

# Innovation Capacity in Agricultural Sector

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## ABSTRACT

The changing context for agricultural development has highlighted a strong need to understand and adopt innovation systems thinking. Science, technology and innovation policy has equated rural development to agricultural development. The main objective of this paper was to examine the role of innovation capacity in agricultural sector. With the growing diversification of rural livelihood options into non-farm activities and with the increasing interconnectedness of rural areas and activities to the global environment, a new rural economy is emerging. This is bringing with greater pressures on farmers, companies and governments to innovate in response to different situations. So ideas of what constitutes “research capacity” have evolved, along with approaches for investing in the capacity to innovate, there for this study was done. This paper is to review and to describe, innovation system and agricultural innovation.

**Keywords:** Innovation Capacity; Innovation System; Agricultural Innovation.

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## INTRODUCTION

Agricultural development depends to a great extent on how successfully knowledge is generated and applied, and indeed knowledge intensiveness has featured prominently in most strategies to promote agricultural development. Yet the changing context for agricultural development has highlighted a strong need to understand and adopt innovation systems thinking. Science, technology and innovation policy has equated rural development to agricultural development. With the growing diversification of rural livelihood options into non-farm activities and with the increasing interconnectedness of rural areas and activities to the global environment, a new rural economy is emerging. This is bringing with greater pressures on farmers, companies and governments to innovate in response to, for instance, rapidly changing pattern of competition and market and trade standards. So ideas of what constitutes “research capacity” have evolved, along with approaches for investing in the capacity to innovate, for instance, rapidly changing pattern of competition and market and trade standards. So ideas of what constitutes “research capacity” have evolved, along with approaches for investing in the capacity to innovate. To enhance innovation capacity, it is necessary to invest in learning and capacity building, provide incentives that allow actors to put new skills in touse, and also nurture new attitudes and practices (Rajalahti *et al.*, 2008).

Due to the specificity of knowledge and the rapidity of change associated with innovation and technological change, training is necessary to upgrade the skills of individuals (Baldwin & Johnson, 1995).

Participatory approaches to agricultural research that builds on local knowledge and innovation can stimulate and diffuse innovation capacity among farmers and external scientists. Rural people themselves have been a major source of new knowledge and practices – indigenous knowledge and organization. Small-scale farmers’ own creative responses continue to be important sources of improvement to agricultural productivity in many regions of developing countries (Poole & Buckley, 2006).

Ragasa *et al.* (2010) in a research about enhancing capacity innovation in Nigeria agricultural research organization have concluded the role of capacity innovation on skills to

creating knowledge and utilization of knowledge for social and economical purposes.

## INNOVATION CAPACITY

The innovation capacity of communities is strongly related to their capacity to use their traditional knowledge for innovative practical solutions for everyday life problems. Hence, to foster local innovation it is important to understand the particularities of how knowledge is generated and transmitted (Mc Namara, 2009).

Innovation capacity typically combines technical, institutional, organizational, and other sorts of change. Its broad features include a combination of: (1) scientific, entrepreneurial, managerial, and other skills and knowledge; (2) partnerships, alliances, and networks linking different sources of knowledge and different areas of social and economic activity; (3) routines, organizational culture, and traditional practices that pattern the propensity to innovate; (4) an ability for continuously learning how to use knowledge more effectively; and (5) clusters of supportive policies and other incentives, governance structures, and the nature of the policy process (Rajalahti *et al.*, 2008).

A large element of this capacity arises from learning-by-doing, thus incrementally improving the ability to utilize knowledge and information (Hall *et al.*, 2007).

The innovation capacity concept recognizes broad set of skills, links and structures, but in relation to the total process of producing accessing, diffusing and, most importantly, putting into use knowledge in socio-economically useful ways. It stresses that institutional settings are a critical part of this capacity and that capacity development is often an issue of institutional and policy change. Innovation capacity is an embedded capacity that cannot be understood or development without considering its contextual setting. Furthermore innovation capacity is a dynamic capacity not just concerned with systems, linkages and institutions as they exist today, but also about the ability to reconfigure these arrangements in response to changing demands and circumstances. It is necessary to understand capacity in terms of holistic evolutionary systems of learning and change, where future states were unknown and unknowable. The differences between research capacity, technological capacity and innovation capacity are summarized in Table 1.

