Extension NEXT

Bulletin No. 2, June, 2017

Agricultural Innovation Systems:

Fostering Convergence for Extension

Published by

National Institute of Agricultural Extension Management (MANAGE)
(An Organization of Ministry of Agriculture and Farmers Welfare, Govt. of India)
MANAGE-Centre for Agricultural Extension Innovations, Reforms and Agripreneurship (CAEIRA)
Rajendranagar, Hyderabad – 500 030, Telangana State, India

About the Publication

This occasional bulletin is aimed at imparting better understanding about recent developments in agricultural extension. It also intends to develop basic understanding about the role of extension in agricultural and allied sectors and start a dialogue on how to make extension efforts to contribute for better impact. Each issue of the bulletin will take up a single topic and discuss merits and implications. The target audience for the bulletin are extensionists, extension managers and administrators, extension students, policy makers, and agricultural practitioners.

Authors

Dr. Saravanan Raj
Director (Agricultural Extension)
National Institute of Agricultural Extension Management (MANAGE)
Rajendranagar, Hyderabad, Telangana, India
e-mail: saravanan.raj@manage.gov.in/ saravananraj@hotmail.com

Dr. Suchiradipta Bhattacharjee
MANAGE Fellow, Centre for Agricultural Extension Innovations and Reforms
National Institute of Agricultural Extension Management (MANAGE)
Rajendranagar, Hyderabad, Telangana, India
e-mail: suchiradipta.b@manage.gov.in/ suchiradipta@hotmail.com

Content Reviewer

Dr. Rasheed Sulaiman V
Director
Centre for Research on Innovation and Science Policy (CRISP)
Road No 10, Banjara Hills, Hyderabad-500 034, Telangana, India

Language Editing

Ms. Rajani Kumar

Layout Design

Ms. Niharika Lenka

Disclaimer

Correct citation: Saravanan, R. and Suchiradipta, B. 2017. Agricultural Innovation Systems: Fostering Convergence for Extension. MANAGE Bulletin 2 (2017), National Institute of Agricultural Extension Management, Hyderabad, India.

Message from Director General, MANAGE

Smt. V. Usha Rani, IAS
Director General, MANAGE

Agriculture sector involves number of players – the universities into education and research, State and Central Government in extension, the ICAR system with core research, the KVKs delivering knowledge at field and the NGOs implementing programs for farmers. Agricultural Extension System no longer means delivery of new technology to farmers, but it has much more responsibility. Extension education should talk about Climate Change, Conservation of National Resources, Protection of Environment, new technologies for better yields, value addition, Supply Chain Management, safe food to consumers and so on. Extension has to link farmer and consumers and also take care of interest of both. Given the complexity of requirements of farmers like Weather Forecast Information, Technologies for Soil and Water Management, Farm Credit, Insurance, markets, various organisations working for farmers including private players should work with synergy in effective innovation systems.

ATMA model in India was developed to synergise multiple stakeholders to work together in a complementary fashion. While it has the potential to set exemplary evidences in Agricultural Innovation Systems context, it still has a long way to go to fulfill the goals.

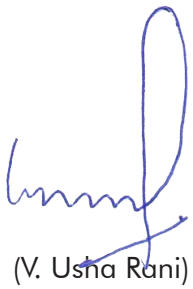
The anomalies like not making locally cultivated crops like millets as a part of food distribution system, criss-cross movements of food grain as a part of public distribution system ignoring locally grown crops thus denying local markets for the farmers still remain unaddressed. Similarly, many nutrition programs implemented by Women and Child Department do not take locally grown crops or local food into consideration in procurement. Very often, food given in Anganwadi Center is procured centrally at State level. There

is disconnect between farmers and local population. Contrary, if the programs are redesigned to take decisions in decentralized manner, local markets for farmers can emerge. Safe and healthy food is also available for local population. This kind of policy and stakeholder integration can happen though proper facilitation in the Agricultural Innovation Systems context.

Agricultural Innovation Systems brings high focus to policy structure as well, thus ensuring positive administrative systems that facilitates network of actors empowering farmers and integrating them with consumers under local market conditions.

Good Agriculture practices, enriched soils with organic matter, availability of water on sustainable basis, skilled farmers to adapt changes and profits at farm levels are indicators for success of extension systems. This can be achieved definitely with Agricultural Innovation Systems (AIS) where in there is eco-system to learn from each other, to respect others view points and to work in team and share the knowledge.

I am happy our "MANAGE" has brought out "Extension NEXT" on Agricultural Innovation Systems with some ideas on how minds of extension personnel can be opened up and how we can go beyond technology transfer for better society where farmers, children and all other are safe, comfortable and happy.



(V. Usha Rani)

Agricultural Innovation Systems:
Fostering Convergence for Extension

Authors' Note

Dr. Saravanan Raj
Director (Agricultural extension)

Agricultural innovation systems approach is essential in the present challenging and complex nature of agriculture with the increased institutional pluralism in agricultural extension and advisory service delivery. Well co-ordinated, mutually beneficial collaboration among them can bring together ideas, knowledge as well as better organizational culture and resources to work for the betterment of farmers. Multi-stakeholder partnerships and innovations are the pathways for future agricultural extension and advisory services to reach needy farmers and others.

Collaboration and coordination is as hard in practice as easy it sounds in theory. Especially in the agriculture sector, where actors are many and roles are fluid, this becomes more important to achieve keeping in mind the dynamic sets of objectives and interests of the stakeholders. Agricultural Innovation Systems concept delves exactly into that providing a road map of how to identify different actors, what roles and functions they can take up, and how to effectively work together for the greater goal of making smallholders better managers of their farming enterprises and achieving a better future for agriculture

Dr. Suchiradipta Bhattacharjee
MANAGE Fellow

In this issue

Introduction

Agriculture has been one of the key issues in the global development dialogue for a long time now. With a majority of the rural population in developing countries depending wholly or partially on agriculture, the sector is important for development, but the challenges in agriculture are of a wide spectrum – ranging from local infrastructure to global trade. In this situation, the role of Agricultural Extension and Advisory Services (AEAS) is also changing rapidly. AEAS, which started as an agency or organisation to provide technology or advice to the farmers, has come a long way today. It is now a critical component in rural development with the changing dynamics of decreasing political and financial support, consequent downsizing and decentralizing of public extension system, and increased pluralization with private and civil society organisations, and ICT-based services (Sulaiman and Davis, 2012).

Dealing with multiple challenges of the agriculture sector needs involvement of the stakeholders of AEAS as well as research and technology development in a coordinated manner, and more so in countries like India where pluralistic AEAS is very common. The emphasis of AEAS has shifted from technology transfer and advisory to improving the innovation capacity of different stakeholders. The Agricultural Innovation Systems school of thinking that emphasizes learning about how innovation can be scaled up and innovation capacity can be developed among stakeholders. Innovation systems is a framework to better understand the process of knowledge generation, sharing, access and exchange among stakeholders and put them into social and economic use. Innovation in this context can be technological (like ICTs, farm machineries etc.), technical (like adoption of better variety or package of practices), social (like System of Rice Intensification), organisational (like farmer organisations) or institutional (like Agricultural Technology Management Agency in India) and not necessarily driven by research or AEAS alone (Sulaiman, 2015).

With an increased emphasis on convergence, increased innovation capacity, and holistic development in national and international development arena, Agricultural Innovation Systems is gaining ground and needs to be discussed, implemented and worked upon in agriculture and allied sectors. Therefore, this issue of Extension NEXT aims at initiating the dialogue by introducing the concept of AIS and discussing its development throughout the past decades. It also discusses the elements of AIS – a complex system of actors with dynamic roles changing over time and strongly influenced by the spatial pattern of their components; a few cases from across the globe to understand how AIS works and the role extension plays in it; and capacity development in AIS using the common framework for capacity development as it recognizes the diverse actors, rules, and processes pre-existing in a system This issue also serves as an introduction to resource databases on AIS that are suitable for a diverse set of actors in the agricultural development arena and identifies the implications of AIS for extension.

Agricultural Innovation Systems – A theoretical background

The concept of innovation systems has been derived from countries and sectors with a strong record of innovation to explain patterns of past economic performance in developed countries. Its recent application in agricultural sector of developing countries is offering opportunities to understand how new knowledge can be put to better use in this sector. During 1980s and 1990s, research was a major priority with central focus and budgetary allocation favouring setting up of national research institutes. At the international level too programmes funded by the CGIAR, World Bank and USAID (U.S. Agency for International Development) also concentrated on training, infrastructure development and programme formulation within the research systems. In the later part of 1990s, the focus gradually moved from research institutes to more broad-based, pluralistic National Agricultural Research Systems (NARS). But because of selective investment in agricultural research, a majority of the systems were left with limited capacities, sans a few relatively strong NARS (Lynam, 2012).

