increased oil content; and
- Reduced risk, e.g. a more stable yielding crop variety.

##### Off-farm

An improved technology off-farm can be comprised of:

- Decreased handling/transport/storage/processing cost;
- Decreased wastage/spoilage; and
- Improved health.

#### Information

Information can be about the existing technology or the new technology. Both types of information are aimed at improving the returns to research investment. Some examples of improved benefits from information systems are:

- Information on an existing technology which enhances adoption both on-farm and off-farm, i.e. a more rapid adoption and/or a higher level of adoption of beneficial existing technology;
- Better management decisions (strategic and tactical) leading to higher profit;
- Better application rates, timing and inputs;
- Improved fertilizer management on sandy soils;
- Quality of research;
- Institutional changes;
- Reduced risk; and
- Facilitation of other research.

It is worth noting that there is no clear-cut dichotomy between technology and information. For example, a new technology must accompany information at least on how to apply it

#### Box 4. Types of impact

- Production impact
  - Yield/productivity gains
  - Acreage
- Economic impact—Comparison of benefits and costs
  - Income
  - Rate of returns
  - Reduced risk
  - Number and type of jobs created or/reduction in employment rates per type
  - Distribution of benefit
- Gender
  - Income group
  - Location
  - Changes in resource allocation, e.g. labour patterns
  - Nutritional implications
- Social/cultural impact (can be positive or negative)
  - Changes in status of women
  - Changes in the knowledge and skill level of people
  - Changes in the health of various groups of people
- Environmental impact (can be positive or negative)
  - Air and water pollution
  - Soil erosion and sedimentation
  - Contamination of soil and water by herbicide or pesticide residues
  - Effects on the long-term functioning of biosphere, potential climate change etc.
  - Effects on biodiversity
- Institutional impact
  - Changes in intermediate organizational structures of methods and plans
  - Changes in the number and composition of scientists
  - Changes in the proportion of funds allocated to research
  - Changes in the mix of public and private sector participation
  - Improvement in interdisciplinary involvement

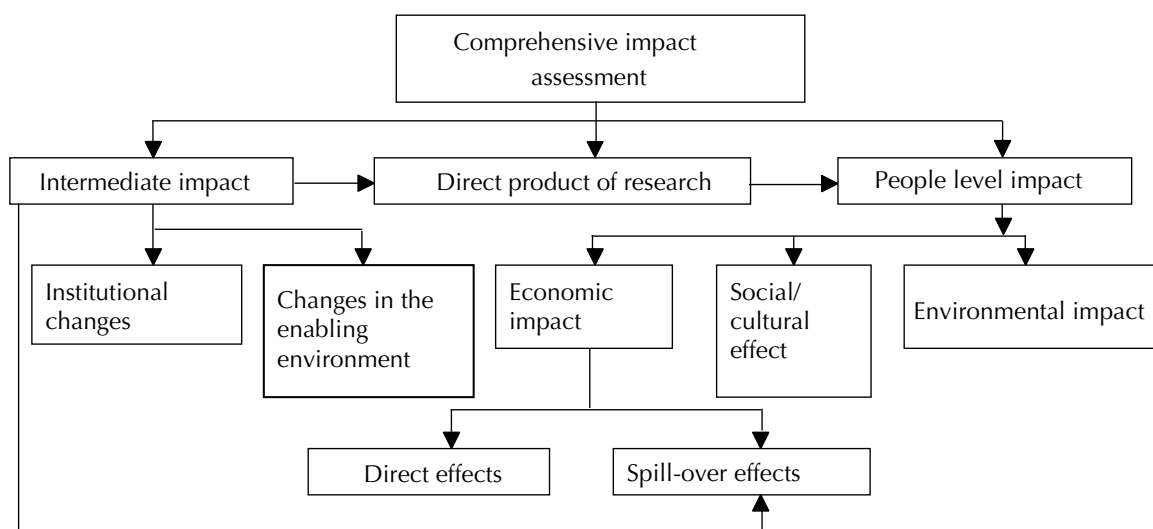
Based on the previous discussions, there are three broad categories of impact that form part of a comprehensive impact assessment exercise. The first is the direct outcome of the research activities. The second, the intermediate impact is concerned with the organizational strategies and methods used by researchers, and other actors in conducting more effective technology development and transfer. This is the so called people level impact. The people level impact can be economic, socio-economic, socio-cultural, and/or environmental. The various types of impact are summarized in the next section.

## 5 Overview of impact assessment methods

A comprehensive impact assessment should simultaneously assess the various impact of the TDT. The various techniques and methods used to assess the different types of impact are summarized in Table 2 and discussed in the subsequent sections.

**Table 2.** *Impact types, techniques, and methods used in a comprehensive assessment*

Impact type	Technique	Method
Intermediate impact	Simple comparison/trend analysis	Survey
Institutional changes		
Changes in the enabling environment		
Direct product of research	Simple comparison—target vs. actual	Effectiveness analysis using logical framework
Economic impact	Various	ROR estimates
Socio-cultural impact	Comparison over time	Socio-economic survey/adoption survey
Environmental impact	Various Qualitative Quantitative Need bio-physical information	Environmental impact assessment



Source: Anandajayasekaram et al. (1996).

**Figure 4.** *Comprehensive impact assessment.*

### Direct product of research—Effectiveness analysis

The most commonly used approach for assessing the direct product of research is known as effectiveness analysis. A useful starting point for effectiveness analysis is the logical framework of the project. The logical framework permits the assessment of the degree to which the research activities have made changes in the desired direction. The logical framework itself is a simple matrix that provides a structure for one to specify the components of a program/activity and the logical linkages between the set of means (inputs and activities) and the set of ends (outputs). This logical framework makes the impact assessment process transparent by explicitly stating the underlying assumptions of the analysis.

The effectiveness analysis is a simple comparison of these targets to actual or observed performance of the project. Three sets of comparisons are identified in the literature: ‘before’ and ‘after’ comparison (also called historical comparison); ‘with’ and ‘without’ comparison; and ‘target’ vs. ‘achievement’ comparison. The most useful comparison is target vs. achieved. The targets need not be completely achieved for the project to be deemed effective. The movement in the direction of the desired target is evidence of project effectiveness.

## Evaluating the impact of intermediate product(s)

The link between the intermediate product and the ultimate economic benefit is not clear and, therefore, tends to be ignored in most impact assessment studies. The evaluation of the intermediate product is made difficult by the fact that the benefits of these products are not easy to quantify. Thus, most studies acknowledge the fact that having the institutional capacity to conduct agricultural TDT is of paramount importance. These studies, however, do not include the benefits in the assessment of the impact. The costs that are easy to quantify are usually included. Thus, the assessment of the intermediate product has been a tricky issue. The practice has been to trace the changes in institutional capacity over time using either simple trend analysis or comparisons. This requires baseline information on these indicators and careful monitoring. The results from these analyses can be incorporated in the quantitative analysis through a multi-criteria analysis.

### People level impact

As pointed out earlier, the people level impact can be economic, socio-cultural, and environmental.

### The economic impact

The economic impact of TDT initiatives can be traced through its effect on production and income. The approach used is called the efficiency analysis. Efficiency analysis assesses the people level impact by comparing the benefits that society gets from TDT and the costs incurred in conducting TDT programs. The benefits and costs are normally collapsed into a single number, the rate of return (RoR). There are two broad ways of calculating the rate of return to TDT: *ex ante* and *ex post*. The *ex ante* methods are useful as research planning tools as they aid in the selection of the research portfolio, priority setting, and resource allocation. The *ex post* studies are useful for justifying past TDT investments, and demonstrating the payoff of such investments.

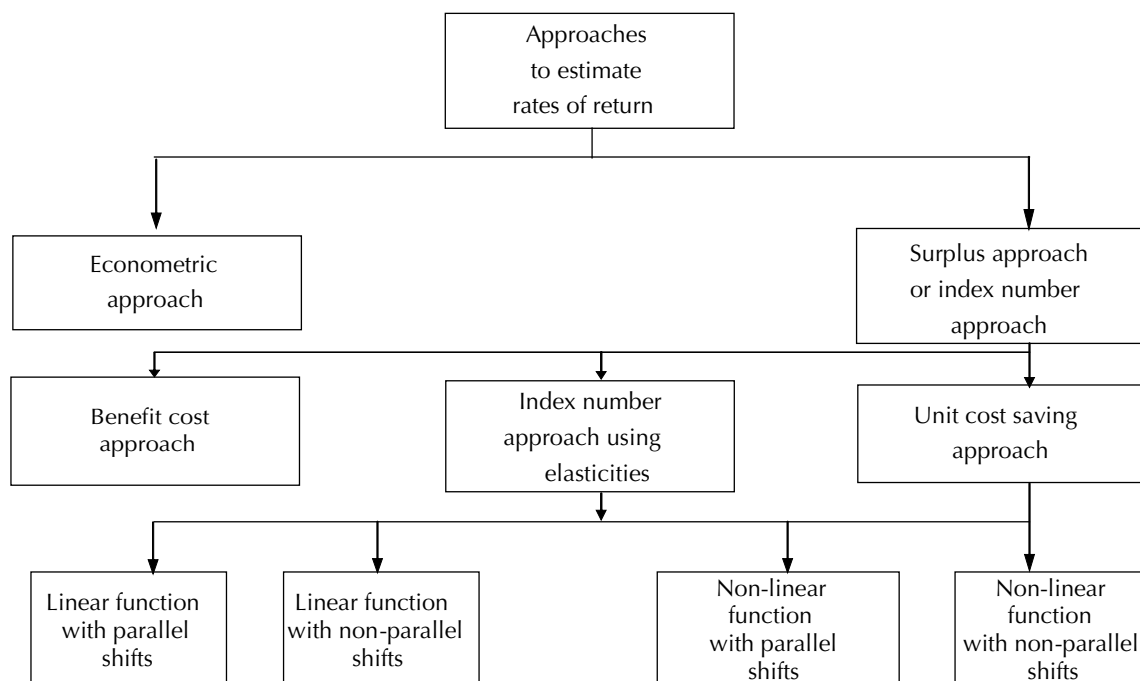
The *ex ante* methods for estimating RoR include benefit–cost analysis, simulation models, and mathematical programming models. The last two methods are data and skill intensive and, therefore, rarely used.

*Ex post* methods for RoR estimation can be divided into two broad groups, as shown in Figure 5. The econometric method uses the production function in which research and transfer activities are considered inputs and gives the marginal rate of return (MRR) to agricultural TDT. The MRR quantifies the returns to the last dollar expended in the research project. To determine the optimal allocation of funds, it is necessary to know the marginal benefit of the last research dollar invested. This is the only method that allows for the separation of the effects of research from those of extension and other support services. However, the data requirements have reduced the extensive use of this method.

The second groups of methods are the *surplus approaches*. These methods calculate the benefits of TDT as the net change in producer and consumer surplus, employing a partial equilibrium analysis. The different techniques are based on the difference in the assumed nature and elasticities of the supply and demand functions. The benefit–cost approach has various combinations of the nature of the supply shift and the functional form of the supply and demand curves. The cost-saving approach is in between these two approaches, but based on the same theoretical foundation.

These methods calculate the average rate of return (ARR). The average or internal rate of return takes research expenditure as given and calculate the RoR for the project or program in its entirety. This

provides information to assess the success of the project in terms of generating adequate returns. However, the ARR measure is not always helpful in determining if the allocation of research funding to the project was appropriate. Because of the historic nature of *ex post* evaluation, the results of these studies have mainly been used as political instruments to secure future funding. They demonstrate how efficient past investments were, but not necessarily where research resources should be allocated in the present, or the future. For a detailed description of the various techniques see Anandajayasekeram et al. (1996). For our purposes a simple technique such as a partial budget and cost-benefit framework can be effectively used to estimate RoR of TDT efforts.



Source: Anandajayasekeram (1996).

**Figure 5.** Approaches for estimating rates of return.

## Socio-cultural impact

Socio-cultural impacts include the effects of research on the attitude, beliefs, resource distribution, status of women, income distribution, nutritional implications etc. of the community. These can be assessed through socio-economic surveys and careful monitoring. To be cost effective, appropriate socio-cultural questions can be included in adoption survey questionnaires.

## Environmental impact

The adoption of modern agricultural technologies has often resulted in external benefits and costs largely through its effects on the environment. For example, the use of fertilizers or pesticides may lead to surface and ground water contamination by toxic chemical and algae, resulting in significant environmental costs. On the other hand, adoption of minimum tillage technology and herbicides by farmers has probably had environmental benefits in the form of reduced soil erosion and nutrient loss.

The full assessment of environmental quality issues requires complex analysis of physical, biological, social, and economic processes. This also leads into some measurement problems. Such a breadth

of analysis is likely to be beyond the scope of most agricultural research assessment activities. Nevertheless, some assessment of environmental impact is necessary when evaluating agricultural research, especially where the environmental impact of the application of the research is likely to be significant. In the absence of data required for a thorough analysis, it may still be possible to identify qualitatively the nature of the social benefits and costs, together with the likely gainers and losers.

## 6 Multiple impacts of technologies

Technologies often have impacts in more than one area. For example:

- Improvement in one or more categories can be partially offset by a decline in another category:
  - higher quality may be achieved at the cost of lower yields or higher costs;
  - increased yield or quality may be at the cost of higher risk; and
  - decreased risk could be accomplished with a reduction in yields.
- Research often has benefits in more than one category:
  - breeding of new grain legumes has resulted in higher yields for subsequent crops lower 'N' requirements of wheat crops, and higher protein levels in wheat; and
  - field trials of a new crop may serve to promote adoption and to fine-tune agronomic management practices.
- The impact of research is often not confined to the enterprise which was the subject of the research:
  - increased profitability of A:
  - draws resources from alternative enterprises; and
  - imposes an opportunity cost that needs to be recognized;
- There could also be positive spin-offs, e.g. grain legumes and fixation of nitrogen.

All aspects need to be considered in assessing the impact of any technology.