**Table 1: Contrasting concepts of capacity**

	<b>Research capacity</b>	<b>Technological capacity</b>	<b>Innovation capacity</b>
<b>Nature of capacity</b>	- Resources needed to Conduct scientific research	- Resources needed to manage technical change	- Resources needed to continuously innovate in dynamic environments
<b>Main actors</b>	- Research scientists and mangers	-Potentially all scientific,entrepreneurial, policy and Training actors related to technical change.	- Potentially all scientific, Entrepreneurial, policy and training actors related to innovation.
<b>Defining processes</b>	- Knowledge creation	- Knowledge search and acquisition	- Knowledge creation acquisition and use.
<b>Key variables</b>	-Number of scientists, research infrastructure and research expenditure	- Scientific,managerial And scientific skills and experience.	- Diversity of sources of knowledge in a network. - Pattern of interactions in networks. - Extent to which institutional settings promote interaction and learning.
<b>Nature of arrangement/ structures</b>	- Static	- Patterns of Linkage between actors - Static	- Dynamic
<b>Modes of capacity strengthening</b>	- Training, research and infrastructure Investments.	-Training, research and Infrastructure investments. - Networking and cluster development	- Training, research and infrastructure investments. - Development of enabling environment -Institutional change

Resource: Hall & Dijkman (2006)

**INNOVATION SYSTEM**

The last 40 years have witnessed substantial debate over the best way for science and technology to foster innovation. At the risk of oversimplifying a complex reality, two distinct views may be outlined:

The first and earlier view is that scientific research is the main driver of innovation, creating new knowledge and technology that can be transferred and adapted to different situations. This view is usually described as the “linear” or “transfer of technology” model.

The second view, while not denying the importance of research and technology transfer, recognizes innovation as an interactive process. Innovation involves the interaction of individuals and organizations possessing different types of knowledge within a particular social, political, policy, economic, and institutional context. This second view, increasingly discussed in terms of the “innovation system” concept(World Bank, 2007).

An innovation system 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 behavior and performance. The innovation systems concept extends beyond the creation of knowledge to encompass the factors affecting

demand for and use of knowledge in novel and useful ways. Innovation systems not only help to create knowledge; they provide access to knowledge, share knowledge, and foster learning (Rajalahti *et al.*,2008).

Innovation systems can be defined in a variety of ways: they can be national, regional, sectorial, or technological. They all involve the creation, diffusion, and use of knowledge. Systems consist of components, relationships among these, and their characteristics or attributes (Carlsson *et al.*, 2002).

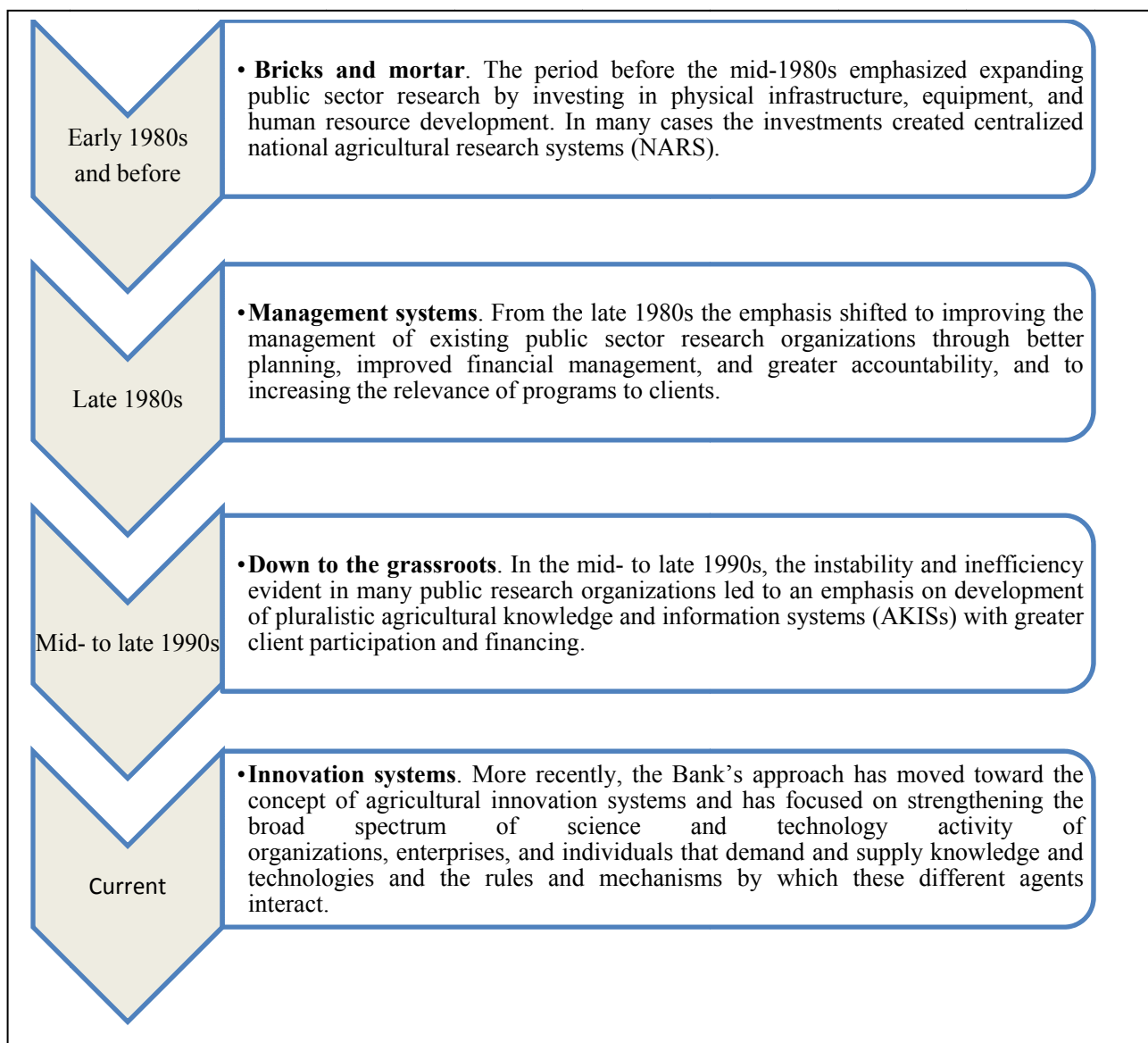
**Changing Approaches for Supporting Agricultural Innovation**