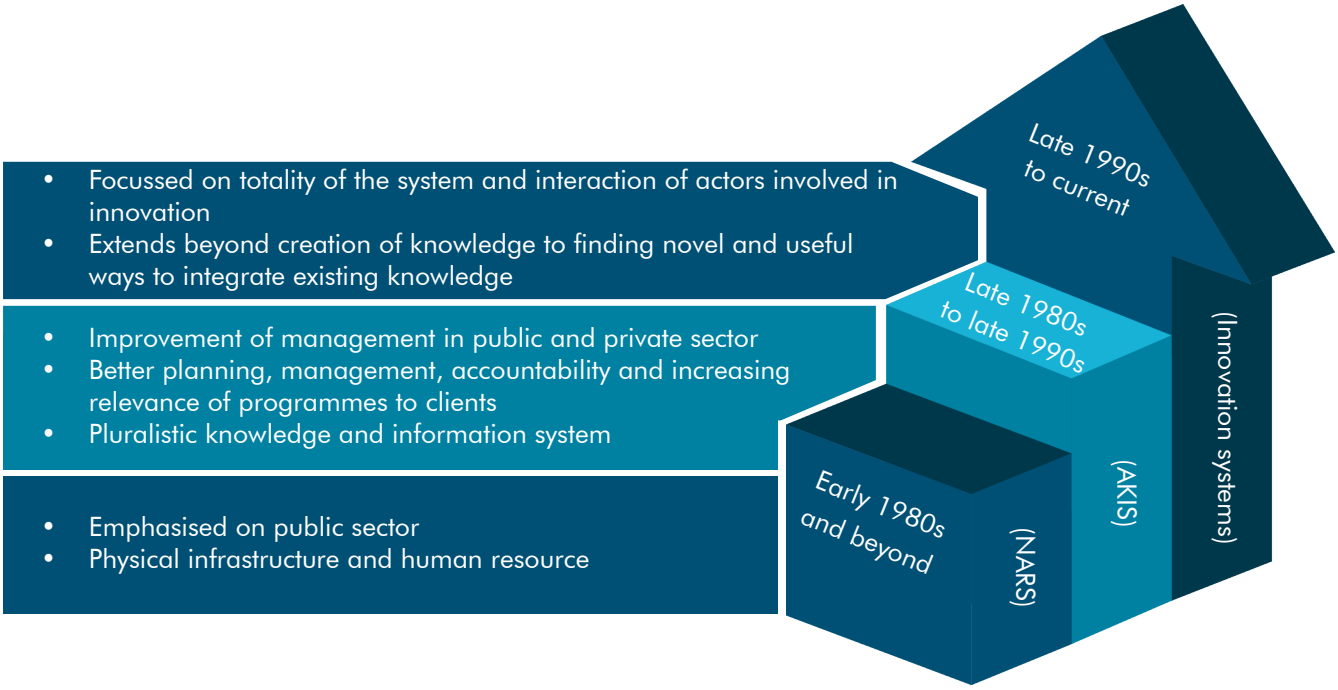


Fig. 1. Evolution of the Innovation Systems concept

Agricultural Knowledge and Information System (AKIS) indicates a system that links people and institutions to promote mutual learning and generate, share, and utilise agriculture-related technology, knowledge and information. The system integrates farmers, agricultural educators, researchers and extensionists to harness knowledge and information from various sources for improved livelihoods. Farmers are at the heart of this knowledge triangle (World Bank, 2012). The main criticism of the approach has been its inability to move beyond the public sector and consider the heterogeneity, institutional contexts and learning behaviors of actors and their surrounding environment. While it viewed agricultural innovation as a one-dimensional, linear circulation-and-adoption process, learning and content creation among multiple stakeholders, networks and reconfiguration of socio-cognitive

elements such as perception, rules, agreements, identities and relationships were mostly ignored (Spielman, 2005; Leeuwis and van den Ban, 2004).

While AKIS focussed on the knowledge and innovation processes in the rural sphere, AIS focussed more on building innovation capacities of stakeholders in a multi-stakeholder process with reduced focus on public research system for knowledge (Assefa et al., 2009). As defined by World Bank (2012), AIS indicates a network of organisations, enterprises and individuals focussed on bringing new products, new processes, and new forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance. Overall, the three systems are interlinked, as 'NARS focusses on the generation of knowledge, AKIS on the generation and diffusion of knowledge, and AIS on the generation, diffusion, and application of knowledge' (Roseboom, 2011).

The concept of innovation dates back to Rogers' definition of innovation as 'an idea, practice or object that is perceived as new by an individual or other unit of adoption' (Rogers, 1962). Later, Gibbons et al. (1994) noted that innovation is a fuzzy concept that requires blurring of boundaries in the production of scientific knowledge. The theory of innovation has now developed into the concept of Innovation Systems. The concept of 'Systems of Innovation' was first given by Lundvall (1985) who again developed the idea from Friedrich List's (1841) 'The National System of Political Economy.' Christopher Freeman in his study of the success of Japanese economy coined the term 'National Innovation Systems' (NIS). Freeman (1987) described NIS as a network of institutions in public and private sector, which initiate, import, modify and diffuse new technologies. Lundvall (1992), Nelson (1993) and Patel and Pavitt (1994) limited it within the boundaries of a nation or state. While Metcalfe (1995) emphasised on the socio-political conditions for contributing to and influencing the innovation process, Hwang and Horowitt (2012) looked at NIS as socio-biological systems of patterns of behaviour to minimise transaction costs caused by social barriers and inefficient social networks. During the last 20 years, the literature on innovation has shifted from national (Lundvall, 1988; Nelson, 1993; Edquist, 1997) to regional (Asheim and Isaksen, 1997) and local (Gottardi, 2000; Garofoli, 2002) dimensions.

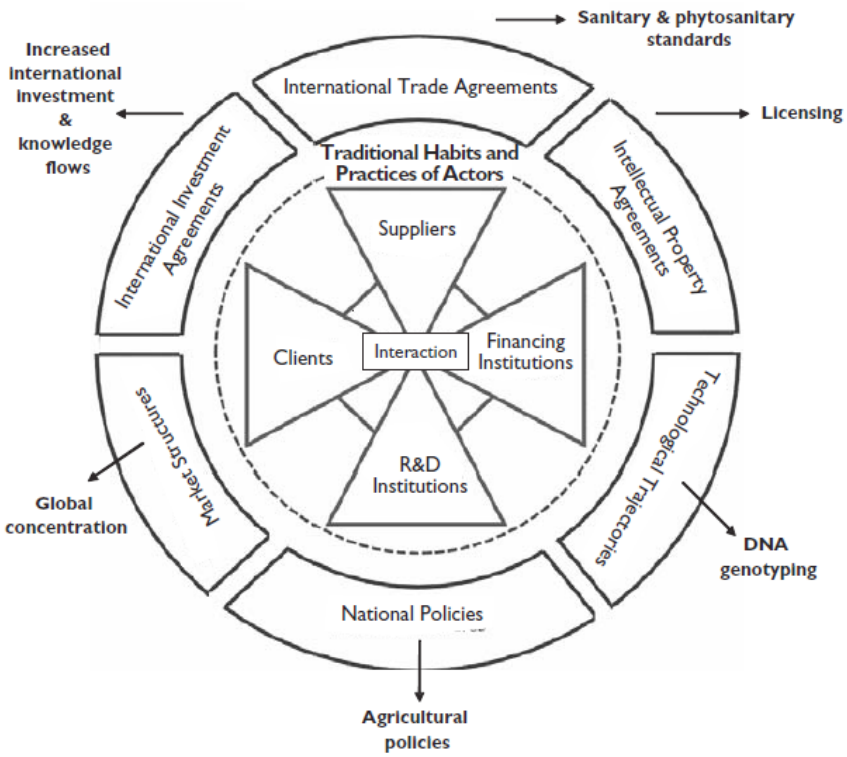


Fig. 2: A stylized innovation system (Source: Mytelka,L. K. 2000. Local systems of innovation in a globalized world economy. Industry and Innovations, Vol. 7, No. 1)

Innovation is an idea, practice or object that is perceived as new by an individual or other unit of adoption.

Regional Innovation Systems (RIS) are complex systems with strong interaction between several actors systematically engaged in interactive learning, in which regions can play a central role in economic coordination, especially with impact to innovation, evolving into 'a nexus of learning processes' (Cooke and Morgan, 1998; Asheim and Isaksen, 2002). Again, regions have been highly heterogeneous concepts which do not always capture factors like regional culture and identity which are more intensively taken into account by local policies (Autio, 1997; Lagendijk, 2004). According to Belussi (2003), Local Innovation Systems are based on the generation of regionalised learning systems where some local innovation policies are activated to transfer technologies, enforce technological cooperation and provide supports and incentives to innovative networks. Technological Innovation Systems is a concept developed within the concept of Innovation Systems approach focussing on explaining the nature and rate of technological change and can be defined as a set of actors and roles that influence the spread and direction of technological change in a specific technological innovation area (Hekkert et al., 2007). The most important insight developed from all these studies is that innovation is a collective activity. The concept of Innovation Systems stresses that the flow of information and technology among people, enterprise and institution is the key to an innovative process (Heimeriks, 2013) and the success of the system depends, to a large extent, on how the innovation system is built up and how it functions (Suchiradipta and Saravanan, 2014).

Fig. 3: Innovation systems thinking should be adaptive to context and open to a good mix of factors that results into an efficient innovation platform

(Source: Klerkx, L., Van Mierlo, B. C. and Leeuwis, C. (2012). Evolution of systems approaches to agricultural innovation: Concepts, analysis and interventions. DOI: 10.1007/978-94-007-4503-2_20. https://www.researchgate.net/publication/236259274_Evolution_of_systems_approaches_to_agricultural_innovation_Concepts_analysis_and_interventions)

About this publication: The Global Good Practice note on Agricultural Innovation Systems (AIS) gives a brief glance on principles of AIS, its implementation, and strengths and weaknesses. AIS helps consider how capacities are developed for innovation that is not merely technical but organisational and institutional. Neither research knowledge nor extension activities alone drive innovation and so greater emphasis and investment is needed to strengthen capacity to innovate. Central to the process of innovation are the interactions of different actors and their ideas, the institutions that shape how individual and organisations interact, and learning as a means of evolving new arrangements specific to local contexts as innovation requires a combination of technological, organisational, institutional, and policy change.


GFRAS GOOD PRACTICE NOTE FOR EXTENSION AND ADVISORY SERVICES

NOTE 13: Agricultural Innovation Systems

Compiled by: Rasheed Sulaiman V, August 2015

There is plenty of information available in the public domain that covers various aspects of extension and know-how about new methodologies for implementation. However this information is often scattered and presented in complex academic language. Hence practitioners, who often have very limited time and/or may only have basic formal education, find it difficult to make use of this information.

The Global Good Practices Initiative aims to bridge this gap by providing information about extension approaches and methods in easy-to-understand formats. As part of this effort, it makes "Good Practice Notes" available to all at www.betterextension.org. This Note contains one of the extension methods included in this series.

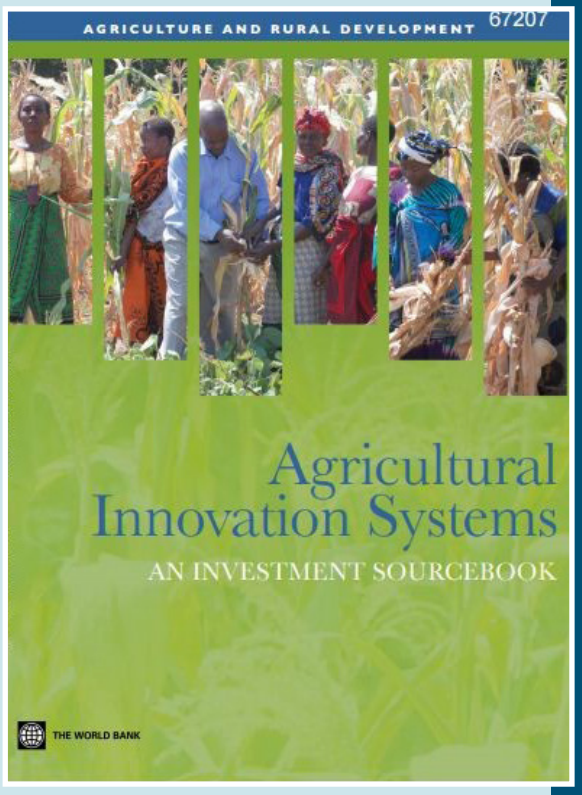
Introduction

Figure 1. The Agricultural Innovation System.