## 7 Multi-criteria analysis

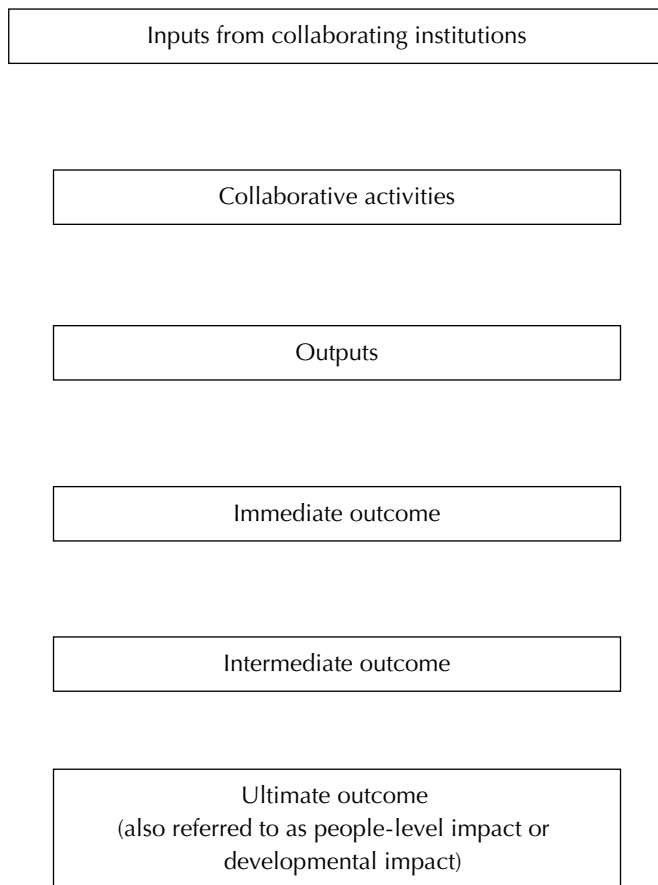
As discussed in the previous sections, due to the wide-ranging implications of agricultural research to the society, no single method is sufficient to adequately capture these impacts. Therefore, a multi-criteria analysis is often recommended for assessing the impact, which may also use a variety of methods, in which way one could use more than one measure to assess the impact. Using the available information, one can construct an 'effects table' or 'effects matrix' which can be used for comparing projects. The columns of the effects table represent the alternative projects/activities, and the rows represent the criteria by which the alternatives are evaluated.

## 8 Impact chain and outcome mapping

### Impact chain

The typical impact chain starts from the set of inputs and activities of a project/program to the most highly aggregated development results, such as poverty reduction, food security, environmental protection etc. The chain also specifies all the main intermediate steps: the activities of a project, the output, the use that others make of this output, the direct as well as possible indirect effects, and the implications of the use of these outputs on the ultimate beneficiaries—society (see Figure 6). The output, outcome, and impact are generally sequentially produced over a period of time become more difficult to articulate, measure, and attribute as one moves from outputs to impact.





**Figure 6.** *Impact chain.*

## Collaborative activities

These are the joint actions undertaken by the collaborators, for example, a training workshop. Here you are expected to identify all collaborative activities undertaken by the individual organization/ stakeholder group. List activities, key collaborators, as well as the contributions of each group. Clearly state the objectives of the collaborative activities.

## Outputs

This refers to the results of the program activities, i.e. goods and services produced by the set of collaborative activities. In the case of training activities the outcomes may be trained individuals with acquired skills (are able to apply the skills taught), a set of training materials, and/or trained trainers. See Box 5 for examples of the types of research outputs.

## Immediate outcome

This refers to the first level effect of the outputs: the observed or documented behavioural changes in those directly affected by program. In the case of training program, how did the training affect the behaviour of the trainee? Did (s)he make any changes in the way of doing business as a result of the training? Did (s)he apply the skills acquired.

In the case of research the first immediate outcome may be a change in the recommendations provided by the extension staff or even the behavioural change to use the direct product, i.e. adoption.

## Box 5: Types of research outputs

The major outputs of R&D activities may be an improved technology or improved set of information. Both types of output will eventually lead to improving the efficiency of agricultural resources.

### Improved technology

#### *On farm*

An improved technology on-farm can be comprised of:

- New enterprise, e.g. a new legume crop species;
- Increased production, e.g. a new crop variety;
- Decreased production costs, e.g. a more efficient technology for the application of chemicals;
- Increased quality, e.g. reduced contamination, increased oil content; and
- Reduced risk, e.g. a more stable yielding crop variety.

#### *Off-farm*

An improved technology off-farm can be comprised of:

- Decreased handling/transport/storage/processing cost;
- Decreased wastage/spoilage; and
- Improved health.

### Information

Information can be about the existing technology or the new technology. Both types of information are aimed at improving the returns to research investment. Some examples of improved benefits from information systems are:

- Information on an existing technology which enhances adoption both on-farm and off-farm, i.e. a more rapid adoption and/or a higher level of adoption of existing technology;
- Better management decisions (strategic and tactical) leading to higher profit;
- Better application rates, timing and inputs;
- Improved fertilizer management on sandy soils;
- Quality of research; and institutional changes;
- Reduced risk; and facilitation of other research.

It is worth noting that there is no clear-cut dichotomy between technology and information. For example, a new technology must accompany information at least on how to apply it.

## Intermediate outcome

This refers to the benefits and changes resulting from the application of the output. In the case of training, what are the effects in the performance of the individual and/or institution as a result of the applications of the skills acquired? In the case of a technology the intermediate outcome may be the effects at the farm/household level, i.e. increased yield, reduced cost.

Note: In order to bring about an outcome, the program has to change people's behaviour. By trying to identify and then document the changes in attitudes, knowledge, perceptions, and decisions taken by program target groups, which logically link to the outcomes being observed, we can often acquire a good understanding of the actual impact that the program has. Often, immediate and intermediate outcomes can be measured and documented directly. This requires clearly identifying the various clients

of the program and the way in which their behaviour is expected to change. If an expected outcome has been observed after the program activity has started up, then this suggests that the program is having an effect. If we can observe these short-term changes, then the logical case for the program's attributions can be enhanced.

Outcomes are measures of the use that is made of the output by clients and partners. They reflect the value they place on them as intermediate product, which in turn are input in their management decision-making.

### Ultimate outcome (impact)

Impact refers to measurable effects of the outputs and outcomes on the well-being of the ultimate beneficiaries of the R&D efforts, namely the poor, the food and nutrition insecure, and the environment. Most socio-economic impacts and developmental impacts fall under this category. Very often the ultimate outcomes are closely linked to the sectoral/regional/national developmental goals.

Since there is considerable time-lag between the realization of outcome and impact, often one could use proxies or partial indicators in terms of assessing the people-level impact. In addition to program output, a number of other factors may contribute to the realization of people level impact. Thus attribution may be more difficult.

Note:

- In assessing the outcome and impact, one should focus the analysis on all three levels:
  - individuals (those who are directly involved in the program);
  - institutional level;
  - people level, i.e. the ultimate beneficiaries.
- One may complement his/her observation with expert opinion (from people outside the program who are seen as knowledgeable about the program area, the program's impacts, and the environment in which the program operate).
- If there is documented evidence available (secondary sources such as evaluation reports) about the program output, outcome, and impact, then it should be collected, analysed and documented. It is important to show evidence for any claims with respect to outcome and impact, as well as indicate where such evidences can be found.

The three basic issues that need to be taken care of in any empirical impact study are causality, attribution, and incrementality. It is important to ensure that the impacts measured are as a result of the intervention/collaborative activities. Incrementality refers to any autonomous endogenous changes that would have taken place in the absence of the collaborative activities or intervention. Attribution problem arise when one believes or is trying to claim that a program has resulted in certain outcomes and there are alternative plausible explanations. Under these circumstances;

- identify the most likely alternative explanations;
- present whatever evidence or argument you have to discuss, and where appropriate, discount these alternative explanations; and
- present whatever evidence there is, that the program is more likely the explanation for the observed outcome.

Addressing attribution problem this way demonstrates that:

- you are aware of the complexity of the situation;
- you acknowledge and understand the other factors at play;
- you are nevertheless concluding (assuming you are) that the most likely explanation for the observed outcome is that the program made a significant contribution.

To sum up, there are four products of concern of collaborative R&D activities: outputs, outcomes, changes in institutional performance, and the final welfare impacts. They are sequentially produced and more difficult to document, articulate, measure, and attribute as one moves from outputs to impacts. Attribution remains one of the methodological challenges in impact assessment studies. This is critical especially, where partnerships and collaborations are an increasing feature of collaborative activities. Therefore, as far as possible joint impact of various players should be measured rather than trying to separate out the contribution of individual institutions, which may not be feasible in most cases. However it is important to make sure that the inputs and contribution of all partners are appropriately acknowledged.

Three basic types of impact evaluation are possible: qualitative, quantitative, and a mixture of both. Qualitative evaluations describe the process by which the outputs of research and development activities have influenced institutional innovations and the eventual social impacts. It seems that the most appropriate approaches to impact assessment should involve a mixture of both qualitative and quantitative methods. Retrospective narratives are essential components of the former and indeed provide the basis for quantitative estimates and the related issue of attribution.

## 9 Outcome mapping

Outcome mapping is a methodology for planning, monitoring and evaluating development initiatives that aims to bring about social change. The process of outcome mapping helps a project team or program to be specific about the actors, its targets, the changes it expects to see and the strategies it employs. Results are measured in terms of changes in behaviour; actions or relationships that can be influenced by the team or program. It enhances the team and program understanding of change process, improves the efficiency of achieving results and promotes realistic and accountable reporting.

The key terminologies/concepts used in outcome mapping are: boundary partners, intentional design, outcome challenges and progress makers.

### *Boundary partners:*

Individuals, groups or organizations with which the program interacts directly and which the program hopes to influence.

### *Intentional design:*

The planning stage, where a program reaches consensus on the macro level changes it wants to influence and the strategies to be used.

### *Outcome challenge:*

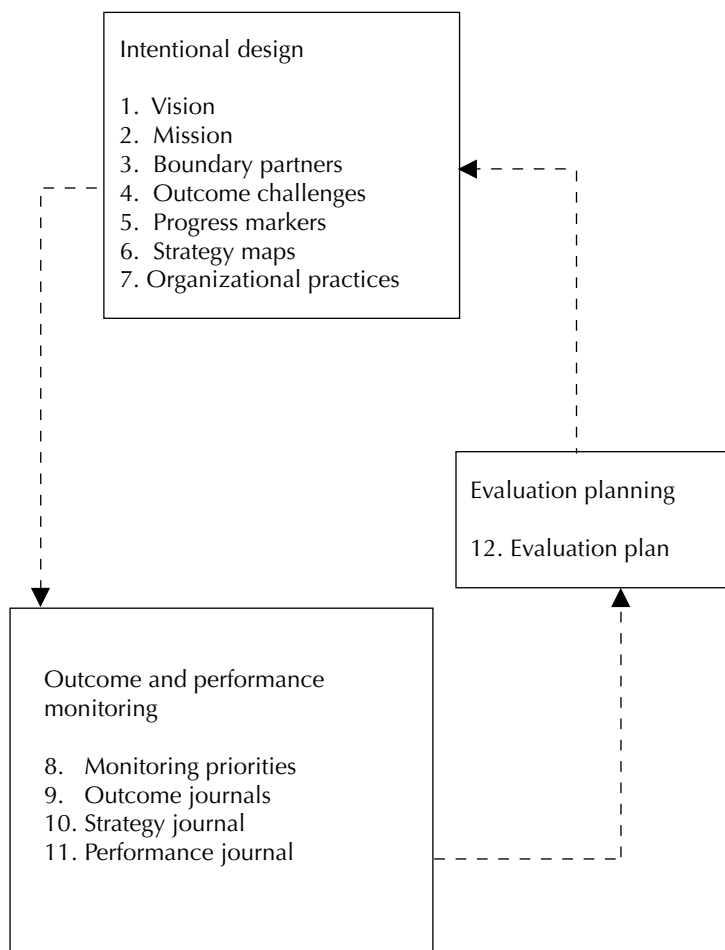
Description of the ideal changes the program intends to influence in the behaviour, relationships, activities and/or actions of a boundary partner.

### *Program markers:*

A set of graduated indicators of changed behaviour of a boundary partner that focus on the depth or quality of change. This is a tool that assists program teams to learn from and to report realistically on their achievements by tracking the connections between what they do and what happens.

Outcome mapping focuses on change processes and outcomes. It defines the limits of the programs influence, promotes strategies that are appropriate to the context and recognizes the potential contributions of other actors. Development results (or outcomes) are measured as changes in behaviour and relationships of actors with which the program interacts directly. Performance is assessed as the programs contribution to influencing those changes with outcome mapping, it is possible to develop and use indicators that facilitate comparison and learning while retaining the relevant contextual details of the story at each site or in each case.

- Outcome mapping is especially useful in projects where success depends on behavioural change.
- Outcome mapping provides tools that help a development program to think holistically and strategically about how it intends to achieve results.
- Outcome mapping is usually initiated through a participatory process at a design workshop led by internal or external facilitators who is familiar with the methodology.
- It is useful to include boundary partners in the initial workshop for their input on the relevance, activities and direction of the program.
- Ideally, the M&E system would have been outlined at the planning stage of the program
- It is a 3 stage 12 step process (Figure 7):
  - Stage 1 Intentional design
  - Stage 2 Outcome and performance monitoring
  - Stage 3 Evaluation planning



**Figure 7.** The 3 stages and 12 steps of outcome mapping.

## 1 Intentional design

The four basic questions to be asked at the intentional design stage are:

Why? — Vision statement

How? — Mission, strategy maps, organizational practices

Who? — Boundary partners

What? — Outcome challenges, progress markers

Helps the team to clarify and reach consensus on the macro-level changes they would like to support and to plan appropriate strategies. The long term goals provide reference points to guide strategy formulation and action plans (rather than acting as performance indicators). Progress markers which are used to track performance are developed for each boundary partners.

Outcome mapping does not help a team identify program priorities. It is appropriate and useful only when a program has already chosen its strategic direction and wants to chart its goals, partners, activities and progress towards anticipated results.

## 2 Outcome and performance monitoring

Provides a framework for monitoring actions and boundary partners' progress towards outcome/goals. The three data collection tools that can be used in this process are:

- a. an outcome journal monitors boundary partners actions and relationship
- b. a strategy journal monitors strategies and activities
- c. A performance journal monitors the organizational practice that keeps the program relevant and viable.

These tools provide workplace and processes and help the team reflect on the data they have collected and how it can be used to improve performance. Select only those information that they can afford to collect.

## 3 Evaluation planning

Helps the team set priorities so they can target evaluation resources and activities where they will be most useful. This stage outlines the main elements of the evaluations to be conducted.