As the context of agricultural development has changed, ideas of what constitutes innovation have changed, and so have approaches for investing in it (Figure 1). In the 1980s, the concept of the “national agricultural research system” or NARS, was developed to guide investments in agricultural development. Development activities based on the NARS concept generally focused on strengthening research supply by providing infrastructure, capacity, management, and policy support at the national level. In the 1990s, the “agricultural knowledge and information system” (AKIS) concept gained currency. The AKIS concept recognizes that research is not the only means of generating or gaining access to knowledge.

Although the AKIS concept also focuses on research supply, it gives much more attention to the links between research, education, and

extension and the identification of farmers' demand for new technologies.

**Fig.1: Changing approaches to investing in innovation capacity**



Resource: (World Bank, 2007)

Strengthened research systems may increase the supply of new knowledge and new technologies, but they may not necessarily improve the capacity for innovation throughout the agricultural sector. Recently more attention has been given to the demand for research and technology and to the development of wider competencies, linkages, enabling attitudes, practices, governance structures, and policies that allow this knowledge to be put into productive use. The concept of an innovation system has

guided this more holistic approach to planning knowledge production and use.(World Bank, 2007).

#### **NARS, AKIS, and agricultural innovation systems compared**

What does the innovation system concept bring to the task of promoting change that other frameworks have missed? It is instructive to compare it with two major frameworks for planning capacity development: the national

agricultural research system (NARS) and agricultural knowledge and information systems (AKIS) frameworks. The main characteristics of

these two frameworks are described, followed by a discussion of their major similarities and differences (Table 2).

**Table 2: The evolution of agricultural innovation capacity development frameworks**

Defining features	Classic NARS	Classic AKIS	Agricultural Innovation Systems
<b>What this is</b>	Organizing framework for planning capacity for agricultural research, Technology development and transfer	Organizing framework for strengthening communication and knowledge delivery services to people in the rural sector	Organizing framework to strengthen the capacity to innovate and create novelty throughout the agricultural production and marketing system
<b>Who this</b>	1. National Agricultural Research Organizations 2. Agricultural Universities or Faculties 3. Extension services 4. Farmers	1. National Agricultural Research Organizations 2. Agricultural Universities or Faculties 3. Extension services 4. Farmers 5. NGOs and entrepreneurs in rural areas	Potential 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.
<b>Outcome</b>	Technological invention and technology transfer	Technology adoption and innovation in agricultural production and marketing in rural areas	Combinations of technical and institutional innovations throughout the production, marketing, policy research and enterprise domains.
<b>Organizing Principle</b>	Using science to create knowledge Invention-driven	Accessing agricultural knowledge Invention-driven	Creating change for social and economic change Innovation-driven
<b>Theory of Innovation</b>	Transfer of technology	Interactive learning	Interactive learning
<b>Degree of market Integration</b>	Nil	Low	High
<b>Nature of capacity strengthening</b>	Infrastructure and human resource development	Strengthening communication between actors in rural areas.	Same as NARS and AKIS and in addition: Combination of: strengthening linkages and interaction; institutional developments to support interaction, learning and innovation, the creating of an enabling policy environment

Resource: World Bank (2007)

**How to Nurture Innovation Capacity**

Two important findings from the workshop center on innovation capacity. First, the actors must be capable of learning and innovating in a changing environment. Second, this dynamic adaptive capacity is often associated with local

institutions possessing sufficient organizational and technical capacity (Rajalahti *et al.*, 2008).

At the same time, approaches to investing in research systems and innovation capacity have evolved, as described in Table 3.