Global Forum for Rural Advisory Services (GFRAS) www.betterextension.org 1

(Source: Sulaiman, R.V. (2015). Agricultural Innovation Systems. Note 13. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS, Lindau, Switzerland. https://www.g-fras.org/en/good-practice-notes/agricultural-innovation-systems.html)

About this publication: The sourcebook draws on emerging principles of AIS analysis and action to help identify, design, and implement the investments approaches and complementary interventions. It also gives insights on how specific approaches and practices can foster innovation in a range of context.



(World Bank. (2012). Agricultural Innovation Systems: An investment sourcebook. World Bank, Washington DC. iteresources.worldbank.org/INTARD/Resources/335807-1330620492317/9780821386842.pdf)

Terminologies and definitions related to AIS

Innovation: An invention that is used for the first time in a product that reaches the market or produces a change in a social process. An innovation that is well known elsewhere may still be regarded as an innovation if it is new locally (World Bank, 2012).

Innovation networks: A diverse group of actors that voluntarily contribute knowledge and other resources (such as money, equipment and land) to jointly develop or improve a social or economic process or product. Innovation networks are a special form of organisation with a nonhierarchical structure, a collaboration-based culture, consensus-based coordination (because members are free to leave the network at any time), usually no legal personality (especially in their early stages), and often relatively fuzzy objectives (such as improving the management of natural resources). They evolve with market opportunities and the technologies they develop. Innovation networks differ from farmer organisations in that farmer organisations have a homogeneous membership and more formal, stable relations. Innovation networks differ from value chains in that the latter are more stable, are focussed on delivering a product or service, and are coordinated by a central actor. Innovation networks are also known as innovation platforms (World Bank, 2012).

Innovation brokers: Teams of specialists that combine a strong background in science with knowledge of business and commercialisation and/or the creation of innovation networks. Innovation brokers are also known as change agents or technology brokers (World Bank, 2012).

Innovation capabilities: The skills to build and integrate internal and external resources to address problems or take advantage of opportunities. Innovation capabilities depend not only on innovative individuals but also on internal features of an organisation, especially incentives, cultures, organisational spaces for experimentation, coordinating structures and collective action (World Bank, 2012).

Agricultural Innovation Systems: A network of organisations, enterprises, and individuals focussed on bringing new products, new processes, and new forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance (World Bank, 2012).

Agricultural Extension and Advisory Services: Services consisting of all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organisational, and management skills and practices so as to improve their livelihoods and well-being. It recognises the diversity of actors in extension and advisory provision (public, private, civil society); much broadened support to rural communities (beyond technology and information sharing) including advice related to farm, organisational and business management; and facilitation and brokerage in rural development and value chains (Sulaiman and Davis, 2012).

Elements of AIS

AIS is a network of organisations of varying dynamics and functions with complex elements that change constantly over time, strongly influenced by the spatial pattern of their components. The concept of innovation systems, with its distinctive functions, reveals the institutional factors that govern the relationship of elements and knowledge production in the system. Innovation Systems has been identified as exogenous and endogenous - the former being controlled by external agencies and the latter by internal agencies. Actors and elements of an innovation system interact in the production,

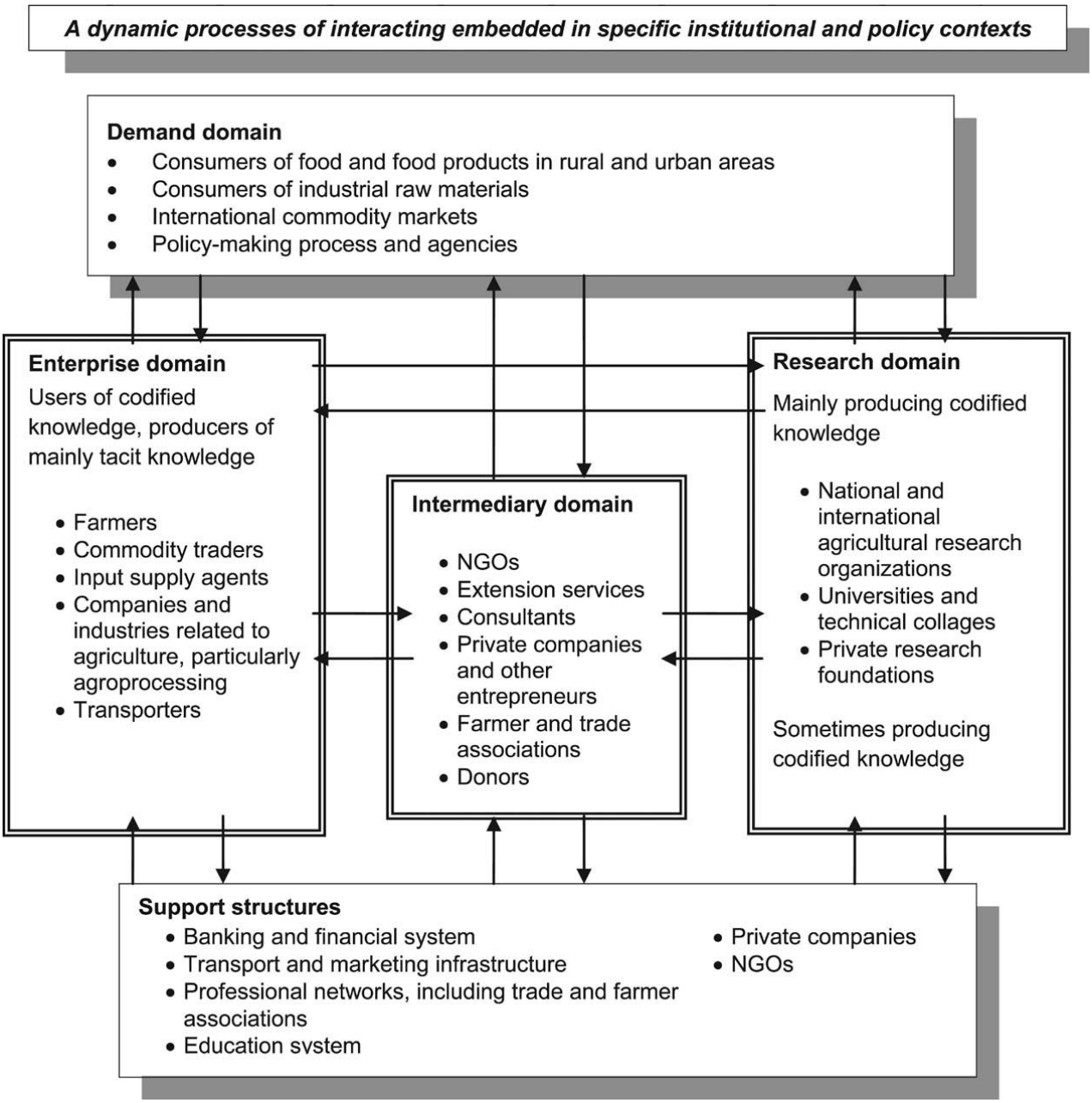


Fig. 4: Elements of Agricultural Innovation Systems (Source: Arnold, E., and Bell, M. (2001). Some new ideas about research for development. In: Partnership at the leading edge: A Danish vision for knowledge, research and development. Danish Ministry of Foreign Affairs: Copenhagen, Denmark)

diffusion and use of economically useful knowledge in an innovation system. Various researchers have identified different elements of AIS – Hall et al. (2006) identified innovation systems as a network of organisations and actors, together with institutions and policies that affect their behaviour and performance. Hekkert et al. (2007) identified them in terms of the activities performed, such as knowledge development, knowledge diffusion through networks, guidance of the search, market information, resource mobilisation, entrepreneurial activities, and counteracting resistance to change. Assefa et al. (2008) identified the endogenous and exogenous innovation systems where the internal and external actors and institutions respectively influence the innovation systems. As an intrinsic nature of systems, IS requires to be understood as an entity of interconnected elements as a whole with their distinctive properties which changes constantly depending on the changing roles of the elements (Hall and Clark, 2010).

The distinctive feature of AIS is the involvement of multi-stakeholders at different levels. At the centre of it all are the farmers, fisherfolk, pastoralists and so on who innovate and share innovation, provide demands to AEAS, agricultural research system, and to some extent, agricultural education system, and interact with other stakeholders through exchange of information, inputs/goods and services. Private sector actors (agroprocessors, input dealers, distributors, traders, corporate houses, etc.) mostly innovate and share innovation, assess demand, provide and distribute inputs, purchase, process, trade, and export produce, educate and advise. AEAS, input and service suppliers, financial service suppliers and agricultural research systems have major interactions with the private sector with limited interaction with the agricultural education system. The financial service sector (banks, microfinance institutions, credit agencies, etc.) mostly deals with loan and credit linkage and advise producers and hence, their network is stronger with producer organisations and to some extent with research system and advisory service providers. Producer organisations form a strong network in AIS with AEAS, input and service suppliers, financial service suppliers, private sector actors, agricultural research system to innovate and share innovations, provide demands to AEAS, agricultural research and education systems. Major roles of the Agricultural Research Systems in AIS are to innovate and share innovations, assess demand, conduct and communicate research, advise producers; educate producers, private sector actors, and agricultural advisory services in close collaboration with AEAS and agricultural education system. Agricultural education system (universities, schools, colleges, formal, informal and vocational training institutes, etc.) deals with education, advisory services, and research and their interactions are mostly confined to AEAS and agricultural research systems. Input and service suppliers are mostly involved in provision of goods and services to producers and agricultural advisory provides. AEAS plays important roles like linking producers with other actors in the agricultural innovation system; sharing information; educating producers; brokering; empowering; advisory; innovation, and sharing innovations, and assessing demand. AEAS providers work in close quarters with producer organisations, private sector actors, agricultural research system, and agricultural education system and to a limited extent with input and service suppliers, financial service suppliers. Government policy and regulation frameworks (regulating agencies, lawmakers, Heads of departments, senior managers, ministers, global and regional agencies) form an important part of AIS by regulating and creating standards, policy dialogue and policy making, setting codes and standards within organisations. Consumer demands are also part of AIS as it influences policy and creates demand for products and innovations. In AIS, innovation is driven by neither research nor extension but by a process through which different types of knowledge are combined to address specific issues (Sulaiman, 2015).