'Outcome mapping' and 'result based management' are compatible and outcome mapping can contribute important elements to results-based management; such as supporting stakeholder learning in relation to the management of the program, fostering social communication as a basis for interactive participation, and strengthening local organizations and institutions.

## References

- Anandajayasekeram P, Martella D and Rukuni M. 1996. *A training manual on R&D evaluation and impact assessment of investments in agricultural and natural resources research*. SACCAR, Gaborone, Botswana.
- Horton D, Ballantyne P, Peterson W, Uribe B, Grapasin D and Sheridan K. 1993. *Monitoring and evaluating agricultural research: A source book*. ISNAR (International Service for National Agricultural Research), the Hague, the Netherlands.
- McLean D. 1988. *Monitoring and evaluation in the management of agricultural research*. Working Paper No. 14. ISNAR (International Service for National Agricultural Research), the Hague, the Netherlands.

## Exercise 7 Studying key features of evaluation activities (group work)

Form four groups of participants, each group elects a rapporteur.



Phase 1. Group work (1 hour)

1. Discuss the project you were handling in the previous exercises and respond to the questions below. Use the worksheet (handout 7.4) to record your responses.
2. Assume that you are in charge of setting up a monitoring and evaluation system to assess the performance and impact of the project.
  - Please develop the objective hierarchy (the logic path from input to impact)
  - Identify the relevant indicators you would use to assess the performance and outcome of the project.

**Note:** *Anticipate and consider the indicators that each stakeholder would like to be included.*

- Identify data needs and the methods you would employ to collect the data.
  - Identify appropriate stakeholder(s) who will be responsible for these tasks.
3. The groups organize their presentations, and the rapporteurs write the results on flipcharts and prepare to present their groups' results (40 minutes).

Phase 2. Reporting and discussion (30 minutes)

4. The rapporteurs present the groups' results to the audience. Each rapporteur has 7 minutes to present the results (30 minutes)
5. After the presentations the trainer invites the participants to participate in a plenary discussion (15 minutes)
6. The trainer provides feedback on the content and closes the session (10 minutes).





# Trainer's guide

## Session 8 Managing innovation systems

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Purpose	The purpose of this session is to demonstrate the link between effective management and innovation
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"><li>• understand what is needed to build a culture of innovation, and</li><li>• identify the factors contributing to successful innovation</li></ul>
Resources	<ol style="list-style-type: none"><li>1. Flipcharts</li><li>2. White board</li><li>3. Flipchart and white board markers</li><li>4. Copies of handouts 8.1 to 8.3 for every participant</li><li>5. Computer and LCD projector</li></ol>
Time needed	One hour and fifteen minutes

### Session structure

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Activity		Time required	Remark
Presentation	<ul style="list-style-type: none"><li>• Distribute handouts 8.1 (presentation slides) and 8.3 (exercise) before you start your presentation</li><li>• Give a presentation on managing innovation systems</li><li>• Allow some time for questions to make sure participants understand what is presented</li><li>• Distribute handout 8.2 (presentation text) to supplement your presentation</li></ul>	30 minutes	
Exercise	<ul style="list-style-type: none"><li>• Make sure that all the participants have handout 8.3 (exercise 8)</li><li>• Give participants about 5 minutes to read the discussion points and prepare for the discussion</li><li>• Go through the discussion points one by one</li><li>• Summarize the discussion</li></ul>	25 minutes	
Transition	Make closing remarks and transit to the next session	5 minutes	

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## Session 8: Presentation slides

Slide 1

Session 8

Managing innovation system

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Slide 2

Objectives of the session

- Understand what is needed to build a culture of innovation
- Identify the factors contributing to successful innovation

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Slide 3

Managing innovation systems

- Management and leadership are crucial to create successful innovations
- Important to understand how innovation functions and, can be directed and supported

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Slide 4

## Building a culture of innovation

- Innovation is fostered by a culture that aims to meet the needs of all stakeholders — clients, teams and employees
- Increasing emphasis on long-term thinking and strategies for achieving those
- Cultural change for promoting innovation starts at the top with leaders who provide strong direction for innovation and establishing organizational climates and culture that are conducive to innovative activity

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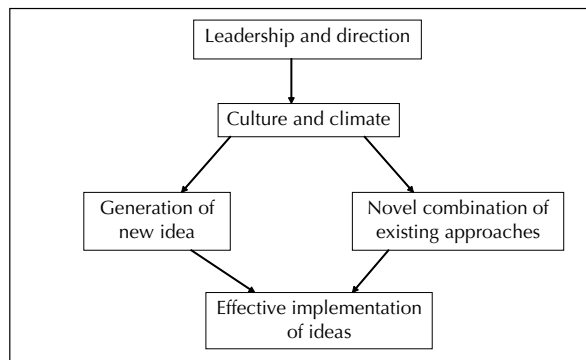
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Slide 5

## Critical steps towards building the culture of innovation



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Slide 6

## Leadership and direction

- Leadership means:
  - Developing a vision
  - Turning vision into workable agendas
  - Communicating these agendas to others in a way that results in excitement and commitment
  - Creating a climate that encourages problem solving and learning
  - Making sure that everyone persists until the agendas are actually accomplished

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Slide 7

## Leadership and direction

- Innovation leaders articulate a clear vision for innovation — they provide a consistent and focused direction to which employees can link their own contribution to organizational objectives
- The way that people work and work together, is also a defining feature of innovative leader
- People need to have the space to work together, share ideas and challenge old ways of thinking



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Slide 8

## Effective leaders should consider:

- A strong focus on having the right team in place at the top
- Building a culture for growth and innovation
- Telling the story (compelling story) of the organization and aligning everything within the organization with it
- Managing relationships — inside and out
- Getting real — not being afraid to show their human side



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Slide 9

## Leadership style of innovative companies

- Assertive — providing strong vision and direction
- Affiliative — fostering harmony within the team
- Participative — building commitment and generating new ideas
- Coaching — focusing on long-term individual development



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Slide 10

## Organizational culture and climate

- Culture
  - Represents the norms, standards and value
  - How things are done in an organization
  - Macro-level organizational phenomenon
- Climate
  - Micro level phenomenon
  - Created by managers and experienced by managers and their teams



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Slide 11

## Organizational climate includes

- Standards — Where people are expected to do their best
- Responsibility — Where people are given appropriate authority
- Clarity — Where goals and expectations are well established
- Flexibility — Where new ideas are accepted and bureaucracy is minimized



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Slide 12

## Generation of new ideas and novel combinations of new ideas:

- Ideas fuel innovation
- Innovation is often costly and require resources
- Accept a reasonable degree of risk
- Old ideas may serve as raw material for new ideas



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Slide 13

## Effective implementation

- Translate ideas into business practice
- Being creative in the abstract and being an innovator in the concrete



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Slide 14

## Note

- Innovation leaders ensure that change occurs at an adequate but realistic pace
- Innovation is often costly (time and money), thus avoid the temptation to take all opportunities and change at once
- Pace of change means balancing patience and accountability
- Resist the temptation to 'pull the plug' too quickly on promising ideas
- Align performance measures to strategic objectives



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Slide 15

## Factors contributing to successful innovation

- Much better understanding of user needs and emphasis on satisfying them
- Good internal and external communication, willingness to take on external ideas
- Treating innovation as a corporate task — developing process and structures to integrate development, production and delivery activity
- High quality resources and level of commitment
- Implementing careful planning and project control procedures
- Implementing effective quality control procedures



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Slide 16

## Top ten killers of innovation

- Not creating a **culture** that supports innovation
- Not getting buy-in and **ownership** from unit managers
- Not having a widely understood, system-wide **process**
- Not allocating **resources** to the process
- Not tying projects to organizational **strategy**



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Slide 17

## Top ten killers of innovation (cont'd)

- Not spending enough time and energy on the **fuzzy front-end**
- Not building sufficient **diversity** into the process
- Not developing **criteria and metrics** in advance
- Not **training and coaching** innovation teams
- Not having an **idea management system**



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Slide 18

## Conclusion

- Innovation is an essential ingredient
- Innovation takes place throughout the economy
  - Not all innovations have their origins in formal R&D
  - Not all innovations are exclusively technical
- The innovation system concept is an analytical construct



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Slide 19

## Conclusion (cont'd)

- ISP has its own implications for project planning, implementation, evaluation and management
- Developing, nurturing and managing a productive and sustainable structure and modalities of operation takes time and long term commitment



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Slide 20

*Thank you!*



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# Managing innovation system

## 1 Introduction

Innovation is neither science nor technology but the application of knowledge of all types to achieve desired social and economic outcomes. Ideas are only one of the elements in successful innovation. Developing, nurturing and managing a productive and sustainable institutional structure and modalities of operation (including idea management) is crucial for generating commercially relevant innovation consistently. Management and leadership are crucial elements in this process. This chapter describes a basic model for managing innovation and deals with the various aspects that should be considered in order to build a culture of innovation within an organization.

### 1.1 Model for managing innovation<sup>1</sup>

The best way to achieve innovation is to understand how it functions; is directed and supported. A model helps us to see and understand the situation more clearly and, enables us to structure a workable approach to the management of innovation.

The idea here is to develop a viable system of innovation. Beer (1995) argued that the viability of a system is maintained by managing the various elements of the system together, keeping elements from interfering with each other, but interacting; and looking to the future with the whole rather than just the parts in mind. A viable system is a solid foundation upon which to build innovations.

#### Description of the model:

The management model proposed includes a system with four levels. The purpose and activities of the four systems levels are summarized in Table 1.

**Table 1.** *The four systems levels in the innovation management model*

System Level	Purpose	Typical activities
System IV	Creating the environment for innovation	Values, long-term goals, long-term strategies, policies and organizational character
System III	The strategic and managerial decisions	Operational goals, operational strategies, negotiation and compliance function, resource allocation decision and common decisions
System II	Provision of shared resources	Legal, human resources, information service, library, accounting, communication, advertising—promotion, market-research etc.
System I	Operational team level (all line functions)	Product development teams, process development teams, manufacturing/multiplication function

Source: Bean and Radford (2001).

#### *System I*

Represents the people who actually get work done: the product development teams, process development team and manufacturing (multiplication) teams. This includes all the non-support activities, the so called line functions in any organization.

#### *System II*

System II supports system I with shared resources. The efficient provision of system II services to system I units is one of the biggest challenges for all organizations. System II units make it possible for system

1. This section is heavily drawn from Bean and Radford (2001).

I units to actually function in their assigned role. Understanding the relationship of system II to system I is a critical component in the management of innovation. When system II functions find themselves in competition with system I elements, then something obviously is wrong.

### *System III*

This is the first place where we find management. System III provides operational direction, resolves conflict and allocates resources in cases where system II needs help or clarification. Negotiation of issues is a function of system III. Compliance with prior agreements is also a system III function. It is up to system III to ensure quality control, safety standards, and the general state of infrastructure is all maintained. It is important to keep in mind that the functions of system III are distinctly operational.

### *System IV*

The primary role of this group is to create the organizational environment for innovation. In very large organization it is easier to see the differentiation between system III and IV. In smaller organizations, one could often find that the functions of system III and IV being performed by the same executive team. Even here it is important to differentiate between the different roles and responsibilities of the system III work and system IV work among the managerial staff.

Each of the four levels or subsystems in the innovation management model represents common and necessary elements of the model. The necessary condition is that system I must produce something of value such that in its own right it could be a viable system. All other systems (system II, system III, and system IV) exist only to support the individual teams and groups that make up system I. If system I does not create something of value to its market place or society, then there is no purpose for the others, and hence by definition, no viable system.

## Activity clusters

Innovation occurs across the complete range of organizational activities. These set of organizational activities can be grouped into four clusters, each requiring management and each is essential to a comprehensive understanding of innovation. These clusters are: nurture and build; create and develop; implement and commercialize and; exploit and manage. The activity clusters describe what has to be done. The combination of viable system with the activity clusters gives us a useful way to dissect and examine the management of innovation.

**Table 2.** *The typical activity clusters*

Cluster	Purpose	Activities
Nurture/build	Creating the environment for innovation, i.e. trust, openness, security, honesty community etc.	Values, organization, compensation, communication etc.
Create/develop	Creating the capacity of the organization to meet its goals	Customer/client coordination, process development, technology/knowledge development, research, recruiting skilled people, employee skill building, corporate knowledge base
Implement and commercialize	Putting the innovation into place within the context of the organization	Operation, process application, technology application, distribution etc.
Exploit/manage	Carrying through with exploitation of the opportunity to mine the profit from it	Marketing/promotion, product line extensions, distribution, expansion etc.

Source: Bean and Radford (2001).

## Nurture and build

This cluster of activities provides a nurturing and hospitable environment for innovation. The organizational environment is a function of the policies and values held and reinforced by management itself. These are the values and policies reinforced consistently by the actions of all, particularly management. It is what the executives say and do that determines the behaviour of others.

## Create and develop

This cluster deals with the capacity of the organization to meet its goals. At the top of the list is the accurate and useful information about the client or customer. The capacity to serve the client is based upon understanding the needs of clients. Organizations known for innovative or creative performance invariably have created the capacity for recurrent innovation to happen.

## Implement and commercialize

This implementation cluster is the essence of what the organization does—every day blocking and tackling. All professional and technical activities related to the creation of knowledge/technology of the organization fall under this category.

