An ISNAR Perspective to 2020: Emerging challenges and new opportunities for addressing the CGIAR goals of alleviating poverty, hunger and malnutrition through agriculture, forestry and fisheries related activities

"Technological or institutional innovation: implications for the agenda and the organization of agricultural research"

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Agricultural developments in the last decade

Agriculture is undergoing rapid changes in developing countries. In Asia, Latin America, and Africa many poor farmers carry their radio with them to the fields and listen to the latest world news and music on commercial radio stations. Electricity in rural areas has given many villagers access to TV. Even in poorer areas, radios are common. Indigenous knowledge is resting with the older generation, and young people are enthusiastically taking up new things. Many young men are migrating to find work in towns and cities, leaving women in charge of the farm. A rising portion of the farmers is female and works part-time. The HIV/AIDS pandemic is taking a heavy toll on young adults, leaving the very old and the very young.

Global staples have fallen in price during most of the last 20 years, and food shortages are more often caused by wars, political instability, and poverty than by a lack of production capacity. Due to rapid growth in commercial and service activities and in industry, the production of food and fiber has fallen as a share of national income in most economies. In many developing areas, comparable numbers of people earn their living from processing and marketing agricultural products as from growing crops and raising livestock.

Worldwide, there are 750 million food insecure people, and many households have inadequate purchasing power to acquire sufficient food, even where it is available in local markets. Women and children are most seriously affected by food shortages. To overcome problems of food scarcity and malnutrition, food must become more widely available in developing regions.

Three agricultural challenges

Agriculture across the world is facing important challenges. These include globalization, trade liberalization, the redefinition of the role of government in society, and the shift – in particular in developed countries – from production and productivity concerns towards concerns for environmental protection, food safety, and food quality. Three groups of challenges deserve special attention.

1. Through the WTO, agricultural subsidies are being challenged and trade regimes are becoming increasingly open and competitive. If farmers are able to compete effectively, trade becomes an opportunity to escape from poverty. Trade, however, threatens the livelihoods of those who are not competitive, and the income-earning capacity of local farmers increasingly depends on their ability to compete in local, regional, national, or international markets with farmers that may live thousands of kilometers away. Competitiveness depends not only on the productivity of farmers, but also on the effectiveness of collaboration among farmers, traders, shippers, processors, and government. Market integration provides many opportunities and threats for farmers and traders.

2. The share of primary agriculture in the national production of many economies is falling. Agriculture is increasingly evaluated on other aspects than the food or income it produces. Not only do farmers become increasingly interested in urban society and better linked with the urban economy, but urban dwellers also become more interested in how rural life affects them. Agriculture is being viewed not only as a source of food and fiber, but also as a vehicle for maintaining natural resources and preserving biodiversity, and as an activity that can strongly influence human health. Agriculture is increasingly being linked to issues of food safety and climate change.

3. The technological base of agricultural development is also changing rapidly. Biotechnology is beginning to change the trades of crops and animals and their use. Genetically modified plants are now planted in Asia, Africa, and Latin America. Animals and fish are used to produce medicine or are being multiplied with the aid of biotechnology. Whereas biotechnology, breeding, and agronomy all have roots in biology, new information technologies have hardly any link with the traditional agricultural sciences. Yet, these new technologies have a radical effect on agriculture because of their impact on access to information across society. Traditional sources of technological progress in agriculture such as breeding and agronomy are often the vehicles for bringing the new technologies to fruition (e.g., for genetically modified organisms and precision agriculture). In other cases, they are surpassed by innovations that stand on their own, such as Web-based marketing and information exchange networks. Capitalizing on these new technologies is a third challenge for developing countries that aspire to agricultural development.

New insights on the drivers of development

An important insight that has emerged during the past 10-20 years is that economic progress is as much based on institutional as on technological innovation. While the CGIAR has focused primarily on technological innovation, it is high time that it gives considerably more attention to institutional innovation. Most technological innovations require a counterpart in terms of institutional innovation. The impact of improved varieties depends as much on plant breeding as on the development of a well-functioning seed market with sufficient quality control mechanisms, plant variety right legislation, etc. The introduction of genetically modified crops is also a good example where institutional issues (i.e., bio-safety, IPR) have become a critical bottleneck in the adoption of a new technology. More generally, the increased use of external inputs, which is inherent to many of the new technologies, requires well-functioning markets for farmers to sell their surplus and buy their inputs. The slow technological progress of African agriculture, for example, is often attributed to the lack or underdevelopment of markets. In areas like natural resources management, institutional issues have always received considerable more attention and innovations in this area are often more institutional than technological in character.

The state of the NARS

The realization that the base of agricultural development is shifting from technological to institutional development has important consequences for agricultural research. To start understanding these consequences, Table 1 reveals some interesting facts on developing country NARS in comparison to developed countries.

Table 1. *Public and private expenditures on agricultural research, mid nineties*

	Public expenditure (million 1993 PPP dollars)	Public intensity ratio (%)	Private expenditure (million 1993 PPP dollars)
Sub-Saharan Africa	1270	0.85	
China	2063	0.43	
India	2104	0.49	
Other Asia	2515	0.83	
Latin America & Caribbean	1947	0.98	
Middle East & North Africa	1521	na	
Developing countries	11469	0.62	672
Developed countries	10215	2.64	10829
Total	21692	1.04	11511

Source: ASTI database.
Note: Private research expenditures include research expenditures in agricultural input, production as well as processing industries. Most of it is concentrated in the agricultural input and processing industries in developed countries.

Research intensity in the agricultural sector is lower in developing countries than in developed countries. There are positive exceptions, such as Brazil, Kenya, and

Zimbabwe, but these are compensated by negative exceptions, such as Ecuador, Nigeria, and others.