Innovation Coproduction Support Initiatives (ICSIs)

Agricultural Innovation Systems is an approach of innovation coproduction where actors along a domain interact, cooperate and coordinate their activities to generate new knowledge, technology and practices for desired change. Co-innovation approaches have been found to be better capable of fostering multiple changes requiring reordering of production systems and value chains compared to more linear approaches. Innovation Coproduction Support Initiatives (ICSIs) are explicit activities in the innovation systems that bring together diverse stakeholders representing different organisations and practices and stimulate their collaboration to co-produce innovation. Major challenges in ICSIs are aligning objectives of different actors involved, creating adequate incentives for linkage and collaboration, and agenda setting for innovation coproduction. With varying challenges of multiple stakeholders, AEAS can play many interesting roles in innovation systems such as: developing a knowledge base for a domain; developing as a support structure; capacity building of other actors; identifying and setting together all the correct actors and facilitating stakeholder networks; establishing a common vision/agenda by conducting joint priority setting exercises; providing farmers/clients with required information and resources; and facilitating farmer networks and stimulating entrepreneurship (Klerkx and Nettle, 2013).

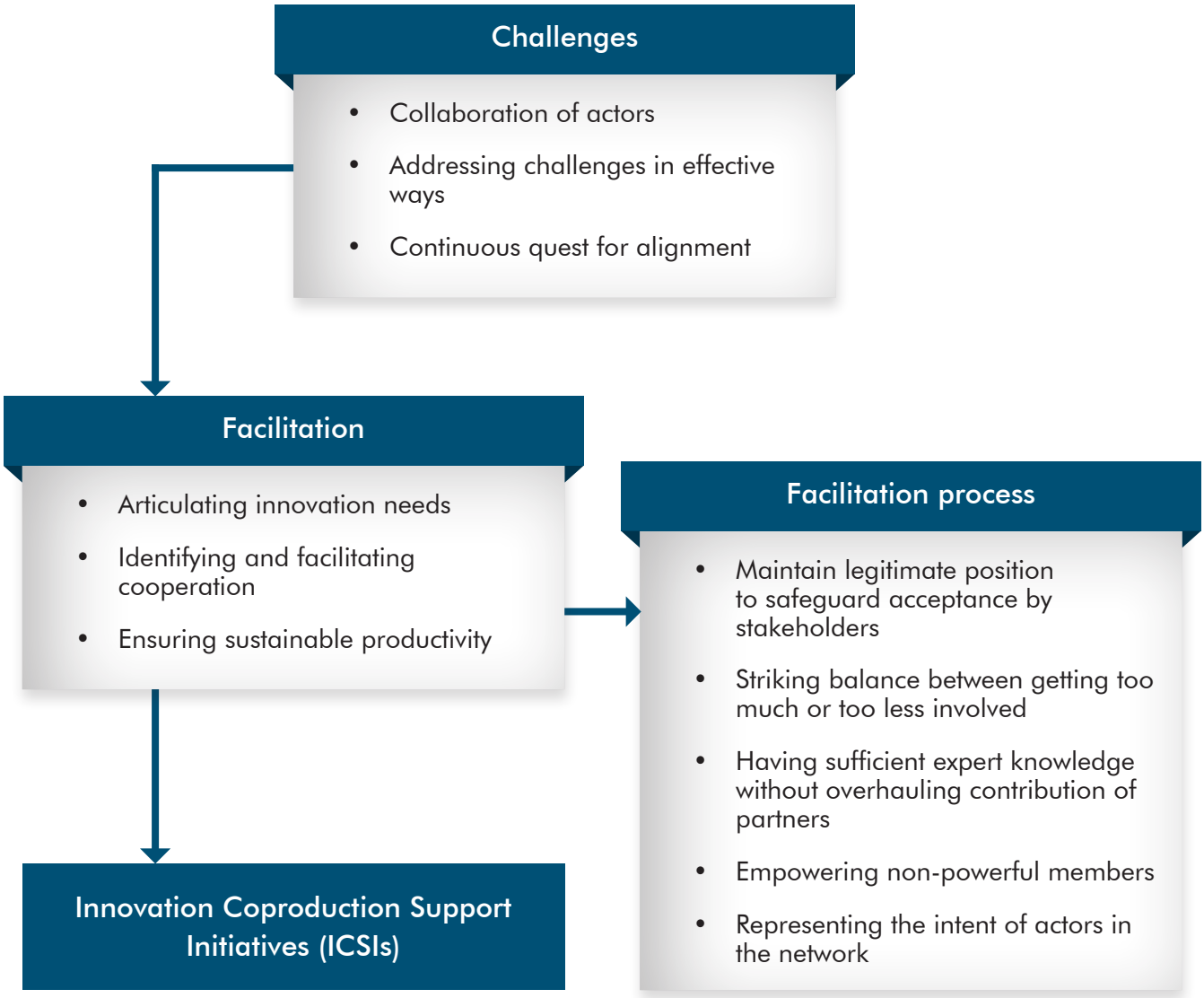


Fig. 5: Innovation Co-production Support System

How AIS works – A few cases

Stimulating effective linkages among heterogeneous actors and eliminating the implementation challenges (aligning different mindsets and interests of different stakeholders, creating adequate incentives for linkage building and collaboration, identifying research areas, extension roles, agenda setting and funding) is the central element of AIS (Klerkx and Leeuwis, 2008, 2009; Klerkx and Nettle, 2013). Innovation coproduction requires facilitation to get the right network of actors together on the right roles, articulation of the vision and the goals that are to be achieved, organising the actors, and make the network function smoothly through negotiation and continuous alignment. The role of innovation brokers get very important in such systems as they play the major role in connecting farmers to different service providers and other actors In the systems. The major functions of the innovation brokers can be analysing the context of the innovation systems and articulating demands, composing networks and facilitating interactions (Klerkx and Gildemacher, 2012).

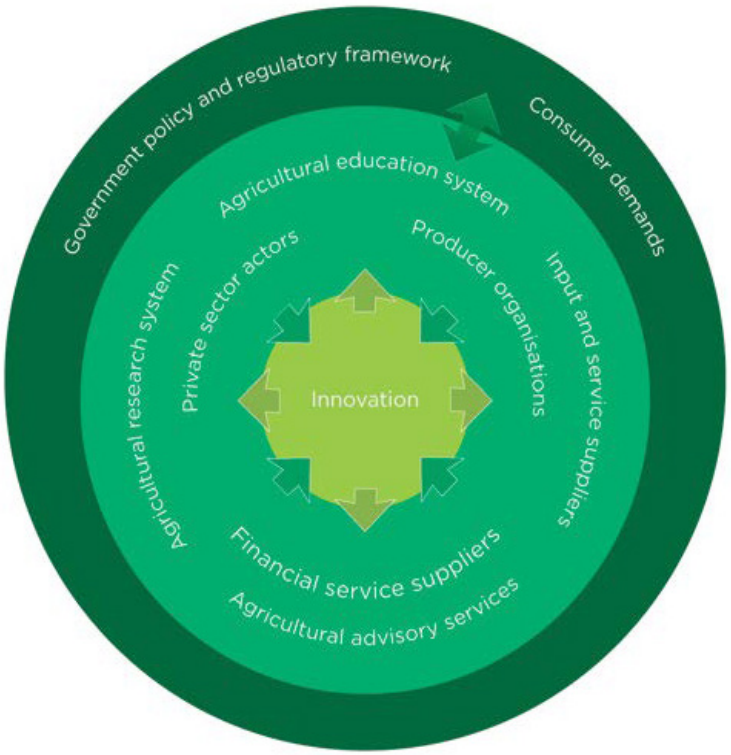
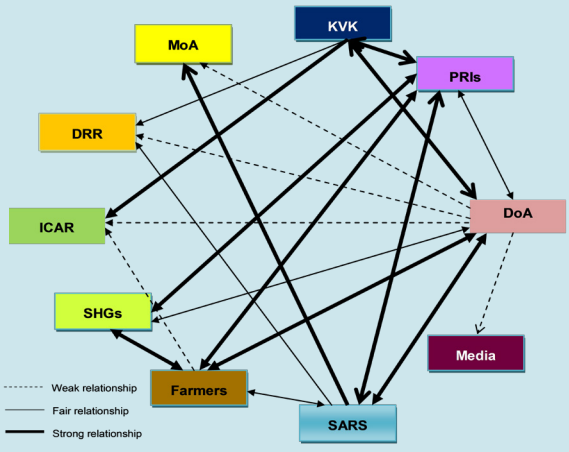


Fig. 6: Agricultural Innovation Systems (Source: Sulaiman, R.V. 2015. Agricultural Innovation Systems. Note 13. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS, Lindau, Switzerland)

Case 1: AIS in SRI in Tripura



SRI (System of Rice Intensification), a social innovation, was a success in increasing income of the farmers and help the state achieve self-sufficiency in rice in Tripura state of India. Multi-stakeholder collaboration in research [with Indian Council of Agricultural Research for North East Hill Region, Tripura Centre (ICAR); Krishi Vigyan Kendras (KVK) and State Agricultural Research Station(SARS)] and extension with high involvement of state extension machinery [Department of Agriculture (DoA)] and grassroots level administrative units (Panchayati Raj Institutions or PRIs) was the major

reason of the success with strategic policy support for encouraging the farmers to take up SRI method of rice cultivation, increasing their social and economic status.

(MoA: Ministry of Agriculture, DRR: Directorate of Rice Research, SHGs: Self Help Groups, SARS: State Agricultural Research Station) (Suchiradipta and Saravanan, 2014 a, b)

Case 2: Fodder Innovation Project "Enhancing livelihood of poor livestock keepers through increasing use of fodder"

Implemented by International Livestock Research Institute (ILRI) and funded by Department of International Development (DFID), with major partners like UNI-MERIT, CRISP, IITA, and ICRISAT in a phased manner with 1st phase from 2003-2006 and second phase from 2007-2010.