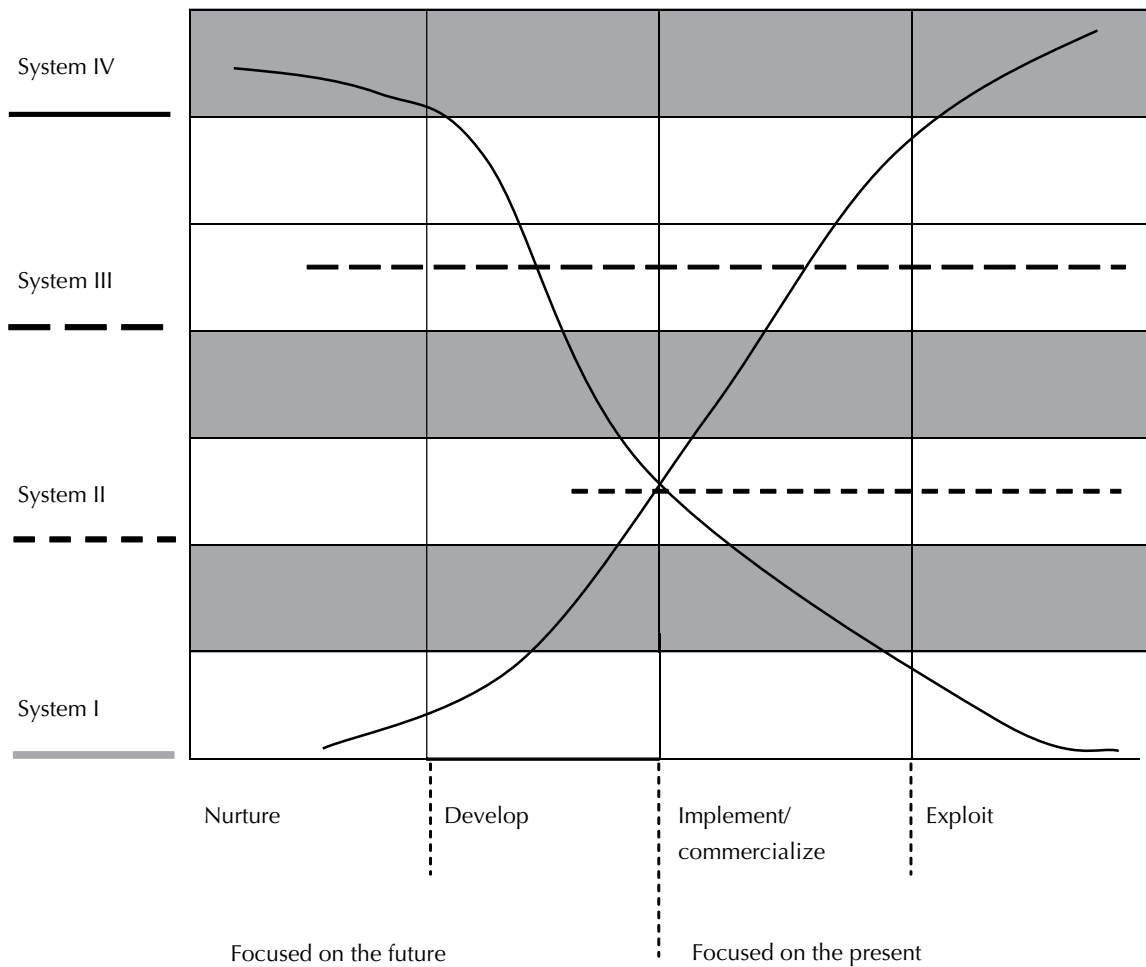
## Exploit and manage

These set of activities deal with the full exploitation of what has been created/developed. These deal with the realization of the outcomes of technologies and knowledge that has been generated. There is room for innovation in the exploitation phase too.

The adaptation of viable system model with activity cluster as shown in Figure 1 helps us to manage innovation. A number of observations can be made with respect to this combination.

- The involvement of the various participants in the system varies by system, time horizon, and activity;
- System IV is almost entirely focused on the future dealing with organizational cluster and work environment;
- System IV in conjunction with system III, provides the critical elements of the capacity for innovation. Effective capacity for innovation is seldom if ever present in any organization where management is not consciously working to provide it;
- System III maintains a constant role across the entire spectrum of activities—this is the nature of operational management;
- System II has little to do with creating the culture and environment for work. System II is certainly part of it and may support and contribute to it, but in no way can the support elements of an organization determine the culture that is contrary to that held by management. System II may indeed have some impact on developing capacity for innovation and the support role must continue throughout implementation and exploitation; and
- The activities of system I are biased towards the present. Some may be involved in future activities at least in the sense of contributing to new products, services or processes but majority work on the present.

The innovation management model provides us with a means of seeing and understanding what needs to be done and provides insight into how to go about it. The model can be applied to a numerous central aspects of managing innovation including:



Source: Bean and Radford (2001).

**Figure 1.** Innovation management model combined with the activity clusters.

- Creating the ideal environment for innovation;
- Linking innovation to market opportunities;
- Organizing for innovation;
- Implementing innovations;
- Exploiting innovation; and
- Supporting the innovative enterprises.

All systems need a purpose clearly understood and widely accepted. In the case of innovation (both commercial and non-profit) the purpose is to serve the client or customer. It is important to remember that strategy, innovation and management matter. However, for an organization to survive there can be no other focus but the ultimate client/customer. Innovation management model describes organizational functions in terms of how each is best performed. Senior management is primarily responsible for the future and everyone else working in the present. The model thus implies who does what. The activity clusters describe what has to be done. The interaction of the what and who/how provides us with an effective model for examining and managing innovation.

We can take a realistic example to demonstrate how the above model works in real world. The decision-making levels and the types of planning involved in a typical public sector NARI is presented in Table 3. Typically, there are three types of planning: strategic, tactical, and operational resulting in three different set of outputs. It is worth noting that these processes are interdependent and complementary.

**Table 3.** *Decision-making levels and types of planning*

Decision-making levels	Types of planning	Characteristics
Top management		
Strategic level Strategic decisions	Strategic planning	Diagnostic and prognostic process that considers the institution as a whole, as an open system, and in relation to its environment Long-term objectives, goals, policies, priorities, and strategies (10–15 years), which indicate the tactical planning More comprehensive, with greater risks and less flexibility than tactical and operational planning
Middle management		
Tactical level Tactical decisions	Tactical planning	Organizational process that considers the subsystems of the institute Medium-term objectives, goals, policies, priorities, and strategies (3–5 years), derived from the strategic plan, and oriented to the operational planning More comprehensive, with greater risks and less flexibility than operational planning
Operations		
Operational level Operational decisions	Operational planning	Practical process that considers the individual activities of each subsystem of the institution Short-term objectives, goals, policies, priorities, and strategies (1 year), derived from the tactical plan, to be implemented Not as comprehensive, less risks and greater flexibility than strategic and tactical planning

Figures 2 and 3 represent the organizational structure of the Institute of Agrarian Research of Mozambique (IAR) and the proposed structure of the zonal research centres of Mozambique. From these structures one could identify the four systems as well as the different division levels in the organizations as shown in Table 4. This Table clearly demonstrates the different system levels within an R&D organization, and the functions of the various actors involved are described in the respective job description.

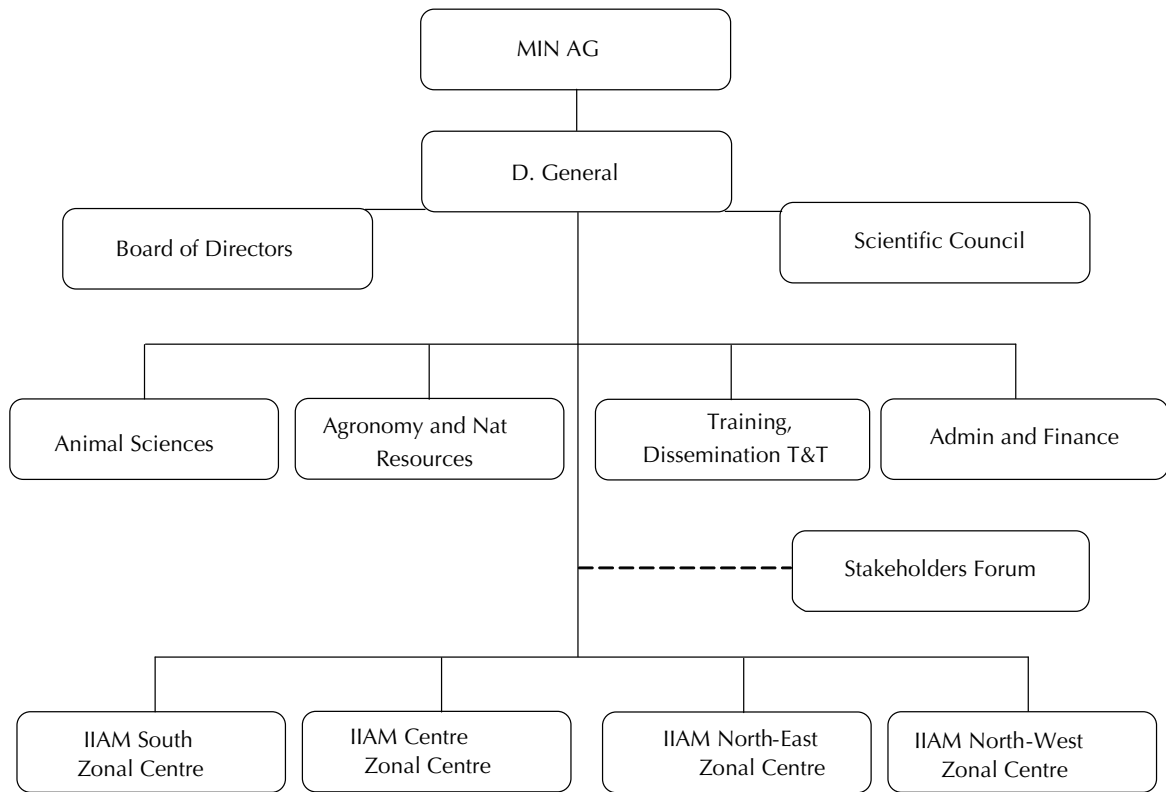
**Table 4.** *System level and participation*

System level	Potential actors
System IV	Director General; Directors of the various directorates; Directors of zonal centers; Scientific Technical Councils, and Stakeholders Forum
System III	Directors of various directorates; directors of zonal centres; heads of departments; training centres; laboratories, experimental stations; farming systems group; and interest groups
System II	Staff of training centre, laboratories, experimental station, administration, finance, libraries etc.
System I	All scientific staff

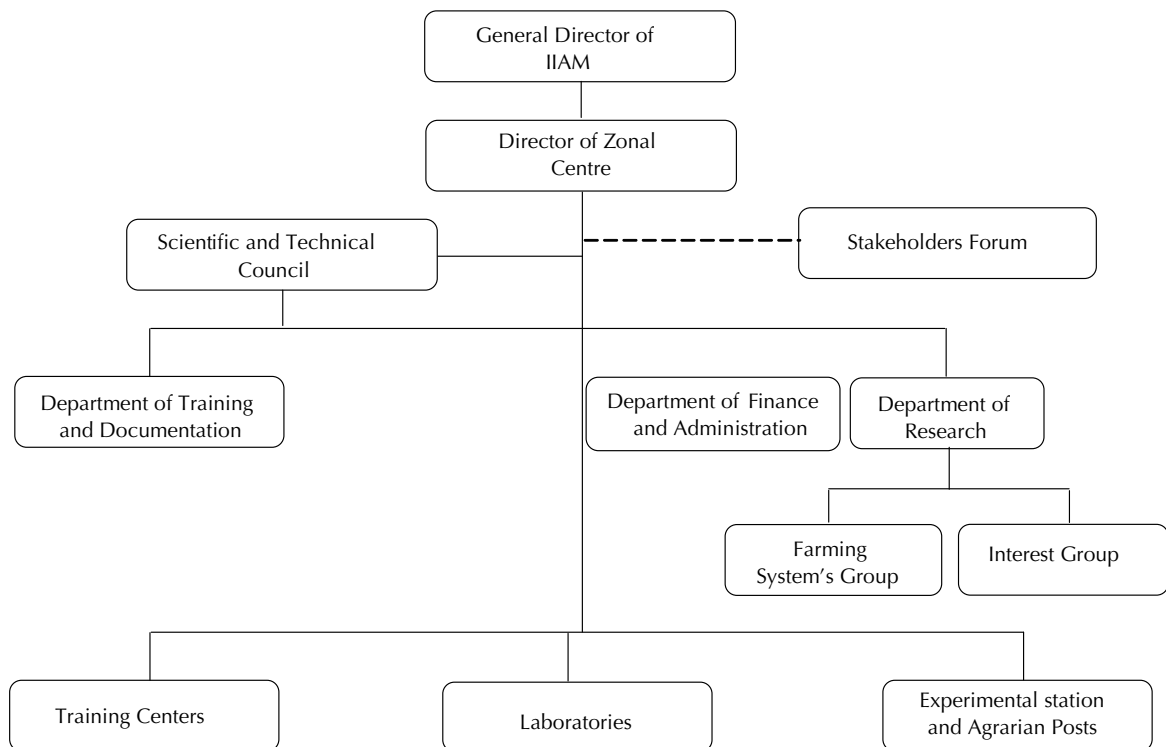
## 2 Building a culture of innovation

The most admired organizations exhibit a significantly higher level of consensus about both the current culture and ideal culture of their organization and are closer to achieving the culture that they seek.

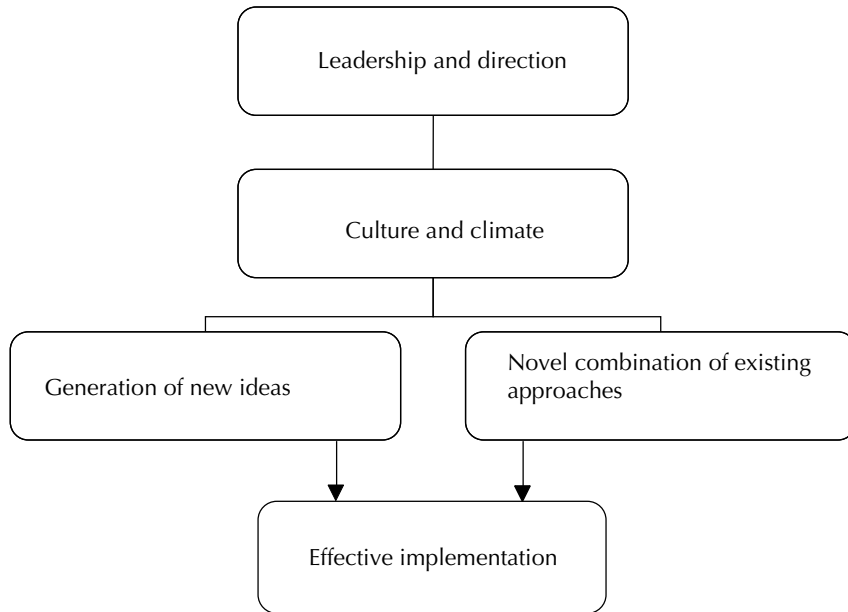
Innovation is fostered by a culture that aims to meet the needs of all stakeholders—customers, teams and employees. This can mean questioning budgeted objectives, systems, processes and norms that emphasis meeting short-term management plans and increasing the emphasis on long-term thinking and the strategies for achieving these. Hay Group (2006) had closely researched this question by partnering with Fortune Magazine and identified five critical steps towards building a culture of innovations (Figure 4).