**Table 3: The Expanding View of How to Strengthen Innovation Capacity in Agriculture**

Scope	Approach	Focus	Actors
<b>Activity based</b>	National Agricultural Research Systems	Technology generation and transfer	Research organizations universities
<b>Output based</b>	Agricultural Knowledge and Information Systems (AKIS)	Knowledge and Technology dissemination	Research organizations, universities, extension services, nongovernmental organizations
<b>Outcome based</b>	National Agricultural Innovation Systems (NAIS)	Technological and institutional innovation	All economic actors that actively use or generate knowledge

Resource: Rajalahti *et al.* (2008)

One of the most important points about these changing paradigms is the gradual shift from technology delivery to capacity enhancement and specifically the capacity to innovate. Underlying this is the idea that to be effective in an ever-changing world a continuous process of innovation is required to adapt economic processes to presenting situations - for example, livestock disease outbreaks or changing consumer preferences. As a result, it is not technology per se that is important, but the ability to adapt - often through technical or design changes - to meet new demands of production conditions, markets or technology users. The caveat here is that changes in ways of working - institutional innovations - go hand in hand with technical and design changes. Thus the propensity for institutional learning and change in enterprises, research organizations and developmental agencies and their programs is central to innovation capacity (Hall *et al.*, 2007).

### **Strengthen innovation capacity within AET organizations**

The capacity for innovation within AET (agricultural education and training) organizations and professionals can be strengthened by improving incentives to forge stronger linkages between the AET and diverse user communities, knowledge sources, and private industry. Instilling this capacity to innovate is particularly important to the long-term sustainability of an agricultural innovation systems approach (Rajalahti *et al.*, 2008).

The innovation studies literature has been good at categorizing different styles of agricultural innovation and this, in combination with the efforts of practitioners to promote different approaches, has led to recognizable eras or paradigms of agricultural innovation. Table 4 presents an overview (Hall, 2007).

**Table 4: Characteristics of different paradigms of agricultural innovation**

<b>Paradigm</b>	<b>Transfer of Technology</b>	<b>Farming Systems Research</b>	<b>Farmer First / Farmer Participatory Research</b>	<b>Interactive Learning for Change/ Innovation Systems</b>
<b>Era</b>	Widespread since the 1960s, but building on a very long history	Starting in the 1970s and '80s	Starting in the 1990s	Work in progress
<b>Organization focus</b>	Agricultural research Organization arranged as a National Agricultural Research organization	Agricultural research Organization arranged as a National Agricultural research organization NARS	NARS as part of AKIS including agricultural extension and education organizations	NARS as part of agricultural innovation systems
<b>Farmers seen by scientists as</b>	Progressive adopters, laggards	Objects of study and sources of info	Colleagues	Key actors among many others
<b>Farmers' roles</b>	Learn, adopt, conform	Provide information for Scientist	Diagnose, experiment, test, adapt	Co-generate knowledge, processes and innovation
<b>Scope</b>	Productivity	Input-output relationships	Farm-based	Beyond the farm gate
<b>Driver</b>	Supply push from research	Scientists' need to learn about farmers' conditions and needs	Demand pull from farmers	Responsiveness to changing contexts
<b>Intended outcome</b>	Technology transfer and uptake	Technology produced with better fit to farming systems	Co-evolved technology with better fit to livelihood systems	Enhanced capacities to innovate
<b>Innovators</b>	Scientists	Scientists adapt packages	Farmers and scientists together	Potentially all actors
<b>Intervention mode</b>	Core funding of research and research infrastructure development	Core funding of research and research Infrastructure development	Decentralized technology development and planning	Strengthening systemic capacity to innovate
<b>Role of policy</b>	Set priorities and allocate resources for research	Set priorities and allocate resources for research	Set priorities and allocate resources for research in Consultation with different stakeholders	Integral part of innovation capacity. Strengthening enabling environment and support system coordination

Resource: Hall(2007)

**CONCLUSION**

Science, technology and innovation policy has equated rural development to agricultural development. With the growing diversification of rural livelihood options into non-farm activities and with the increasing interconnectedness of rural areas and activities to the global environment, a new rural economy is emerging. This is bringing with greater pressures on farmers, companies and governments to innovate in response to, for instance, rapidly changing pattern of competition and market and trade standards. So ideas of what constitutes “research capacity” have evolved, along with approaches for investing in the capacity to innovate.

To enhance innovation capacity, it is necessary to invest in learning and capacity building, provide incentives that allow actors to put new

skills into use, and also nurture new attitudes and practices. Programs that encourage greater openness in organizations to collaborating with diverse formal and informal actors, introduce organizational and managerial innovations within organizations, or strengthen individual and organizational incentives to develop innovative capacity, should be considered.

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