Features	Phase 1	Phase 2
Fodder scarcity defined as	Technical and information scarcity on fodder	Lack of capacity of livestock system to innovate and not scarcity of technology
Approach	Transfer of Technology approach	Innovation systems approach
Rationale	Participatory selection of fodder option for better dissemination	Facilitating creation of networks and new working relationship to tackle fodder scarcity
Project management role	Implementing and monitoring pre-determined action plan	Flexible to accommodate evolving activities providing enabling environment
Lessons learnt	Cooperation of all stakeholders, rather than technology transfer, determines success	Continuous engagement and interaction through free flow of communication among partners is important for building innovation capacity in the system

(Reddy *et al.*, 2013)

Case 3: Joint Learning in and about Innovation in African Agriculture (JOLISAA)

The project was implemented in Kenya, South Africa and Benin funded by European Union (EU) in partnership with four EU-based consortia and three Africa-based consortia. Innovation systems in the countries were identified through inventory and the criteria for inclusion were: smallholder and other resource-poor rural stakeholders, at least three different kinds of stakeholder involvement, and three years of experience over the initial years of innovation.

Inventory cases	Diversity of stakeholders, Interaction among stakeholders, Innovation triggers, innovation time frame, innovation dimensions
No of cases documented	Benin – 28; Kenya – 18; South Africa - 11
Approach	Innovation Systems approach
Rationale	Assess a broad diversity of multi-stakeholder agricultural innovation processes involving stakeholders

Lessons learnt	Longer timelines help better understand innovation dynamics; ambiguous yet strategic link exists between innovation and externally funded projects in developing countries
Salient findings	• Market-led innovation is the most critical for smallholders. • Institutional and technological innovations most actively shape innovation in a system. • Farmers receive skills, capabilities and support to pursue innovation well beyond the spectrum of research and extension. • Interwoven dimension of innovation exists in the systems which change with time and as the innovation process unfolds.

(Triomphe *et al.*, 2012)

Case 4: Potato Innovation Systems in Bolivia, Ethiopia, Peru and Uganda

The stakeholders of Potato innovation Systems in the countries were national and local government organisations, NGOs, private companies, farmer organisations and media.

Features	Bolivia	Ethiopia	Peru	Uganda
Stakeholders	31	14	30	22
Role of farmer organisations	Important	Important	Limited	Important
Role of national governments	Minimal	Research, extension and input marketing	Minimal	Promoting private advisory
Role of local governments	Coordination and promotion of potato production	Weak	Coordination and promotion of potato production	Weak
Role of interna-tional research organisations	CIP as innovation broker; CIAT and AHI promoting value chain for local crops	CIP as innovation broker; CIAT and AHI promoting value chain for local crops	CIP as innovation broker; CIAT and AHI promoting value chain for local crops	CIP as innovation broker; CIAT and AHI promoting value chain for local crops
Role of NGOs	Major	Minor	Major	Major
Role of private sector	Major	Minor	Major	Minor
Role of media	Limited	Limited	Limited	Limited

(CIP – International Potato Centre; CIAT – International Centre for Tropical Agriculture; AHI – African Highland Initiative; Private sector mostly implies input supplier companies for the present study)

Salient findings:

1. Promoting interaction or coordination among stakeholders was seen as important by different organisations.
2. Poor linkages among the institutions in the Potato Innovation Systems was one of the hindrances to information and technology access.

3. Limited coordination reduced the access of farmers to essential information and production inputs.
4. Large number of components in the innovation system, without quality interactions, leads to anarchy.

(Ortiz *et al.*, 2013)

Case 5: Agricultural Technology Management Agency (ATMA) in India

The semi-autonomous, decentralised, participatory and market-driven extension model initiated in India had the major aim of converging across departments and programmes, linking research and extension activities in a district, and decentralising extension decision-making through participatory planning. ATMA approach was initiated in the backdrop of the ill effects of the Green Revolution and the limitations of Training and Visit (T&V) System and an existing wide gap in extension, lack of holistic technology transfer systems, narrow focus on agricultural extension system, lack of convergence, lack of competent human resource, inadequate involvement of stakeholders, weak linkages among stakeholders, and inadequate operating resources. ATMA was conceived to mainly tackle the problem of convergence while increasing access to extension services to farmers in a bottom-up approach. Under Innovations for Technology Dissemination (ITD) component of National Agricultural Technology Project (NATP), ATMA approach was successful in organising crop or product-based Farmer Interest Groups (FIGs) at village level, farmers were getting directly benefitted through increased income because of extensive extension activities, farmer-led innovations were being documented and implemented, strong partnerships were developed with private sector firms, rural employment was increased through diversification in agricultural activities, and eco-friendly sustainable agricultural technologies were successfully promoted in rural areas. During the four years of implementation from 1999 – 2003, area under horticultural and oilseed crops, aromatic and medicinal herbs were increased, productivity of cereals increased and average farm income increased by 24 per cent. Under the umbrella of activities, multi-agency extension strategies were promoted through 10 per cent of the fund, extension system was made farmer-centric, Strategic Research and Extension Plans (SREPs) ensured convergence of all activities for extension, mainstreaming of gender was focussed on, and extension activities were made sustainable through 10 per cent contribution of beneficiaries with respect to beneficiary-oriented activities.

(Source: Singh *et al.*, 2012)

The above cases illustrate various levels of multi-stakeholder involvement in varying degrees at local, regional and national levels. While for SRI, the focus was on increasing food security and sufficiency; fodder innovation system focussed on increasing the livelihood status of fodder growers and reducing fodder scarcity; JOLISAA assessed innovation experiences in smallholder farming in Benin, Kenya and South Africa; the study of potato innovation systems in Bolivia, Ethiopia, Peru and Uganda tried to get an insight on how multi-stakeholder collaboration works in different potato-producing areas. The ATMA approach in India tried to integrate all the stakeholders in agricultural extension systems and through effective convergence, focussed on increasing the income of farmers. Different roles and functions for the stakeholders emerged in the innovation systems and varied the involvement of the extension mechanism. In SRI innovation systems in Tripura, the extension mechanism of the State Government took up the major role in absence of any private or civil society actors. Their functions encompassed facilitation, coordination, funding, policy formulation and implementation, awareness creation, and transfer of technology. In the Fodder Innovation Project, with a much larger participation

of stakeholders, networking among partnership was given high importance, especially in the second phase where collaborative relationships evolved with full participation of the partners and free-flowing communication. Major roles of extension was taken up by the Innovation Coordinator, coordinating and facilitating the stakeholders by providing thematic guidance, reflection opportunities and plan implementation activities. Partner-level workshops also increased networking and developed in-depth knowledge. Multi-stakeholder partnerships that went beyond the conventional linkage helped build a robust innovation system in JOLISAA where smallholders needed to acquire new capacities and skills and receive stimulation and support to pursue innovation, which required an active participation of the extension systems for ensuring better management of energies and knowledge in a continuing process of innovation. Role of extension varied across countries in the Potato Innovation Systems and functions of actors varied depending on the country context. While national government system promoted private advisory services in Uganda, in Ethiopia they took a major role in research and extension. Transfer of technology, capacity development of stakeholders, coordination with local administrative bodies, participatory technology development, facilitating interactions among stakeholders in a coordinated way and increasing market interaction were the major roles played by extension mechanism with participation from public, private and civil society organisations. Extension system at the district (local) level under ATMA focussed on facilitating convergence of actors and schemes, increase participation of producer farmers and enhance a conducive environment for effective collaboration. The cases illustrated the role of extension in facilitating coordination among stakeholders that can ultimately help in nurturing an environment that facilitates innovation capacity of the stakeholders.

Capacity development for AIS

Capacity development (CD) in AIS is an important aspect as innovation, to be useful, should be locally relevant and not just a replication of technologies and methods of 'foreign research'. Endogenous capacity development is required to generate, systemise and adapt knowledge to adopt and up-scale new practices. The common framework for CD from the AIS perspective recognises the diverse actors, rules and processes pre-existing in a system. Recognising the interdependencies of the system at all levels and identifying the roles they can play is imperative for effective design and implementation of CD interventions. Along with a shift in how we understand the innovation process, innovative and systematic approaches to CD are required for capacity to navigate complexity, capacity to collaborate, capacity to reflect and learn, capacity to engage in strategies and political processes and capacity to adapt and respond to realise the potential of innovation. The CD approach recognizes the synergies and inter-relationships among three dimensions of IS – individual, organisational and enabling environment – and deals with each component in its own right through multiple but complementary pathways. The conceptual approach of CD in AIS focuses on (i) functionalities and performance of whole IS at systems level; and (ii) an innovation niche where CD takes place around a specific innovation agenda.

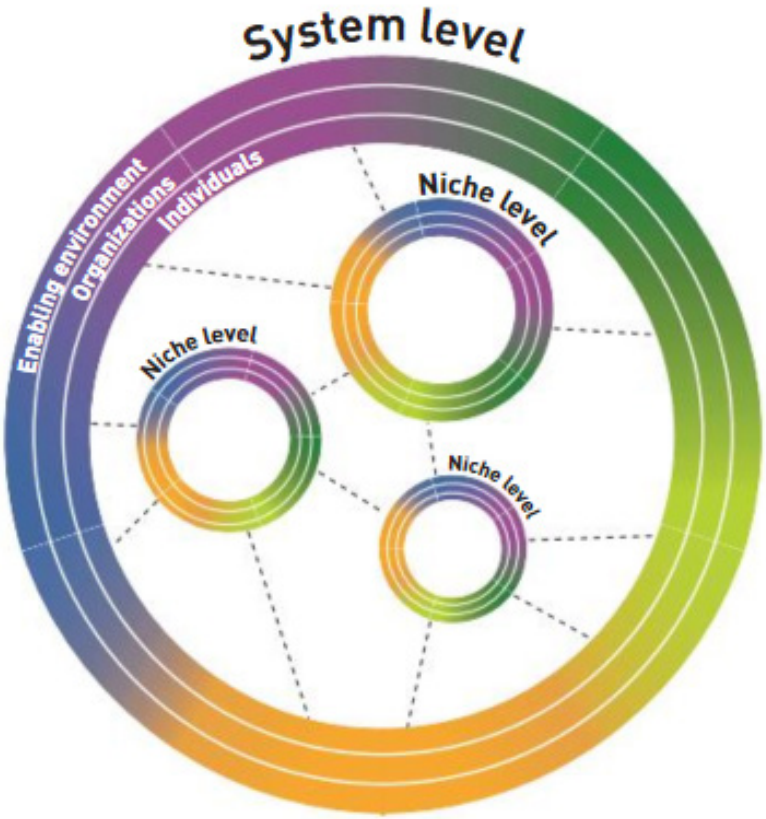
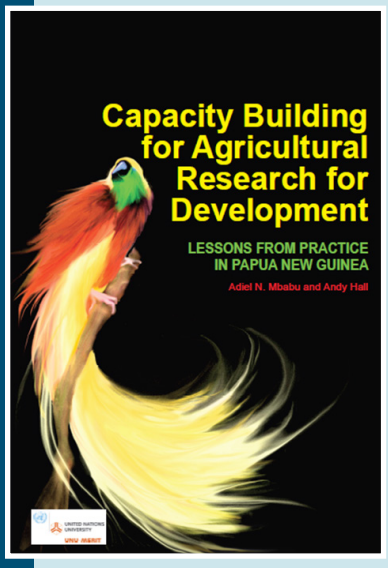


Fig. 7: Conceptual approach in Capacity Development for AIS (Source: http://tapipedia.org/framework

This framework for CD in AIS is a logical sequence of five consecutive steps at the level of innovation niche – (a) galvanizing commitment, (b) Visioning, (c) Capacity Need Assessment, (d) CD strategy development and action plan, and (d) Implementation. The cycle is an ongoing process that requires continuous reflection and documentation for further adaptation and implementation, while it is also a guide for action that can significantly vary depending on local or national context. The only commonality across context is the systemic approach which ensures all actors within the system have equal opportunity to participate.