**Figure 2.** Organizational structure of IIAM.



**Figure 3.** Proposed structure of the zonal research centres.



Source: Focus, Hay Group (2006).

**Figure 4.** *The five critical steps towards building a culture of innovation.*

The cultural change for promoting innovation starts at the top with leaders who provide strong direction for innovation and establishing organizational cultures and climate that are conducive to innovative activity. Those who are perceived to succeed at innovation align leadership, culture, robust processes and structures that support innovation and effective implementation.

## 2.1 Leadership and direction

Leadership means:

- developing a vision;
- turning vision into workable agendas;
- communicating these agendas to others in a way that results in excitement about and commitment to them;
- creating a climate that encourage problem solving and learning around the agendas; and
- making sure that everyone persists until the agendas are actually accomplished.

Innovation leaders articulate a clear vision for innovation—they provide a consistent and focused direction to which employees can link their own contribution to organizational objectives. The way that people work and work together, is also a defining feature of innovative leader. People need to have the space to work together, share ideas and challenge old ways of thinking.

Effective leadership is about continuous focus on the future rather than reviewing the past. The key issues on the minds of many leaders are achieving growth; managing costs; making tough strategic choices; getting closer to the customer; building the leadership pipeline; managing the external interface; and increasing accountability. Most effective leaders should consider:

- a strong focus on having the right team in place at the top;
- building a culture for growth and innovation;
- telling the story (compelling story) of the organization and aligning everything within the organization with it;

- managing relationship; and
- getting real—not being afraid to show their human side.

### 2.1.1 The right team

Success is no longer about functional speciality. The kinds of decisions made are related to investment, change management, managing partnerships, meeting the emerging challenges and demand. Decisions need to be made and executed quickly. Team effectiveness at the top is not about team building as such. It is about execution of strategy, which means top team having the right dialogue, on the right issues, making the right decisions and executing their tasks well. The most important and credible teams of all are those that are accountable to external stakeholders. It is about building credibility for the team in the perception of these stakeholders—the funders, employees and the target group (market).

Focus (2006) stated that a team operates best when they display the following characteristics:

- Outstanding leadership teams are real teams, with clear boundaries and stable membership. The membership of an executive team is not about functional representation or politics, but about having the right membership to achieve the purpose;
- Leaders of outstanding teams are not necessarily outstanding organizational leaders. What they do instead is to understand and manage five conditions for team success: support, direction, structure, people and development;
- Leaders of outstanding teams have unique managerial styles and competencies—the kind that facilitates and encourages dialogue;
- Leaders of outstanding teams do a better job of setting direction and clarifying norms of behaviour—they work with the team to articulate a clear mandate; and
- Members of outstanding leadership teams are not smarter, but they have more emotional intelligence. They have competencies such as empathy, understanding others and the position that they take in an issue—which is critical to influencing. They walk the talk, showing integrity to decisions made by the team—which is particularly important to team functioning.

### 2.1.2 Building a culture for growth and innovation

Institutions have to grow to remain relevant and be competitive. Learning to think and operate collaboratively is both a major pathway and a major challenge to organic growth. Organizations need to innovate in order to gain edge, satisfy consumers' demand and to simply remain competitive. The most successful companies manage innovation better than their competitors—but not without significant challenges.

This requires a completely different culture—a move away from individualistic thinking (my opportunity, my result, my reward) to a collaborative way of thinking whereby individuals pause in the face of an opportunity and consider: 'how can this be leveraged to an even bigger outcome? Who could I involve to multiply the results of this deal? What might I need to trade off, in the short-term to a greater long-term outcome?'

A culture of collaboration is about vision, co-operation and self management and it needs to be led from the top. The top management should create a shared vision where growth and innovation have purpose and are valued. They will create cultures that foster and reward customer focus, collaboration and innovation and high standard of performance.



### 2.1.3 The story teller

Strategic vision is one of the most important qualities of the leader. It is the ability to articulate a simple yet robust and compelling strategy and disseminate it through the organization. They engage all their stakeholders with a clear and compelling story that brings life to the vision, the cause and the purpose of the organization. The story reflects what the organization stands for, what it believes in and what it aspires to. It talks about the employees and the part they play in the story and it talks about the customer. It is most powerful when it combines three elements: use of emotion; genuineness and a good sense of timing. Emotional engagement is pretty important in the face of major challenges. The story has to be authentic; it is not a role-play and neither a con. Outstanding leaders will seek to deliver a message when their target audience is ready to hear it.

### 2.1.4 Managing relationships—inside and out

Management of the environment is crucial for effective leadership. They see building and nurturing relationship as a key part of their role. The best leaders are able to step back from day to day management in order to lead the organizations. This will usually be because they have actually done the work around establishing a capable executive team; they work to manage the critical relationship with the board, and they manage the politics between the stakeholders, between the board and management and the organization and target clients. They bring in the right talent; make tough performance decisions, clarity in the roles and responsibilities. This clarity enables each of these parties to make its unique contribution without the frustrations of overlap and boundary confusion.

### 2.1.5 Getting real

This deals with the ability of the leaders to show humility, to show that they do not have all the answers, that they need their people. They will be open and candid about their own leadership challenges, show real commitment to developing other leaders. They have the ability to adopt their own thinking and behaviour to changing circumstances and new challenges. That means:

- think differently—mental model vs. facts;
- walk in other people's shoes—empathy;
- in sync—with everything they think, do and say;
- share everything—their own desires, feelings and actions;
- turn their tongues—in other words to show self-control before meeting, showing humility;
- explain well and seek feedback that messages are understood; and
- dream vividly—story teller vs. evangelist. Tell stories that engage and inspire rather than just 'telling'.

Leaders in most innovative companies exhibit distinctive profile. Prevalent leadership style includes:

- assertive—providing strong vision and direction;
- affiliative—fostering harmony within the team;
- participative—building commitment and generating new idea; and
- coaching—focusing on long-term individual development.

These leadership styles are commonly evidenced by managers with high performing teams. And they are also leadership styles that can be expected to be conducive to innovation, fostering high levels of direction, empowerment, participation and team work.

## 2.2 Organizational culture and climate

Leadership shapes the organizational culture and climates. Organizational culture represents the norms, standards and values that broadly define 'how things are done' in an organization. While often taken for granted by employees, organizational cultures drive employee behaviour in important ways. Indeed, the role of culture in impacting actions and decision-making is even more important in the fast-changing environment that characterizes most organizations today. Organizations must count on employees to act on their own in ways consistent with organizational objectives, cultures and values.

Leaders tend to be much more closely aligned in their understanding of their current cultures and their priorities for future cultural development. They display cultures that promote individual initiative and high levels of team work, both factors that are supportive of the development of innovative approaches. While culture is a macro-level organizational phenomenon, climate is much more micro, created by managers and their teams. If the essence of leadership is getting things done through people, then effective leaders clearly need to create climates where people can be maximally effective (Hay Group 2005). Results suggest that leaders in the most innovative companies create more effective climate for their direct reports than leaders in other companies.

Work climate includes:

- standards—where people are expected to do their best;
- responsibility—where people are given appropriate authority;
- clarity—where goals and expectations are well established; and
- flexibility—where new ideas are accepted and bureaucracy is minimized.

While effective climates support individual performance, having the right people is also critical. It needs a mix of people who show leadership ability to be collaborators, people who display a results-focus and, people who can build an organization and mentor and develop others.

## 2.3 Generation of new ideas and novel combination of new ideas

As in biological evolution, organizational innovation is fuelled by experimentations. But where genetic mutation is random, organizational mutations are highly intentional (i.e. driven by clear direction).

Ideas fuel innovation, whether they are new ideas or existing ideas that are leveraged in novel ways. To promote the development of innovative concepts, innovation leaders encourage high levels of individual initiative and promote effective cross-functional team work.

- Innovation is often costly and innovation leaders commit significant resources;
- Innovation leaders are more focused in their investments in innovation. They have clear procedures for determining the level of investment in innovative ideas;
- They leverage the skills and capabilities of their people by giving them broad latitude in carrying out their job responsibilities;
- Innovation leaders foster high levels of empowerment;
- Ensure decisions are made at the most appropriate level, i.e. where the most appropriate knowledge and expertise reside; and
- They encourage managers and employees to take reasonable degree of risk in an attempt to increase organizational effectiveness.

Innovation leaders discourage people from 'playing it safe' by creating climate where innovative ideas can fail without penalty to the originating people or group. Old ideas may also serve as the raw material for new ideas if combined in productive ways.

## 2.4 Effective implementation

Successful innovation requires more than good ideas. Innovative organizations need to translate novel approaches into business practices that improve organizational performance or products and services, that reach the market.

*'Innovations have generally failed to distinguish between the relatively easy process of being creative in the abstract and the infinitely more difficult process of being innovationist in the concrete. Innovative ideas are relatively abundant. It is implementation that is scarcer.'* ('Creativity is not enough,' Harvard Business Review, August 2002).

Note:

- Innovation leaders manage implementation by ensuring that change occurs at an adequate but realistic pace;
- Innovation is often costly in terms of both time and money; they avoid the temptation to take on all opportunities and changes at once;
- Managing the pace of change means balancing patience and accountability;
- Innovation leaders ensure that the individuals and groups imitating new approaches see them through to full implementation. They resist the temptation to 'pull the plug' too quickly on promising ideas; and
- Align performance measure to strategic objectives—success in innovation would be directly measured in performances management and compensation systems. Reward system should provide adequate incentive for innovative activity.

Effective innovations promote alignment around a clear leadership vision. They recognize that having the right people working with the right management in the right environment is essential for the development of new ideas. And they ensure that processes and practices are in place to translate innovative activity into implementation and end results. Survey results also confirm that innovation leaders are more likely than others to have established a clear vision for innovation, identifying the areas in which they intend to pursue new ideas and approaches.

## 3 Factors contributing to successful innovation

Although the concept of 'innovation' and innovation system is relatively new for agriculture, these frameworks have been used in the industrial sector for a considerable period. A number of lessons can be drawn from these experiences. Rothwell et al. (1992) conducted a landmark study in the UK to identify factors that characterize successful innovations and unsuccessful innovations. The key conclusions of this study were:

- Successful innovators were seen to have a much better understanding of users' needs than did the unsuccessful;
- Successful innovators developed processes and structures to integrate development, production, and delivery activity; failures lacked such communication between these areas;

- Successful innovators performed the development work more efficiently than the failures, but not necessarily more quickly;
- Successful innovators, although typically having internal R&D capability, made more use of outside technology and scientific advice, not necessarily in general but in the specific area concerned; failures tended to have little communication with external knowledge sources;
- Success was correlated with high-quality R&D resources and effort dedicated to the project, and to the level of commitment in terms of team size; failures had fewer resources and the result was lower-quality products; and
- Success was found to be linked to the status, experience, and seniority of the innovator or entrepreneur responsible for the innovation. Successful innovation champions were usually more senior and had greater authority than their counterparts in unsuccessful projects. This indicated a stronger commitment by senior management to the project.

The single most important feature is to stress that the central importance of *understanding users' needs* must translate into action across all functional areas. This does not only mean better market research, it also means that R&D design, and production departments are involved with users at an early stage in the innovation process. 'R&D people and entrepreneurs tend to dismiss the point as obvious, but nevertheless continue to ignore it in practice' (Freeman 1982). In addition, Wycoff (2004) identified the top ten killers of innovations (see Box 1).

#### Box 1. Top ten killers of innovation

- Not creating a **culture** that supports innovation
- Not getting buy-in and **ownership** from business unit managers
- Not having a widely understood, system-wide **process**
- Not allocating **resources** to the process
- Not tying projects to company **strategy**
- Not spending enough time and energy on the **fuzzy front-end**
- Not building sufficient **diversity** into the process
- Not developing **criteria and metrics** in advance
- Not **training and coaching** innovation teams
- Not having an **ideal management system**

Source: Wycoff (2004).

Therefore, the main factors influencing the success of innovation are:

- Establishing good internal and external communication: effective links with external sources of scientific and technological know-how; a willingness to take on external ideas;
- Treating innovation as a corporate task: effective functional integration; involving all departments in the project from its earliest stages; ability to design for 'marketability' (people who have been to the field have strong feelings on what is feasible and what is not);
- Implementing careful planning and project control procedures: committing resources to early and open screening of new projects; regular appraisal of projects;
- Efficiency in development work and high-quality production: implementing effective quality control procedures; taking advantage of up-to-date production equipment;
- Emphasis on satisfying user needs (efficient customer links): where possible, involving potential users in the development process;

- Providing good technical service to customers, including customer training where appropriate;
- The presence of certain key individuals: effective product champions; and
- High quality of management: dynamic, open-minded; ability to attract and retain talented managers and researchers; a commitment to the development of human capital.

It should be emphasized that innovation requires organizations to build and coordinate capabilities across all functions. There are no examples of successful innovators being focused on a single factor. Empirical evidence also supports the view that quality of management is of paramount importance since innovation is a social process. In applying the innovation systems perspective (ISP) to agriculture, these lessons are highly relevant, and can make a significant contribution to institutionalization.

## 4 Conclusion

Innovation is an essential ingredient to future success in agricultural R&D. Every organization/stakeholder group innovates to some degree. For some, innovation takes the form of creative and successful new products; others rely on innovative solution for achieving cost reduction and higher quality service; and some others see innovation as a source of competitive advantage to secure greater market. The key challenge to R&D managers is to learn how to identify/generate commercially relevant innovation and how to achieve it consistently.

Because of the greater emphasis on the broader developmental goal, the R&D strategies have shifted during the past decades from NARIs to NARS to AKIS and more recently to AIS. This change in thinking recognizes that innovation takes place throughout the whole economy and not all innovations have their origin in formal R&D, nor are all exclusively technical. The new perspective places more emphasis on the role of farmers, input suppliers, transporters, processors, and markets in the innovation process. These developments clearly demonstrate that there is no uniquely best system to analyse all situations. The goal is to find the most appropriate system for the situation one will face; find the one that will evolve with the situation and put in place the process that allow it to learn and effect the future (van der Heijden 1966; Elliot 2004).