Fig. 8: TAP Common Framework on CD for AIS - Capacity Development cycle (Source: http://aims.fao.org/activity/blog/tapedia-enhancing-knowledge-exchange-support-capacity-development-agricultural)

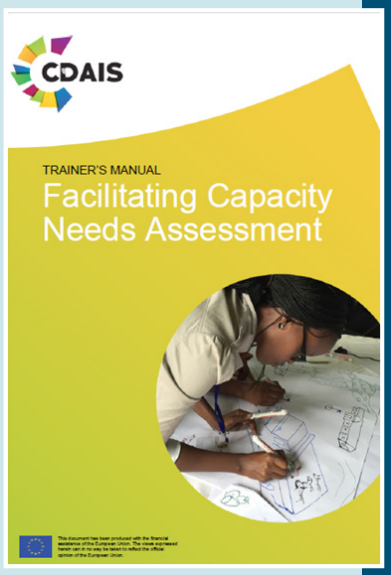


About this publication: Agricultural Research and Development Support Facility (ARDSF), an AR4D capacity building programme in Papua New Guinea (PNG) funded by AusAID sought to improve the delivery of services by agricultural research organisations to smallholder farmers. The book entails the experience in capacity building process in the project and the lessons learnt from it. The book is a hybrid between a conventional academic book on AR4D and a traditional manual on how to use AR4D in capacity building programme, giving both theoretical background and practical experiences. Mbabu, A. N. and Hall, A. (Eds.) (2012).

Capacity Building for Agricultural Research for Development: Lessons from Practice in Papua New Guinea. United Nations University-Maastricht Economic and Social Research Institute on Innovation and Technology (UNU-MERIT), Maastricht, The Netherlands http://www.merit.unu.edu/archive/docs/hl/201302_Capacity%20Building%20for%20Agricultural%20Research%20Development_Final.pdf)

About the publication: This training manual was prepared under the project Capacity Development for Agricultural Innovation Systems (CDAIS), a global partnership (Agrinatura, FAO and eight pilot countries) that aims to strengthen the capacity of countries and key stakeholders to innovate in complex agricultural systems, thereby achieving improved rural livelihoods. CDAIS uses a continuous learning cycle to support national agricultural innovation systems in eight countries in Africa, Asia and Central America and brings together key partners to develop and implement national capacity development plans.

CDAIS. (2017). Trainer's manual - Facilitating Capacity Needs Assessment. http://cdais.net/wp-content/uploads/2017/07/CDAIS-Manual-2017-07-21-3.pdf

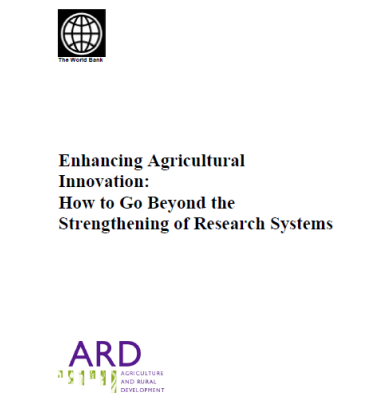


Diagnostic assessment of AIS

Basic understanding of the actors in an innovation system – their typology, roles and functions, learning and linkage – helps unpack information on what's working well in the system. Sector mapping can be split into four parts: identifying the existence of relevant organisations; the extent of competency of relevant organisations; the roles of the actors in the sector; and the existence and nature of linkages between organisations relevant to innovation in the sector (adapted from Hall, Mytelka and Qyeyinka, 2006).

Typology of actors: This typology by Arnold and Bell (2001) provides simple guidance on the kinds of organisations that are likely to be important in a sectoral innovation system and is a useful way to identify organisations relevant to a sector.

- *The research domain* primarily involves formal research organisations producing mainly codified knowledge, largely in the public sector, but it recognises that the private sector and NGOs may also have a role.
- *The enterprise domain* primarily involves firms and farmers, uses mainly codified and tacit knowledge, and produces tacit knowledge.
- *The demand domain* primarily involves consumers and domestic and international markets for products. It also includes policy actors. Policy actors are not consumers in the conventional sense, but they have a demand for knowledge and information produced by the innovation system (to inform policy), and they should be considered an integral part of the system, just as consumers of more conventional products.
- *The intermediary domain*, in which organisations may not necessarily be involved in creating or using knowledge but play a critical role in ensuring that knowledge flows from one part of the system to other parts. For example, NGOs, cooperatives, or industry associations might articulate the demand for knowledge or products from disadvantaged or fragmented constituencies such as farmers. This domain could also involve organisations whose business is to broker access to



About this publication: The paper incorporates prior innovation systems work and eight case studies of innovation systems and potential investments to support their development. It also discusses an analytical framework for innovation systems diagnostics. (World Bank. 2006. Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Agriculture and rural development. Washington, DC: World Bank. (Source: http://siteresources.worldbank.org/INTARD/Resources/Enhancing_Ag_Innovation.pdf)

knowledge, including consulting companies or third-party agencies such as those trying to give developing countries access to biotechnology tools.

Extent of competency in existing organisations: Understanding the heterogeneity between the above typology of stakeholders and their competencies is important to get an insight into their underlying skills and the extent to which these skills can support problem solving, creativity, and innovation. These capacities will include numbers, qualifications, and skills of scientists, managers, and marketing experts. The types of competencies to be investigated will depend on the nature of the organisation.

Role of actors: One of the features of effective innovation systems is the way organisations beyond the State are playing a proactive role in the creation and development of opportunities. In addition, role flexibility is also important as highly compartmentalized and rigidly defined roles do not allow organisations to reconfigure and respond flexibly to changing circumstances.

Existence and nature of linkages between organisations relevant to innovation in the sector: Interactions between actors and organisations are central to an effective innovation system. To understand patterns of interaction, it is important first to map linkages in a general ways and then to understand the nature and purpose of these linkages. Understanding the type of linkage and purpose is important as it helps to distinguish between the links an organisation has with other actors in the system.

Table 1: Nature of linkages between organisations in innovation systems

Type of linkage	Purpose	Type of learning
Partnership	Joint problem solving, learning, and innovation. May involve a formal contract or memorandum of understanding. May be less formal, such as participatory research. Highly interactive. May involve two or more organisations. Focussed, objective-defined project.	Interacting, imitating and searching
Paternalistic	Delivery of goods, services and knowledge to consumers with little regard to their preferences and agendas.	Learning by training
Contract purchase of technology or knowledge services	Learning or problem solving by buying knowledge from elsewhere. Governed by a formal contract. Interactive according to client-contractor relations. Usually bilateral arrangement. Highly focussed objective defined by contract concerning access to goods and services.	Imitating and mastering, learning by training
Networks	May be formal or informal, main objective is to facilitate information flows. Provides knowhow and early-warning information on market, technology and policy changes. Also builds social capital, confidence and trust, and creates preparedness for change, lowering barriers to forming new linkages.	Interacting and searching
Advocacy linkages to policy process	Specific links through networks and sector association to inform and influence policy.	Interactive learning
Alliance	Collaboration in marketing products, sharing customer bases, and sharing marketing infrastructure. Usually governed by a memorandum of understanding. Can involve one or more organisation. Broad collaborative objective.	Learning by doing

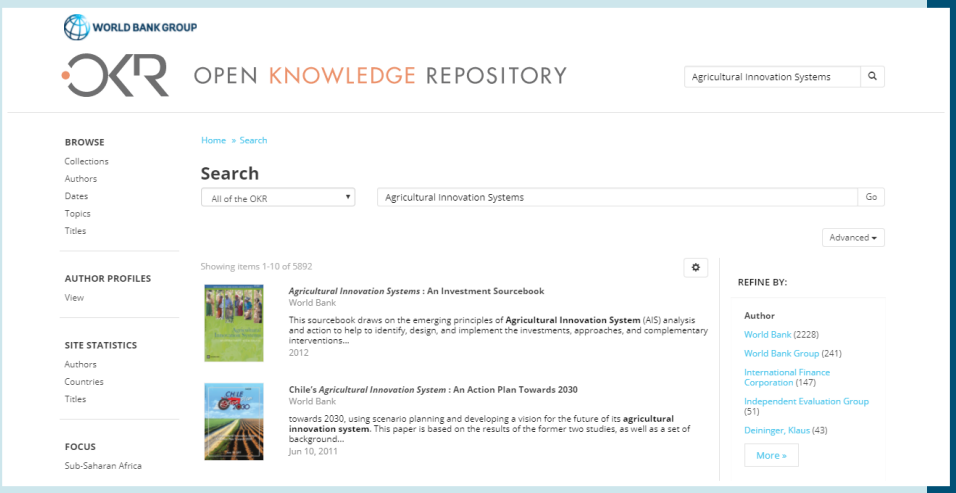
Type of linkage	Purpose	Type of learning
Linkages to supply and input and output markets	Mainly informal but also formal arrangements connecting organisations to raw materials and input and output markets. Includes access to credit and grants from national and international bodies. Narrow objective of access to goods.	Limited opportunities for learning; some learning by interacting

(Source: Hall, A., Mytelka, L., and Oyeyinka, B. (2006). Concepts and guidelines for diagnostic assessment of agricultural innovation capacity. UNU Working Paper Series #2006-017.)