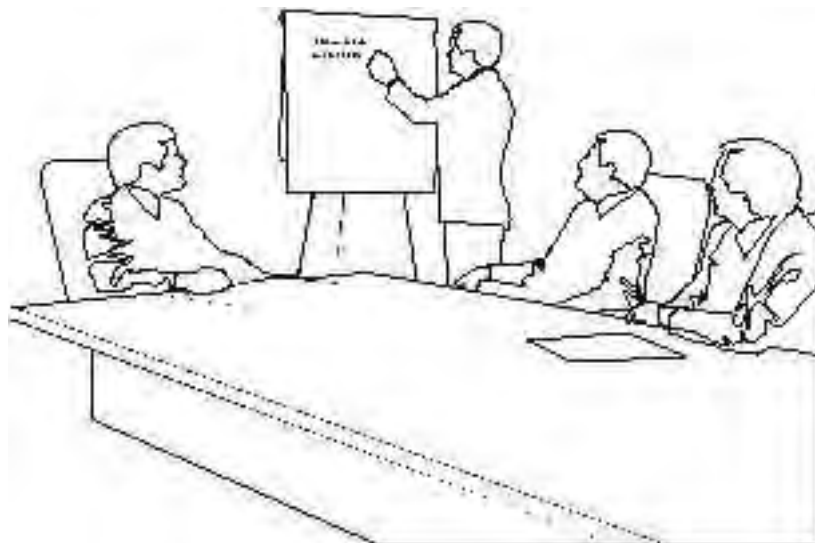
The innovation system idea does not provide one generic institutional model for innovation. There is no uniform theory of innovation. Instead of postulating a defined role for different actors, it becomes necessary to assess actual condition of each case and look who among several partners may take over one or more of these functions. In this perspective, the different functions from funding to research to technology dissemination and technology adoption are still performed but who performs them and how is not pre-determined. Therefore, the concept of innovation is empirical. One has to observe, who is interested in a particular innovation, who participates in developing it and which rules and regulatory mechanisms are operating.

Institutionalizing such a perspective in the agricultural R&D system offers both opportunities and challenges. Developing, nurturing and managing a productive and sustainable institutional structure and modalities of operation takes time and long-term commitment by all actors involved. The strength of an innovation system depends on the strengths of its components and the management of its linkages. Developing a clear understanding of the historical, political and institutional dimensions of the system and its components is crucial to draft national policies that not only help build capacity in individual R&D actors, but also create incentives and support mechanisms for institutional learning and partnerships that will improve the systems performance.

## References

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- Elliot H. 2004. *Systems thinking, commodity chains and agricultural innovation strategy*. ASARECA (Association for Strengthening Agricultural Research in Eastern and Central Africa), Entebbe, Uganda.
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- Wycoff J. 2004. *The big ten innovation killers and how to keep your innovation system alive and well*. (www.thinksmart.com).

## Exercise 8 Discussion on managing innovation system



### **Plenary discussion** (25 minutes)

While the trainer makes the presentation, think about responding to the following questions:

- Why do you think innovation requires a different kind of management?
- Have you come across with a leadership which you considered has enhanced innovation? Explain.
- Based on your experience what activities kill innovation? What can be done to improve them?

# Trainer's guide

## Session 9 Institutionalizing innovation systems perspective (ISP) and implications

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Purpose	The purpose of this session is to understand the requirements for institutionalizing an innovation systems perspective in agricultural R4D organizations and the challenges involved
Objectives	At the end of this session participants will be able to: <ul style="list-style-type: none"> <li>• describe the concept of institutionalization; and</li> <li>• identify areas that need attention in order to institutionalize innovation systems perspective within the agricultural R4D systems</li> </ul>
Resources	<ol style="list-style-type: none"> <li>1. Flipcharts</li> <li>2. White board</li> <li>3. Flipchart and white board markers</li> <li>4. Copies of handouts 9.1 to 9.4 for every participant</li> <li>5. Computer and LCD projector</li> </ol>
Time needed	Two hours and 30 minutes

### Session structure

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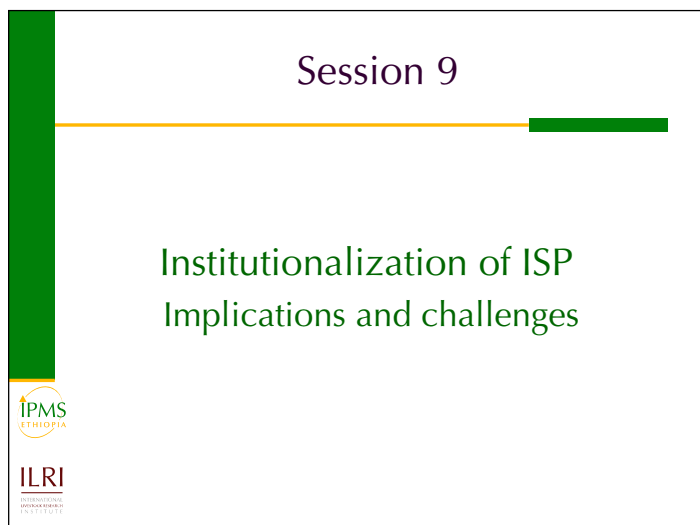
Activity	Time required	Remark
Presentation	<ul style="list-style-type: none"> <li>• Distribute handout 9.1 (presentation slides) before you start your presentation</li> <li>• Give a presentation on institutionalizing ISP and implications</li> <li>• Allow some time for questions</li> <li>• Distribute handout 9.2 (presentation text) to supplement your presentation</li> </ul>	45 minutes
Exercise	<ul style="list-style-type: none"> <li>• Distribute handouts 9.3 and 9.4 for exercise 9 on institutionalizing innovation system</li> <li>• Ask a volunteer to read the exercise</li> <li>• Ask participants to actively participate in completing the exercise</li> <li>• Invite the rapporteur to present the group response</li> </ul>	One hour and 55 minutes
Transition	Make closing remarks	5 minutes

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## Session 9: Presentation slides

Slide 1



Session 9

Institutionalization of ISP  
Implications and challenges

IPMS  
ETHIOPIA

ILRI  
INTERNATIONAL  
LIVESTOCK  
RESEARCH  
INSTITUTE

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Slide 2



Objectives of the session

- Describe the concept of institutionalization
- Identify areas that need attention in order to institutionalize innovation systems perspective within the agricultural R&D systems

IPMS  
ETHIOPIA

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INTERNATIONAL  
LIVESTOCK  
RESEARCH  
INSTITUTE

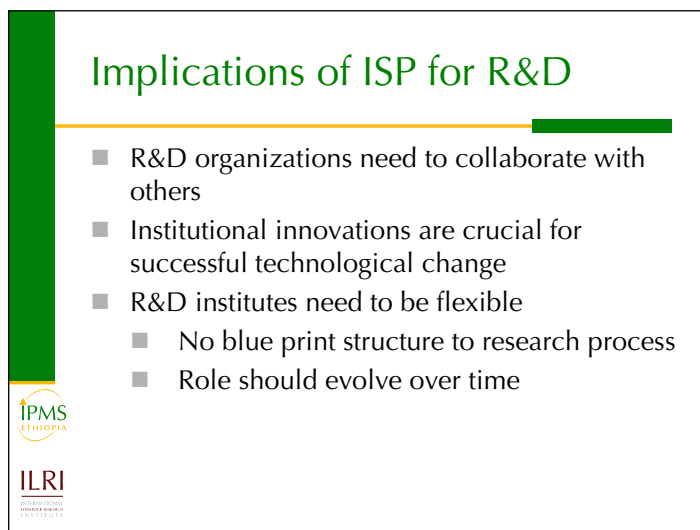
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Slide 3



Implications of ISP for R&D

- R&D organizations need to collaborate with others
- Institutional innovations are crucial for successful technological change
- R&D institutes need to be flexible
  - No blue print structure to research process
  - Role should evolve over time

IPMS  
ETHIOPIA

ILRI  
INTERNATIONAL  
LIVESTOCK  
RESEARCH  
INSTITUTE

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Slide 4

## Implications of ISP for R&D (cont'd)

- R&D institutions need to develop
  - Pro-poor technology
  - Pro-poor institutional arrangements
  - Research on institutions is as important as research on technological issues
- R&D approaches become important public goods
- Researchers and managers need to be open to learning and change
  - Key determinant of institutional change



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Slide 5

## Institutionalization of innovation systems perspective

- Institutionalization refers to the permanent integration of concepts, principles, and procedures of ISP in planning, management, evaluation of R&D interventions and subsequent utilization of the knowledge generated
- It involves:
  - Institutionalization of the process
  - Institutionalization of training



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Slide 6

## Preconditions for successful institutionalization:

- Clear demonstration of the utility of the process
- Policy and organizational commitment — including resources
- A clear national strategy for institutionalization
- Trained capacity to implement
- A national capacity to offer continuous training
- Broader participation and effective linkages



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Slide 7

## Institutionalization of ISP training

With respect to institutionalization of training, there is a need to:

- Have well-established organizational linkages between the agricultural higher learning entities and the relevant ministries dealing with 'agriculture'
- Recognition of the need, firm commitment, willingness, and flexibility of the policymaking body of the higher learning entities to meet the requirements of the R&D system in terms of providing the required skills



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Slide 8

## Institutionalisation of ISP training (cont'd)

- Development and/or existence of capacity to offer the training:
  - Availability of professional expertise or trained manpower
  - Resources and facilities to offer the training
  - Availability of training materials
- There is a need to prepare the higher learning entities to offer such training at the national and regional levels on a regular basis



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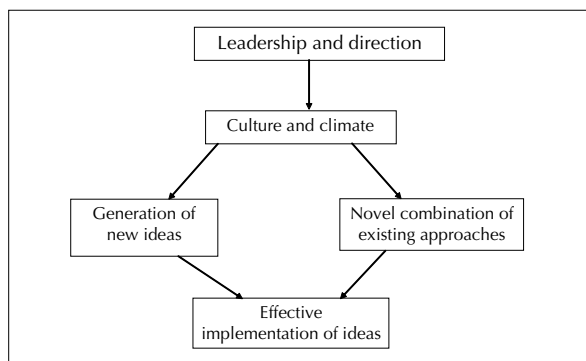
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Slide 9

## Critical steps towards building the culture of innovation



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Slide 10

## Developing a sustainable structure and mechanism for AIS

Strategic principles:

- Systems development and networking
- Introduction of new funding mechanisms for publicly subsidized service
- Organizational capacity development of individual service organizations



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Slide 11

## Developing an institutional structure for AIS

Strategic principles (cont'd)

- Support entities which promote communication and public debate on agricultural problems and thus help to identify the guidance and social control of public R&D institutions
- Foster capacity to manage and account for external funds with a greater degree of accountability and impact orientation



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Slide 12

## Systems development and networking

- Create relationship between the different actors and support their exchange
- Organize and strengthen public and private demand for innovation services
- Include and support new service providers outside the public sector—including intermediaries to provide non-marketable services
- Organize collective supervision and mediation mechanisms



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Slide 13

## Introducing new funding mechanisms

- Clearly define the public functions that remain to be performed
- Increase control of public resource allocation by technology users and clients
- Link public funding to performance criteria



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Slide 14

## Introducing new funding mechanisms (cont'd)

- Introduce competitive elements in service provision and foster private supply of innovation services
- Support local organizations to formulate and express their demand for technology and services



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Slide 15

## Implications and challenges

1. How to develop productive and sustainable institutional arrangements for AIS?
  - Growing interrelationships between participants
  - Intensive communication between stakeholders
  - Political and economic context
  - What are the preconditions needed to achieve this?
  - How do we institutionalize the IS perspective?
  - How do we facilitate the creation of learning institutions?



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Slide 16

## Implications and challenges (cont'd)

2. How to create the capacity for innovation?  
Building up of collective capacity of networks or systems of actors interactively linked with a view to innovate
3. How to assess successful partnerships, networks and innovations? How to reward and provide incentives? How do we demonstrate the utility and added value?



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Slide 17

## Implications and challenges (cont'd)

4. How do we scale up the capacity to innovate? Scaling up the innovation as well as the capacity to innovate
5. How to ensure adequate attention is given to such factors as socio-economic equity, and environmental sustainability?  
How to promote pro-poor innovation?



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Slide 18

## Implications and challenges (cont'd)

6. How can we better understand the factors that contribute to successful and sustainable innovations?
7. What are the central concepts, methodologies and principles that contribute to the institutional and organizational transformations needed to promote successful innovation?
8. How to identify/generate commercially relevant innovation and how to achieve it consistently?



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Slide 19

## Conclusion

- Innovation is an essential ingredient
- Innovation takes place throughout the economy
  - Not all innovations have their origins in formal R&D
  - Not all innovations are exclusively technical
- The innovation system concept is an analytical construct



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Slide 20

## Conclusion (cont'd)

- ISP has its own implications for project planning, implementation and evaluation
- Developing, nurturing and managing a productive and sustainable structures and modalities of operation takes time and long term commitment



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Slide 21

*Thank you!*



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# Institutionalizing innovation systems perspective

It is abundantly clear that the various stakeholders in the agricultural R&D arena face increasingly new challenges for which their current experience provides limited guidance. There is an urgent need to move away from the old models to those which are more suitable for the contemporary development needs. The concept of innovation system is increasingly being used to articulate what this model might look like.

At its simplest, an innovation system has three elements:

- The organizations and individuals involved in generating, diffusing, adopting and using new knowledge
- The interactive learning that occurs when organizations engage in this process and the way this leads to new products and processes (innovation); and
- The institutions (rules, norms and conventions) that govern how these interactions and processes take place.

As pointed out by Horton (1990) this way of viewing innovations have a number of important implications for the research and development organizations and the way they operate.

- R&D organizations need to collaborate with others. Innovation involves not only formal research and related organizations, but a range of other bodies and non-research tasks. Making the necessary contacts and forming these partnerships, alliances, and coalitions is extremely important for all R&D organizations, since these links facilitate learning and information flow.
- Since innovation is essentially a social process that is influenced by institutional arrangements, institutional innovations are often crucial for successful technological change.
- R&D organizations need to be flexible. The role of different organizations in the innovation processes is not fixed but should evolve over time. Similarly, there is no blue print for structuring research processes. They should also evolve over time, leading to the use of a range of different approaches.
- R&D institutions need to develop not only pro-poor technology, but also pro-poor institutional arrangements. For this reason, research on institutions is as important as research on technological issues. New research and development approaches become important international public goods.
- Both the 'researchers' and the managers need to be open to learning and change, since they are the key determinants of institutional change.

These key features should be kept in mind in trying to integrate the innovation systems perspectives within the various R&D organizations. The various considerations with respect to institutionalizing the innovation systems concepts, principles and the perspectives are discussed in the following sections.