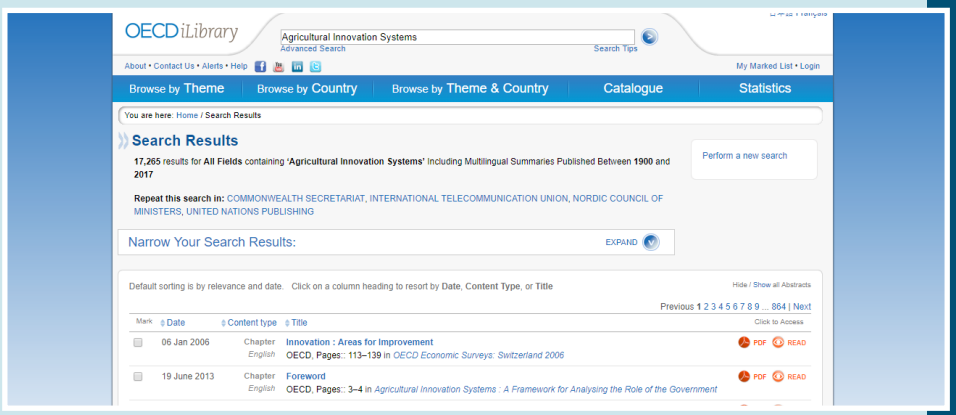
Resource databases on AIS

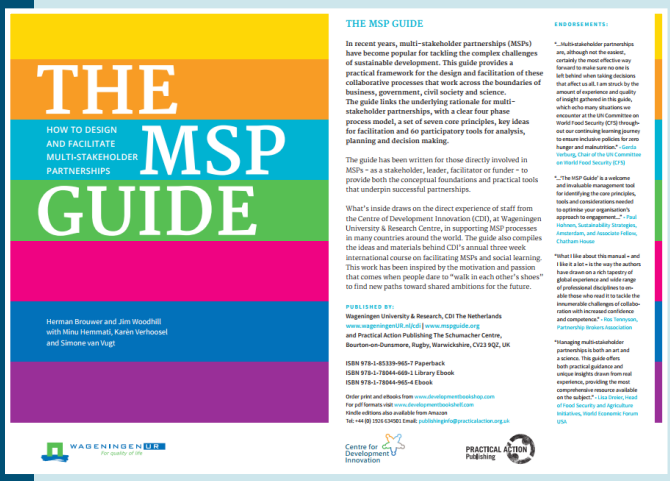
TAPipedia is an information sharing system designed to enhance knowledge exchange in support of Capacity Development (CD) for Agricultural Innovation Systems (AIS). TAPipedia aims to be a global information system for good CD practices, innovation outputs, success stories and lessons learnt. (http://tapipedia.org/)

World Bank Open Knowledge Repository (OKR) has a collection of discussion papers, working papers, research articles, policy papers and other publications on AIS. (https://openknowledge.worldbank.org/)



Organisation for Economic Cooperation and Development (OECD) also has a considerable number of publications on AIS for reference – from getting initial understanding of the topic to in-depth research and policy documents. (http://www.oecd.org/)



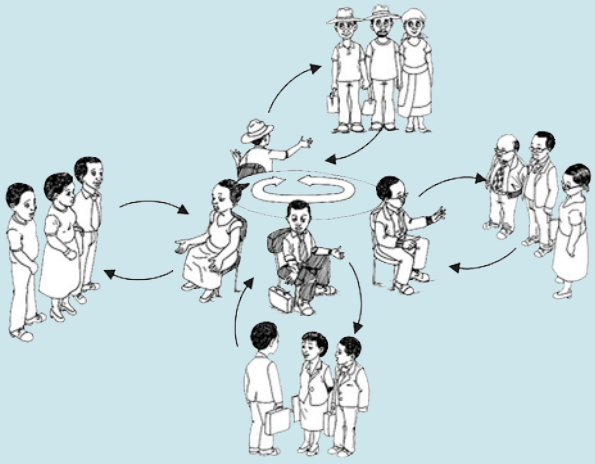


About the Guide: The Multi-stakeholder Partnership Guide links the underlying rationale for multi-stakeholder partnership with models, principles, ideas for facilitation and participatory toll analysis, planning and decision making. It is a useful guide for those directly involved in MSP for providing conceptual foundation and practical tools. (http://www.mspguide.org/; http://www.mspguide.org/msp-guide)

Shortfalls of AIS

While the AIS concept is gaining ground in agricultural development context in the developing economies, the two major aspects that have emerged are capacity development of the stakeholders and multi-stakeholder collaboration. In terms of capacity development, the priority of the national AIS is not sufficiently aligned to the interests of smallholders, farm cooperatives and agribusinesses. While theoretically AIS puts high emphasis on agricultural producers as crucial actors, in practice, the top-down approach still has an upper hand. Organisational capacity development requires to go beyond a few structured and routine trainings and workshops and help the extension professionals understand and explore their roles and functions through participatory learning. Generating and nurturing innovation and innovation capacity in agriculture goes beyond technical issues with higher priority on learning from interaction among the stakeholders for active knowledge construction. Problems in the agriculture sector require participation of stakeholders across scientific disciplines with development organisations. The problems arising in this context are power dynamics in the innovation platforms, opportunistic behaviour, bringing 'experts and 'beneficiaries' on the same page, lack of trust, varying incentives and capacity, and difficulties in setting and enforcing rules. These often inhibit an actual participatory mode in AIS in spite of 'knowledge integration' and 'participatory approach' being the keywords in their implementation. Other than these operational shortfalls, the AIS framework also doesn't have any particular format that works in every context but recognises rather diversified approaches to be experimented and adapted for innovation, which makes it hard to comprehend and prescribe. Competencies to facilitate interactions among stakeholders and operational skills for facilitating, brokering, and relationship building are also missing or in short supply for fostering networking and innovation (Aerni et al., 2015; Sulaiman, 2015; Koutsouris, 2012).

An innovation platform is a space for learning and change. It is a group of individuals (who often represent organisations) with different backgrounds and interests who come together to diagnose problems, identify opportunities and find ways to achieve their goals. They may design and implement activities as a platform, or coordinate activities by individual members. While innovation platforms work well in curated projects, scaling of a platform needs to generate value for all the actors. Most of the time, scaling innovation platforms do not yield intended results as there is no one size that fits all in the larger context. The International Livestock Research Institute (ILRI) practice briefs discuss what innovation platforms are, how they work, and beyond.
(Source: https://clippings.ilri.org/2014/02/03/ipbrief1/)



Implications for Extension and Advisory Services (EAS)

1. While knowledge generated through research is an important component of AIS, EAS requires to be equally functionally active for effective utilisation and determining the outcome of the knowledge on the relevant actors in innovation systems.

2. Agriculture changes with changing social, economic and political context and it becomes necessary for the actors in the AIS to evolve accordingly. EAS can be the innovation coproduction support instrument helping actors realise their changing roles.

3. Collaboration between producers, research organisations, value chain actors, industry, and governments is the key to success in innovation systems. EAS can link all the actors for an effective partnership and catalyse collaboration for nurturing partnerships.

4. With increased focus on sustainability, AIS needs to evolve to be pro-poor, pro-environment and pro-business. EAS system can engage in identifying suitable resources for farming communities and connect them with appropriate actors.

5. In countries like India, with an extensive network of public EAS, it can increase interaction among the actors in innovation systems, promote an enabling policy environment, promote small scale farmers, and provide research environment as well as infrastructure to encourage growth.

6. EAS can act as sector-coordinating body by identifying the actors/stakeholders in an innovation system and encourage development of sustainable innovation capacity by changing the existing attitudes and practices by focussing on the activities that support innovation.

7. Capacity building efforts targeting different actors of AIS are required to initiate behavioural and organisational change. Extension organisations at national and regional levels can collaborate to engage in capacity building activities for functional and behavioural skills.

8. Dynamism of EAS in AIS is very important to play different roles – from 'source of knowledge' to 'coordinator of linkages' – at different times based on the system dynamics (Hall, 2004).

Restructuring ATMA for better convergence in India

At its current state, convergence of extension schemes within all line departments is needed to avoid duplication of efforts; additionally, the extension component of allied departments needs to be strengthened. Activities based on SREP need to be defined specifically with the help of facilitators and policy experts from MANAGE and activities on the lines of those salient points need to be developed. Also, as bottom-up planning has practically failed in ATMA, revision of SREPs is required for reformed extension efforts. 'Farmers' Friends' can be selected from rural educated youth and trained to act as links between different stakeholders and line departments, connecting forward and backward linkages in farm production systems. Creation of knowledge societies through low-cost and user-friendly social media channels ensuring technology dissemination under the four sub-missions of National Mission on Agricultural Extension and Technology (NMAET), for capacity building of extension functionaries and farmers can be taken up through ICTs. Increased community extension initiatives in collaboration with prominent stakeholders at the grassroots for creating effective knowledge networks can also help in increased convergence for effective extension.

Conclusion

The main focus of AIS is strengthening the skills and attitudes of the stakeholders to enable innovation, nurture an institutional environment which is supportive to the flow of knowledge, as well as create policies and practices that determine how well these interactions work. Thus, the innovation systems approach not only focusses on the relevant stakeholders in a system but also their network to understand the flow of information among them. The concept of innovation has changed in recent times from a research-driven process to an interactive process with a much broader range of activities, actors, practices, policies and context. Innovativeness, as a driver of social and economic change, can bring significant developments in the rural sectors of developing countries – the home of most of the vulnerable communities of the world and also major environmental resources (Hirvonen, 2008). In today's world, the systems approach is of much greater need and extension has also been changed in its elements through the passage of time. From an agency of technology transfer, it has evolved to be a system that focusses on facilitating interaction and learning rather than training and demonstration. In an innovation systems perspective, extension and rural advisory services are defined as systems that 'facilitate the access of farmers, their organisations, and other value chain and market actors to knowledge, information and technologies; facilitate their interaction with partners in research, education, agribusiness and other relevant institutions; and assist them to develop their own technical, organisational and management skills and practices as well as to improve the management of their agricultural activities' (Davis and Heemskerk, 2012). It aims to provide a supportive environment to the rural setting for enabling innovation capacity among the actors. With an increased number of actors in an agricultural innovation systems AIS and entries from public, private, non-profit and for-profit sectors, it is becoming more important for the public sector (in the Indian context, agencies like ATMA) to take up leading roles in facilitating collaboration, fostering innovation and brokering connections among the stakeholders to ensure effective development efforts.

References

Aerni, P., Nichterlein, K., Rudgard, S., and Sonnino, A. (2015). Making Agricultural Innovation Systems (AIS) Work for Development in Tropical Countries. Sustainability, 2015, 7, 831-850; doi:10.3390/su7010831. http://www.fao.org/uploads/media/sustainability%20paper.pdf.

Asheim, B.T. and Isaksen, A. (1997). Location, agglomeration and innovation: Towards Regional Innovation Systems in Norway. European Planning Studies, 5(3): 299-330.

Asheim, B.T. and Isaksen, A. (2002). Regional innovation systems: The integration of local 'sticky' and global 'ubiquitous' knowledge. Journal of Technology Transfer, 27(1): 77-86.

Assefa, A., Waters-Bayer, A., Fincham, R., and Mudahara, M. (2009). Comparison of frameworks for studying grassroots innovation: Agricultural Innovation Systems (AIS) and Agricultural Knowledge and Information Systems (AKIS), In: P. Sanginga, A. Waters-Bayer, S. Kaaria, J.Njuki, C. Wettasinha (Eds.), Innovation Africa: Enriching farmers livelihoods (pp. 35–56). Earthscan, London. http://www.cgiar-ilac.org/files/Assefa_Comparison.pdf.

Autio, E. (1997). New technology-based firms in innovation networks. In: D. Jones- Evans & M. Klofsten (eds) Technology Innovation and Enterprise: The European Experience, MacMillan, London.

Belussi, F. (2003). The Italian system of innovation: The gradual transition from a weak 'mission-oriented' system to a regionalized learning system. In: S. Biegelbauer& S. Borra´s (eds) Innovation Policies in Europe and the US—The New Agenda, Ashgate Publishing, Aldershot.

Cooke, P. & Morgan, K. (1998). The Associational Economy. Oxford University Press, London.

Davis, K. and Heemskerk, W. (2012). Investment in extension and advisory services as part of Agricultural Innovation Systems. In: Agriculture and rural development: An investment sourcebook. World Bank, Washington DC, USA.

Edquist, C. (1997). Systems of Innovation: Technologies, Institutions and Organisations Pinter publishers, London.

Freeman, C. (1987). Technology policy and economic performance: Lessons from Japan. Frances Pinter, London.

Garofoli, G. (2002). Local Development in Europe: Theoretical models and international comparisons. European Urban and Regional Studies, 9(3): 225-239.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P. and Trow, M. (1994). The new production of knowledge: The dynamics of science and research in contemporary societies, Sage, London.

Gottardi, G. (2000). Innovation and the creation of knowledge in Italian industrial districts: A system model. In: F. Belussi & G. Gottardi (eds) Evolutionary Patterns of Local Industrial System, Aldershot, Ashgate Publishing Ltd.

Hall, A. and Clark, N. (2010). What do complex adaptive systems look like and what are the implications for innovation policy? Journal of International Development, 22:308-324.

Hall, A., Mytelka, L. and Oyeyinka, B. (2006). Agricultural Innovation Systems: A methodology for diagnostic assessments. In: Enhancing agricultural innovation: How to go beyond the strengthening of research systems. World Bank, Washington DC.

Heimeriks, G. (2013). Measuring and modelling innovation Lesson 6: Innovation Systems. http://heimeriks.net/measuring-and-modelling-innovation/mmi-lesson-6-innovation-systems/. Accessed on 18th January, 2013.

Hekkert, M.P., Suurs, R.A.A., Negro, S.O., Kuhlmann, S. and Smits, R.E.H.M. (2007). Functions of Innovation Systems: A new approach for analysing technological change. Technological Forecasting and Social Change, 74: 413-432.

Hirvonen, M. (2008). A tourist guide to systems studies in rural innovation. LINK policy resources on rural innovation series no. 1. http://wwwiinnovationsystems.org. Accessed on 24th February, 2013.

Hwang, V.W and Horowitt, G. (2012). The rainforest: The secret to building the next silicon valley. Create Space Independent Publishing Platform.

Klerkx, L. and Leeuwis, C. (2008). Matching demand and supply in the agricultural knowledge infrastructure: experiences with innovation intermediaries. Food Policy, 33: 260–276.

Klerkx, L. and Nettle, R. (2013). Achievements and challenges of innovation co-production support initiatives in the Australian and Dutch dairy sectors: A comparative study. Food policy, 40: 74-89.

Klerkx, L. and Gildemacher, P. (2012). The role of innovation brokers in Agricultural Innovation Systems. Thematic Note 4. In: Agricultural innovation systems: An investment sourcebook, World Bank, Washington DC.

Klerkx, L. and Leeuwis, C. (2009). Operationalizing demand-driven agricultural research: institutional influences in a public and private system of research planning in The Netherlands. The Journal of Agricultural Education and Extension, 15: 161–175.

Klerkx, L. and Nettle, R. (2013). Achievements and challenges of innovation co-production support initiatives in the Australian and Dutch dairy sectors: A comparative study. Food Policy, 40: 74-89.

Koutsouris, A. (2012). Facilitating Agricultural Innovation Systems: a critical realist approach. Studies in Agricultural Economics, 114 (2012): 64-70.

Lagendijk, A. (2004). Regions and regional boundaries in the minds and practices of policy-makers in a unifying Europe. In: G. Van Vilsteren & E. Wever (eds) Changing Economic Behaviour in a Unifying Europe, Van Gorcum, Assen.

Leeuwis, C., and van den Ban, A. (2004). Communication for Rural Innovation: rethinking agricultural extension. Oxford Blackwell Science, Oxford.

Lundvall, B. A. (1985). Product innovation and user-producer interaction. Alborg University Press. http://vbn.aau.dk/files/7556474/user-producer.pdf. Accessed on 20th May, 2013

Lundvall, B. A. (1988). Innovation as an interactive process: From user-producer interaction to the National Innovation Systems. In: Dosi, G., Freeman, C., Nelson, R.R., Silverberg, G. and Soete,

L.,(Eds.). Technology and economic theory, Pinter Publishers, London.

Lundvall, B. A. (1992). National systems of innovation: Towards a theory of innovation and interactive learning. Pinter Publishers, London.

Lynam, J. (2012). Agricultural research within an Agricultural Innovation Systems. In: World Bank. (2012). Agricultural Innovation Systems: An Investment Sourcebook. World Bank, Washington.

Metcalfe, J.S. (1995). Technology systems and technology policy in an evolutionary framework. Cambridge Journal of Economics, 19(1): 25-46.

Nelson, Richard, R. (1993). National Innovation Systems: A Comparative Analysis University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship. http://ssrn.com/abstract=1496195. Accessed on 20th May, 2013.

Ortiz, O. et al. (2013). Insights into potato innovation system in Bolivia, Ethiopia, Peru and Uganda. Agricultural Systems, 114: 73-83.

Patel, P. and Pavitt, K. (1994). National Innovation Systems: Why they are important and how they might be measured and compared. Economics of Innovation and New Technology, 3(1): 77-95.

Reddy, T. S. V., Puskur, R., Hall, A. and Sulaiman, R. V. (2013). Applying Innovation System principles to fodder scarcity: Experiences from the Fodder Innovation Project. Working Paper 2013-001. Centre for Research on Innovation and Science Policy, Hyderabad, India

Rogers, E.M. (1962). Diffusion of Innovations. Glencoe, Free Press. pp-11.

Roseboom, J. (2011). Supranational collaboration in agricultural research in sub-Saharan Africa, Paper ASTI/IFPRI-FARA Conference, Ghana, December 2011.

Singh, K.M., Swanson, Burton E., Jha, A. K. and Meena, M. S., (2012). Extension Reforms and Innovations in Technology Dissemination – The ATMA Model in India. http://dx.doi.org/10.2139/ssrn.2168642.

Spielman, D.J. (2005). Innovation system perspective on developing countries agriculture: a critic's review. ISNAR Discussion Paper 2.Washington DC: International Food Policy Research Institute.

Suchiradipta, B. and Saravanan R. (2014a). Agricultural Innovation Systems (AIS): A Study of Stakeholders and their Relations in System of Rice Intensification (SRI), The Journal of Agricultural Education and Extension, DOI: 10.1080/1389224X.2014.939200.

Suchiradipta, B. and Saravanan, R. (2014b). Who makes it click? Understanding the stakeholders in Agricultural Innovation Systems in Tripura State of India. Tropical Agricultural Research 25 (4): 479-494.

Sulaiman, R.V. and Davis, K. (2012). The "New Extensionist": Roles, strategies, and capacities to strengthen extension and advisory services. Global Forum for rural Advisory Services, Switzerland.

Sulaiman, R.V. (2015). Agricultural Innovation Systems. Note 13. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS: Lindau, Switzerland.

Sulaiman, R.V. (2015). Agricultural Innovation Systems. Note 13. GFRAS Good Practice Notes for Extension and Advisory Services. GFRAS, Lindau, Switzerland.

Swanson, B.E. and Davis, K. (2014). Status of Agricultural Extension and Rural Advisory services –

Summary report. http://www.g-fras.org/en/world-wide-extension-study.html. Global Forum for rural Advisory Services, Switzerland.

Triomphe, B., Floquet, A., Kamau, G., Letty, B., Vodouhe, S. D., N'gan'ga, T. and Hocde, H. (2012). What does an inventory of recent innovation experiences tell us about agricultural innovation in Africa? Retrieved from http://www.ifsa2012.dk/downloads/WS2_3/Triomphe%20et%20al.pdf.

World Bank. (2012). Agricultural Innovation Systems: An Investment Sourcebook. Washington, World Bank, 660 p.

National Institute of Agricultural Extension Management (MANAGE)
(An Organization of Ministry of Agriculture and Farmers Welfare, Govt. of India)
MANAGE–Centre for Agricultural Extension Innovations, Reforms and Agripreneurship (CAEIRA)
Rajendranagar, Hyderabad – 500 030, Telangana State, India
www.manage.gov.in

About the issue

Agricultural Innovation Systems (AIS) is a network of organisations, enterprises and individuals focussed on bringing new products, new processes and new forms of organisation into economic use, together with the institutions and policies that affect their behaviour and performance. With agricultural systems becoming more and more open to multiple stakeholders throughout the spectrum of the farm-to-plate journey of farm produce, innovation systems thinking will become more and more vital in changing times. A strong network of stakeholders make the system effective and beneficial for the farmers. It also aims for providing an innovation platform where farmers are empowered to become entrepreneurs from mere beneficiaries.

In AIS, roles and responsibilities of stakeholders are dynamic, changing with time and need; for successful development and scaling of innovation platforms, capacity development as well as partnership networking becomes important. The issue delves into what AIS is, how it operates, the diagnostic framework, capacity development for stakeholders in AIS, shortfalls of AIS and its implications on extension and advisory services.