## 1 Institutionalization

The term institutionalization refers to the permanent integration of innovation concept and the innovation systems perspective within the agricultural R&D organizations in guiding their mandated activities. Institutionalization is an interactive, dynamic and evolutionary process. There is no blue print, but the steps taken by the various organizations depend on the existing institutional structures and the modalities of operation. Previous experiences in institutionalizing the systems thinking within the R&D organizations reveal that a number of conditions should be in place for successful institutionalization (Anandajayasekeram and Stilwell 1997). These include:



- Clear demonstration of utility of the process;
- Policy and leadership commitment (including the necessary resources) to integrate the concept and processes within the organization;
- Broader participation and effective linkages between the various stakeholders;
- Experienced, trained, motivated and committed staff;
- A clear organizational strategy (internally driven) for institutionalization; and
- A national capacity to offer continuous training on the concept, principles and procedures, i.e. integration into the learning curricula.

Unless these conditions are met, the institutionalization process will be very slow and may not even be sustainable. It is important to keep in mind that a number of organizations in the region have already integrated the systems concept. Most of the ingredients are already in place. The only thing that is needed is to graft the missing elements into the existing system, i.e. changing the mindset to think about 'innovation' instead of 'knowledge/technology' and then use the innovation systems perspective in the design, implementation and evaluation of interventions, and establish the necessary linkages and partnerships during the process.

Previous experiences also indicate that the process of institutionalization should be undertaken in two phases: the preparatory phase and the institutionalization phase. The preparatory phase is needed to:

- Develop the necessary skills to initiate a number of innovation system based programs;
- Demonstrate to the policymakers and others the usefulness and the value addition by following this approach;
- Sensitize the policymakers and other relevant key stakeholders;
- Change the attitude and mind set of the R&D practitioners;
- Harmonize terminologies and procedures; and
- Develop a national strategy for institutionalization.

The activities of the preparatory phase should include:

- Initial exposure and preliminary training;
- Initiating pilot studies to demonstrate the utility and value addition;
- Sensitizing workshops for senior and middle level managers of the various organizations and policymakers;
- Sharing the experiences of others; and
- Developing a national/organizational strategy for institutionalization.

It is also important to remember that the concept can be applied at different levels—national, sectoral, as well as local level to address farm level problems. As a part of this process, the researchers from the different disciplines, the extension staff, other development practitioners, senior and middle level managers of the various organizations (including educational entities), and policymakers in the relevant key ministries need to be sensitized. Different types of sensitization are required for technical staff, line managers and policymakers. The development of the national/organizational strategy should be the responsibility of the relevant key stakeholders and the process must be internally driven. The strategy should ensure continuity and sustainability and should build on the existing structure, institutional arrangements and modalities of operation. The regional organizations such as FARA, SADC, ASARECA and CORAF can play a catalytic and facilitating role in this process.

The subsequent institutionalization phase should include:

- Mass training of the R&D practitioners and various actors in the innovation process;

- Preparing the learning organizations including training of trainers and curriculum development;
- Creating in-service and on-the-job training capacity;
- Resource mobilization and allocation of adequate human, physical and financial resources for the various actors and organizations;
- Establishing the necessary mechanisms (including roles, responsibilities, sharing of information and benefits) for the enhancement of necessary partnerships and networks among the various actors;
- Establishing the career prospects, performance assessment and reward systems.

Breaking down the barriers between the various stakeholder groups and organizations, establishing the required forward and backward linkages; and forming joint ventures between the various stakeholders is a major challenge in the institutionalization process.

Human capital development is a critical step in the institutionalization process. Training is needed for the various stakeholders involved in the agricultural innovation system. The managers and policymakers require ‘sensitization’ type training, whereas the practitioners at all levels need in-depth training focusing on the skill building—in line with their expected roles and responsibilities. The national agricultural learning institutions should play a pivotal role in capacity building. Since the innovation system is a ‘soft’ system and an analytical construct, the agricultural training institutions can integrate the concepts, principles as well as the tools of analysis within their regular curricula. A number of educational organizations in the region have incorporated the FSA concepts and procedures into their curricula. So the additional materials could be incorporated without much difficulty. However, the training of trainers and the development of location specific training materials are issues that require further attention.

## 2 Developing an institutional structure of agricultural innovation system

It is important to keep in mind that the innovation system is a ‘soft’ system, an analytical construct that does not physically exist. The concept deals with the loose conglomerate of different organizations and actors who work towards a common goal—developing and promoting agricultural innovations. Thus the crucial aspect in the process of institutionalization is to develop an institutional structure that can foster, nurture, promote, and facilitate the innovations within the agricultural sector.

One of the key challenges facing the proponents of the AIS system is that there is no blue print or recipe available to accomplish this task. This is a long term process requiring action on a number of fronts. The following strategic principles could be adopted in creating such a system.

1. Systems development and networking
  - Create relationship (both formal and informal) between the different actors and support knowledge exchange
  - Organize and strengthen private and public demand for innovation services (farmer organizations, and institutions to express social demand)
  - Include and support new service providers outside the public sector—including intermediaries to provide non-marketable services
  - Organize collective supervision and mediation mechanisms (organize ‘countervailing power’ to public organizations; delegate control functions to committees and third sector organizations, improve transparency through information exchange and communication)

2. Introduce new funding mechanisms for publicly subsidized services
  - Clearly define the public functions that remain to be performed
  - Increase control of public resource allocation by technology users and clients (establish customer–contractor relationship)
  - Bind public funding to performance criteria—performance oriented rewards and incentives
  - Introduce competitive elements in service provision and foster private supply of innovation services (encourage user organizations to participate—user controlled innovation projects have a greater probability of success if user groups have to qualify for public support)
  - Support local organizations to formulate and express their demand for technology and services including farmer commissioned innovation projects
3. Organizational capacity development of individual service organizations—Develop the capacity to manage projects, create project-based organizations and decentralize decision-making in R&D organizations
4. Support institutions which promote communication and public debate on agricultural problems and thus help to identify the guidance and social control of public R&D institutions
5. Foster capacity to manage and account for external funds with a greater degree of accountability and impact orientation.

This type of a system pre-supposes a demand–supply relationship between users of services and service providers—a switch from a hierarchal model to a more market-like mode of co-operation, re-directing the incentives for R&D services. Here the centralized R&D bureaucracies are to be replaced by a self-responsive system. This institutional change is gradual, takes time to develop, thus calling for long term commitment.

### 3 Implications and challenges

Embracing the AIS concept in agricultural research and development processes offers a number of opportunities as well as challenges. This chapter by no means is attempting to provide answers to these challenges. The idea here is to raise these issues so that collectively the practitioners can find empirical solutions to these problems. Therefore, in this section of the manual an attempt is made to identify the key challenges, so that we could simultaneously address them while continuing R&D activities that generate socially beneficial innovations.

- The first key challenge is how to develop a productive and sustainable institutional arrangement for AIS. Criteria for sustainable innovation systems include growing inter-relationships between participants in the innovation system, an intensive communication between all stakeholders, and a political and economic context favouring the agricultural innovation process. The term institutional arrangement in this context describes the mechanisms by which the various actors co-operate to promote technical progress in agriculture. What are the preconditions needed to achieve this? How do we institutionalize the AIS thinking? How do we facilitate the creation of learning institutions?
- The second key issue or challenge is creating the capacity for innovation. The capacity for innovation occurs along one or more of four trajectories. These are product innovation, process innovation, institutional/organizational innovation, and service delivery innovation. The notion of capacity building in a system sense entails ‘building up of collective capacity of networks or systems of actors interactively linked with a view to innovate’. This contrasts with the conventional

thinking in which capacity development is often understood as the 'building up stocks of research infrastructure and trained scientists'. Therefore, a shift from a conventional to a systems conceptualization of capacity building requires a reorientation in our thinking. Stimulating changes in behaviour of the system and the institutions that govern the system must become the primary objective of capacity strengthening (Oyeyinka 2005).

- How to assess successful partnerships, networks, and innovations? How to reward and provide incentives for the various partners in an innovation system? How do we demonstrate the utility and added value of this approach?
- How do we scale up the capacity to innovate? Both aspects, the scaling up of innovations as well as scaling up the capacity to innovate are equally important and deserve attention.
- While promoting innovation and institutional arrangements that promote innovation, how to ensure that due attention is given to factors such as socio-economic equity and environmental sustainability while also generating new wealth and opportunities? What types of innovations will address poverty and how to facilitate the pro-poor innovation processes?
- How can we better understand the factors that contribute to successful and sustainable innovations? What are the central concepts, methodologies, and principles that contribute to the institutional and organizational transformation needed to promote successful innovations?

## Note

Innovation is an essential ingredient to success in agricultural R&D. Every organization/stakeholder group innovates to some degree. For some, innovation takes the form of creative and successful new products; others rely on innovative solutions for achieving cost reduction and higher quality service; and some others see innovation as a source of competitive advantage to secure greater market. The key challenge to R&D managers is to learn how to identify/generate commercially relevant innovation and how to achieve it consistently.

Because of the greater emphasis on the broader developmental goal, the R&D strategies have shifted during the past decades from NARIs to NARS to AKIS and more recently to AIS. This change in thinking recognizes that innovation takes place throughout the whole economy and not all innovations have their origin in formal R&D, nor are all exclusively technical. The new perspective places more emphasis on the role of farmers, input suppliers, transporters, processors, and markets in the innovation process. These developments clearly demonstrate that there is no uniquely best system to analyse all situations. The goal is to find the most appropriate system for the situation one will face; find the one that will evolve with the situation and put in place the process that allow it to learn and effect the future (van der Heijden 1966; Elliot 2004).

The innovation system idea does not provide one generic institutional model for innovation. There is no uniform theory of innovation. Instead of postulating a defined role for different actors, it becomes necessary to assess actual condition of each case and look who among several partners may take over one or more of these functions. In this perspective, the different functions from funding to research to technology dissemination and technology adoption are still performed but who performs them and how is not pre-determined. Therefore, the concept of innovation is empirical. One has to observe, who is interested in a particular innovation, who participates in developing it and which rules and regulatory mechanisms are operating.

Institutionalizing such a perspective in the agricultural R&D system offers both opportunities and challenges. Developing, nurturing and managing a productive and sustainable organizational arrangements and mechanisms and, modalities of operation takes time and long term commitment by all actors involved.

The strength of an innovation system depends on the strengths of its components and the management of its linkages. Developing a clear understanding of the historical, political and institutional dimensions of the system and its components is crucial to draft national policies that not only help build capacity in individual R&D actors, but also create incentives and support mechanisms for institutional learning and partnerships that will improve the systems performance.

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## Exercise 9 Institutionalizing innovation systems perspective

1. Form four groups of participants, each group elects a rapporteur (5 minutes)



### Phase 1. Group work (110 minutes)

2. Each group works on the following questions:
  - Based on what you have learned during this session, list actions that you would undertake to effectively integrate innovation systems concepts and principles in research and education in your organization.
  - What kind of challenges do you anticipate?
  - Suggest possible ways of addressing these challenges.
3. The rapporteurs compile the groups' inputs on the worksheet provided.
4. The rapporteurs write the results on flipcharts and prepare to present their group's results (5 minutes)

### Phase 2. Reporting and discussion (50 minutes)

5. The rapporteurs present the results to the audience. About 10 minutes are given for each presentation. After each presentation, the trainer invites the audience to have discussion (40 minutes)
6. The trainer invites the participants to an overall discussion and to share lessons learned during this exercise (5 minutes)
7. Finally, the trainer provides feedback on the content and process of this exercise and closes the session (5 minutes).

## Exercise 9 Worksheet

### Group A

Based on what you have learned during this session, list actions that you would undertake to effectively integrate innovation systems concepts and principles in research and education in your organization.

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What kind of challenges do you anticipate?

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Suggest possible ways of addressing these challenges.

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### Group B

What kind of challenges do you expect to face if you were to initiate institutionalization of ISP in your organization. What could be done to address these challenges? List some recommendations.

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## Glossary of terms

- **Absorptive capacity:** is a limit to the rate or quality of scientific or technological information that a firm/individual/household organization can absorb (Cohen and Leuenthal 1990). Four distinct dimensions of absorptive capacity are: acquisition, assimilation, transformation and exploitation (Zahra and George 2002). Recently absorptive capacity has been adopted to describe the ability of developing countries to effectively utilize the increasing aid flows.
- **Actors:** The term actors refer to an individual person or to a group, organization or network. All interact, taking and implementing decisions on the basis of their own perceptions, interests, agendas, understandings and the opportunities that they are able to see.
- **Adaptive research:** is a research initiative aimed at adjusting technology to specific environments and circumstances. Often results in recommendations to specific target population.
- **Agricultural innovation:** Agricultural innovation is a socially constructed process. Innovation is the result of the interaction of a multitude of agents and stakeholders. If agricultural research and extension are important to agricultural innovation, so are markets, systems of government, social norms, and, in general, a host of factors that create the incentives for a farmer to decide to change the way in which he or she works, and that reward or frustrate his or her decision.
- **Agricultural technology:** is defined as any policy or behavioral change (interaction) that increases the efficiency (reduces cost) in any activity (product as well as process) of the system through which agricultural commodities are produced and flow to final consumers.
- **Applied research:** is problem focused research and aims to create new technology for commercial application.
- **Basic research:** refers to those research activities aimed to generate new knowledge with no attention to immediate commercial application.
- **Benefit–cost analysis:** studies the relationships between costs and outcomes of any project or investment, usually expressed in monetary terms.
- **Benefit–cost ratio:** is the total discounted benefits divided by the total discounted costs.
- **Capacity building:** United Nations Development Programme defines capacity as ‘the process by which individuals, organizations, and societies develop abilities to perform functions, solve problems, and set and achieve goals premised on ownership, choice, and self-esteem.’ Capacity building is the ‘sustainable creation, retention, and utilization of capacity in order to reduce poverty, enhance self-reliance, and improve people’s lives.’ (Whyte 2004).
- **Case study:** is a detailed study of a small number of units aimed at a deep understanding of complicated relationships rather than at making inferences about an entire population.
- **Check list:** a set of questions or points that can be used to guide an interview/survey/evaluation.
- **Clients:** are the intended users of agricultural research products—generally include farmers, agribusiness entrepreneurs, policymakers, extensionists and consumers.
- **Coalition:** It is the process in which distinct/independent entities/institutions/partners work together for the common goal with synergistic effort. This approach tries to make all the stakeholders as partners right from the stage of objectives formulation.
- **Communication:** A process that may take place when people or group of people exchange information.
- **Configuration:** A particular arrangement of actors. An innovation configuration appears when actors work together to achieve innovation.
- **Decision tree:** a method to describe graphically a series of decision points at which one of two or more alternatives has to be chosen.

- **Demand driven research:** is one where the users of the research product help to determine the research agenda and process.
- **Diffusion:** is the way innovation spreads through market or non-market channels from the very first implementation to the application by different consumers, countries, regions, sectors, markets, and firms. Without diffusion, an innovation has no economic impact (OECD 2005).
- **Disembodied technology:** is one where the new technology is not incorporated in any one of the factors of production. It is not possible to discriminate between the consumers. The innovators under-produce knowledge because he/she cannot appropriate all the returns for it.
- **Embodied technology:** is one where the new technology is embedded or incorporated in one of the factors of production/input. When knowledge is embedded in a factor of production or input, the contribution made by each user will depend on the intensity of use.
- **Environmental Impact Assessment (EIA):** is an activity designed to identify and predict the impact of an action on the bio-geophysical environment, on a person's health and well being, and to interpret and communicate information about the impacts.
- **Equity:** equity can be understood as fairness, the standard by which each person and group is able to maximize the development of their latent capacities. Equity differs from absolute equality in that it does not dictate that all be treated in exactly the same way. Equity is the standard by which policy and resource commitment decisions should be made. Justice is the vehicle through which equity is applied, its practical expression.
- **Evaluation/assessment:** is judging, appraising, or determining the worth, value or quality of research—whether it is proposed, on-going, or completed. Research is evaluated in terms of effectiveness, relevance, quality, efficiency and impact.
- **Evaluation research:** is the systematic application of social research procedures in assessing the conceptualization and design, implementation, and utility of social intervention programs.
- **Farm system:** Each individual farm has its own specific characteristics arising from variations in resource endowments and family circumstances. The household, its resources, and the resource flows and interactions at this individual farm level are together referred to as a farm system. The biophysical, socio-economic and human elements of a farm are interdependent, and thus farms can be analysed as systems from various points of view.
- **Farmer innovators:** Farmers/land users, who innovate, test and try new methods of conservation or production, on their own initiative, often using ideas from various sources. Innovators tend to be curious, creative, proud of their innovations, willing to take risks and are skilful in blending their own ideas with ideas picked up elsewhere (Critchley et al. 1999).
- **Farming system:** a farming system is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Depending on the scale of analysis, a farming system can encompass a few dozen or many millions of households.
- **Farming systems approach:** is an approach to the study of farm problems in which the farm; other household activities and wider units such as communities and villages are seen as interdependent systems. The problems of the farm/farmer cannot be understood or solved by looking at single elements alone. Deals with a sequential, farmer participatory approach to generate, evaluate and disseminate agricultural technology.
- **Food security:** food security exists when all people of a given spatial unit, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life, and that is obtained in a socially acceptable and ecologically sustainable manner.

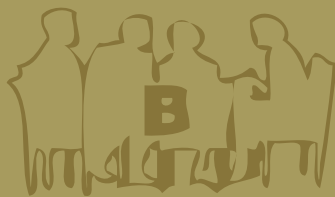
- **Gender:** Gender refers to the social roles of women and men (and not to biological sex). Female and male roles are strongly determined by the social, political, cultural and economic organization of a society and by the respective prevailing legal and ethnic-religious norms and values.
- **Hard system:** These are physical entities—one could touch, feel, dismantle, reassemble, modify, and improve.
- **Indicator:** Information based on measured data used to represent a particular attribute, characteristic, or property of a system.
- **Information:** The explicit part of the knowledge, which can be exchanged among people.
- **Innovation:** an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practice, workplace organization or external innovation. A common feature of an innovation is that it must have been implemented.
- **Innovation activities:** innovation activities include all scientific, technological, organizational, financial, and commercial steps which actually lead or are intended to lead to the implementation of innovations.
- **Innovation capacity:** is the context specific range of skills, actors, practices, routines, institutions and policies needed to put knowledge into productive use in response to an evolving set of challenges, opportunities and technical and institutional contexts (Hall and Dijkman 2006).
- **Innovation or R&D intensity:** is the ratio between innovation expenditure (R&D expenditure) and turnover.
- **Innovativeness:** A social competence. A collective capacity to learn, to generate, identify, obtain, develop and put to use technologies that are appropriate to specific conditions and societal objectives.
- **Institutions:** institutions are the 'rules of the game', which prohibit, permit, or require certain actions. Whether formal or informal, they are recognized and generally followed by members of the community and therefore, impose constraints on the action of the individual members of a community/organization. Whenever there is an observable pattern of people's behaviour, then there is usually an institution underlying it.
- **Institutional impact:** refers to the effects of R&D technology on the capacity of research, extension, and other complimentary programs to generate and disseminate new technology.
- **Interdisciplinary research:** Organizations that bring together the humanities, physical sciences and social sciences to develop and enhance a broad understanding of particular populations, cultures or other related areas of research.
- **Interest group:** organization of people who share political, social or other goals; and agree to try to influence public policy to achieve those goals.
- **Interface:** A shared boundary between actors where interactions may occur.
- **Invention:** Invention is a solution to a problem. It can be a technology or knowledge.
- **Key informant:** an individual who is accessible, willing to talk, and knowledgeable about some aspect of local circumstances.
- **Knowledge:** The set of concepts, meanings, skills and routines developed over time by individuals or groups as they process information. Actors generate, transform, integrate, exchange, disseminate and utilize knowledge while going about their daily business.
- **Knowledge management:** knowledge management involves activities relating to the acquisition, use and sharing of knowledge by the organization.
- **Learning:** A complex activity that manifests itself in a relatively stable change in behaviours of a person or a group of persons.

- **Linkage mechanism:** Organizational arrangements that help to link up the parts/actors of the system.
- **Linkages:** Connection between actors that allows the exchange of resources such as information, money, labour and other material and immaterial assets such as power, status or good will. Studying linkages show how actors are connected to each other, how actors communicate and work together, and which actors and relationships are most important to the functioning of the system.
- **Livelihood:** a livelihood comprises people, their capabilities and their means of living, including food, income, and assets. Tangible assets are resources and stores, and intangible assets are claims and access. A livelihood is environmentally sustainable when it maintains or enhances the local and global assets in which livelihoods depend, and has net beneficial effects on other livelihoods. A livelihood is socially sustainable when it can cope with and recover from stress and shocks, and provide for future generations.
- **Livelihood system:** can be defined as the system within which one makes a living and might be classified as farming, pastoral, fishing or a mixture of these. Within a livelihood system is found a wide array of production and income earning activities.
- **Local knowledge:** local knowledge in development contexts related to any knowledge held by non-scientific communities, informing interpretation of the world. It may encompass any domain in development, particularly that pertaining to natural resource management. It is conditioned by socio-cultural tradition, being culturally relative understanding inculcated into individuals from birth, structuring how they interface with their environment.
- **Marketing innovation:** a marketing innovation is the implementation of a new marketing method involving significant changes in product design, or packaging, delivery channel, product placement, product promotion or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product on the market, with the objective of increasing the firm's sales.
- **Monitoring:** is the continuous assessment measured by the functioning of the project activities in the context of implementation schedules, and of the use of project inputs by the targeted population in the context of design expectations. Monitoring includes periodic recording, analysis and reporting, and storage of data on key research indicators.
- **Multistakeholder processes:** describe processes which aim to bring together all major stakeholders in a new form of communication, decision-finding (and possibly decision-making) on particular issues. They are also based on recognition of the importance of achieving equity and accountability in communication between stakeholders, involving equitable representation of three or more stakeholder groups and their views.
- **Multidisciplinary research:** research based on a combination of several scientific disciplines, without implying that continual interaction and negotiation between these disciplines is necessary (as opposed to interdisciplinary research).
- **National Innovation System (NIS):** Freeman (1987) defined NIS as 'the network of institutions in the public and private sectors, whose activities and interactions, initiate, import, modify and diffuse new technologies'.
- **Norms:** a norm in the generic sense (i.e. encompassing all the various types of norms) involves: (1) a collective evaluation of behaviour in terms of what it ought to be; (2) a collective expectation as to what behaviour will be; and/or (3) a particular reactions to behaviour, including attempts to apply sanctions or otherwise induce a particular kind of conduct.

- **On-farm research:** used variously to refer to on-farm trials or more generally to research involving some degree of farmer participation.
- **Organizations:** Organizations are collectivities oriented to the pursuit of relatively specific goals exhibiting highly formalized social structures. They are conceived as entities created by individuals to support the collaborative pursuit of specified goals. Formal organization is that kind of cooperation that is conscious, deliberate, and purposeful (Barnard 1938).
- **Organizational innovation:** an organizational innovation is the implementation of a new organizational method in the firm's business practices, workplace organization or external relations. Organizational innovations are aimed at reducing administrative costs or transaction costs, improving workplace satisfaction, gaining access to non-tradable assets or reducing costs or supplies.
- **Panel data:** this is the case where a given sample of units is surveyed more frequently and in every subsequent survey using the same set of questions. Panel data provides the opportunity to follow the development over time.
- **Participatory evaluation:** is evaluation that involves those being evaluated as well as clients and stakeholders in the evaluation process.
- **Participatory development:** is a process that involves people (population groups, organizations, associations, political parties) actively and significantly in all decisions affecting their lives.
- **Poverty:** the most commonly used way to measure poverty is based on incomes. A person is considered poor if his or her income level falls below some minimum level necessary to meet basic needs. This minimum level is usually called the 'poverty line'. What is necessary to satisfy basic needs varies across time and societies. Therefore, poverty lines vary in time and place, and each country uses lines which are appropriate to its level of development, societal norms and values.
- **Priority setting:** is deciding on the relative importance of an activity or project, usually in terms of their expected contributions to organizational or development goals.
- **Process:** A series of steps and interrelated work activities, characterized by specific inputs, and tasks which add value, and make up a procedure for a set of specific outputs.
- **Process innovation:** a process innovation is the implementation of new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software. Process innovation can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.
- **Process mapping:** A process map is a type of flow chart, which provides an illustrated description of how things get done. It enables participants to visualize an entire process and identify areas of strength and weaknesses.
- **Product innovation:** a product innovation is the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses.
- **Production:** production is the same as output. It is a physical produce and can be reported in units of volume or weight. For instance, cereal production would be reported in tonnes.
- **Production technology:** broadly refers to all methods that farmers, market agents and consumers use to cultivate, harvest, store, process, handle, transport and prepare food crops, cash crops, livestock etc. for consumption.
- **Productivity:** is defined as output per unit of input, where 'input' can be land, labour and/or capital, and 'output' is agricultural produce. The importance of productivity, however precisely defined, is that it gives a measure for efficiency. It tells us in one figure how much input was used to produce a unit of output.

- **R&D technology:** refers to organizational strategies and methods used by research and extension program in conducting their work including scientific procedures, organizational modes, institutional strategies, interdisciplinary team research etc.
- **Research partnership:** inter-institutional or interpersonal collaborative alliance in a research program involving international and multicultural partners, and guided by a set of 11 principles: (1) decide on the objectives together, (2) build mutual trust, (3) share information and develop networks, (4) share responsibility, (5) create transparency, (6) monitor and evaluate the collaboration, (7) disseminate the results, (8) apply the results, (9) share profits equitably, (10) increase research capacity and (11) build on the achievements.
- **Response capacity** consists of a network of actors interacting and taking action to deal with various challenges and opportunities.
- **Scaling-out:** deals with horizontal expansion such as quantitative expansion, increased geographic coverage, doing 'more of the same', repeating a success case in other places so that the methodology attains a regional or national significance.
- **Scaling-up:** deals with changes in institutional arrangements and policies to encourage use of new approaches. It is a vertical expansion which is a function of time, system, quality, institutional changes, linkages and resources.
- **Science and technology:** science, technology, and innovation include all forms of useful knowledge (codified and tacit) derived from diverse branches of learning and practice, ranging from basic scientific research to engineering to traditional knowledge. It also includes the policies used to promote scientific advance, technology development, and the commercialization of products, as well as the associated institutional innovations. Science refers to both basic and applied sciences. Technology refers to the application of science, engineering, and other fields, such as medicine. Innovation includes all of the processes, including business activities that bring a technology to market.
- **Soft system:** a 'soft' system is an analytical construct/concept that we use to describe a loose conglomerate of different agencies that perform a similar task or work towards a common goal. It is not a real entity and does not physically exist.
- **Stakeholders:** Actors whose interests are affected by a particular area of human activity, whether as victims or beneficiaries. Stakeholders may be individual, organizations, legal entities etc.
- **Strategic research:** is a course of action chosen to reach a long-term vision or goal.
- **Sustainability:** a character or state whereby the needs of the present and local population can be met without compromising the ability of future generations or populations in other locations to meet their needs.
- **Sustainable development:** development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- **Sustainable land management:** this is a system of technologies and/or planning that aims to integrate ecological with socio-economic and political principles in the management of land for agricultural and other purposes to achieve intra- and inter-generational equity.
- **Sustainable technology:** is one which will continue to contribute to economic growth over time, and does not deplete the natural resource base.
- **Sustainable use of natural resources:** natural resource use is sustainable if specific types of use in a particular ecosystem are considered reasonable in the light of both the internal and the external perspective on natural resources. 'Reasonable' in this context means that all actors agree that resource use fulfils productive, physical, and cultural functions in ways that will meet the long-term need of the population affected.

- **Synergy:** An effect arising from the co-operative activity of two agents that, when working together produce a combined result greater than either one could have achieved alone. Each actor achieves more than what they can achieve alone.
- **System:** the term system refers to a collection of related elements that must function in concert to achieve a desired result. A system consists of interlinked subsystems, and the central feature is its integrity. A system also contains one or more feedback loops which are central to the system behaviour. Interrelated parts drive systems and the feedback loops are circular rather than linear in nature.
- **Technology:** is the ensemble of artefacts intended to function as relatively efficient means. Technology is also defined as the sum of knowledge—of received information—which allows things to be done differently.
- **Technology spill-over:** refers to the spill-over of technology from one country to another, or from one environment to another.
- **Well-being:** a context and situation dependent state, comprising basic material for a good life, freedom and choice, health, good social relations, and security.



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