The second interesting phenomenon is the participation of the private sector. Private sector research investments appear to be still very limited in developing countries, which depend almost exclusively on the public sector. In the developed countries, both sectors participate almost equally. However, public and private agricultural research investments are hardly substitutes of each other. Moreover, the impact of research by the private sector is less location specific – a substantial part is exported to the developing countries.

The third interesting factor is related to the participation of universities as illustrated in figure 1. The developed country average is 43%, whereas no developing country approximates this figure. Developing countries separate research and education to a much larger degree than developed countries.

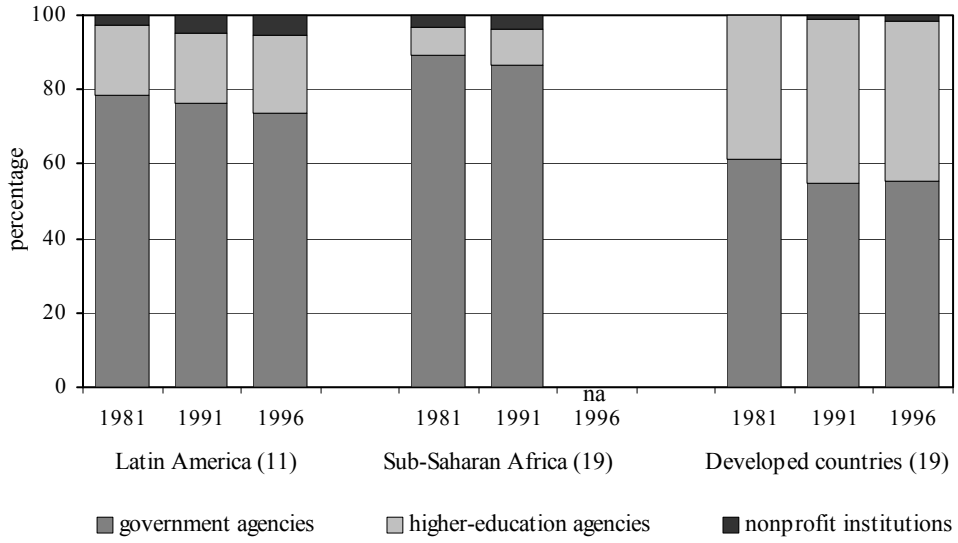


Figure 1: *The institutional orientation of public agricultural research*

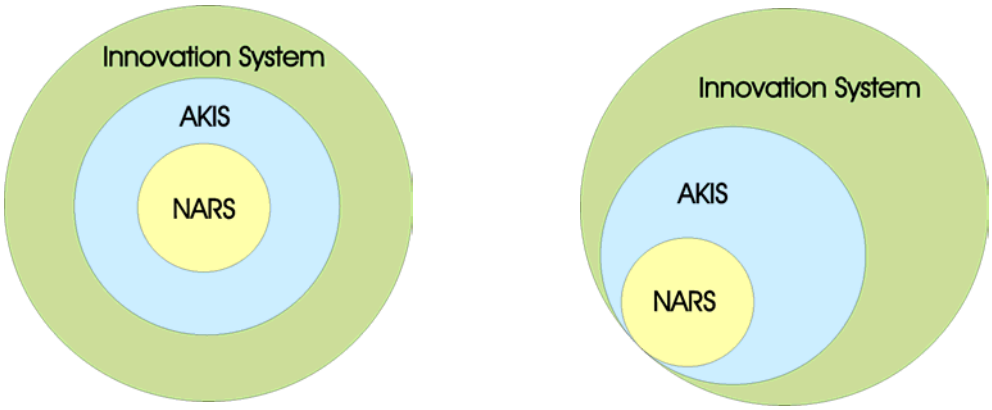
Figure 1 would suggest that the institutional structure of research systems in developing countries is less diversified and that this may constrain the ability to produce, but even more so to share new knowledge and technologies and to have an impact on development. In consequence, many NARS are trying to innovate themselves.

From research management towards innovation management

The greater emphasis on impact (and that on poverty, hunger and malnutrition in particular) is the reason why ISNAR has shifted its focus from optimizing the performance of agricultural research systems towards that of agricultural innovation systems. By adopting an innovation system perspective, quite different issues come into focus than when adopting a more limited NARS concept. By starting at the knowledge

application end, the question of why farmers innovate or why not becomes a major issue for debate and research. What are the bottlenecks that hold them back? Is it prices in the market, is it lack of (access to) technology, or are there other constraints? Are farmers passive recipients or do they actively search for innovations? What are the roles of input suppliers, cooperatives, traders, processors, NGOs, as well as government extension services in technology diffusion? What are the relative strengths and weaknesses of each diffusion channel? How can they be improved and what can be done to reach more farmers? In many instances, we may find out that the bottleneck is not only the lack of technology and that other factors may play a far more crucial role in explaining why the impact of our research efforts is so limited. By the way, ISNAR is not the only center that is taking this perspective. ILRI and CIAT are other Centers that have adopted innovation management based strategies.

The World Bank and FAO promote a third system concept, namely that of an agricultural knowledge and information system (AKIS). This system concept can be positioned somewhere in between the NARS and the innovation system concept as illustrated in figure 2a.



(a) (b)

Figure 2: *Linking NARS, AKIS, and the Innovation System*

While each of the three system concepts has its own strengths and weaknesses, they can be seen as interlinked and well as follows: the NARS concept focuses on the generation of knowledge, the AKIS concept on the generation *and* diffusion of knowledge, and the innovation system concept on the generation, diffusion *and* application of knowledge.

The problem with figure 2a is that it still depicts research as the sole source of innovation. Without research, there is no innovation. We are still held hostage by our linear thinking. Another way of depicting the link is shown in figure 2b. The NARS is no longer seen as the epicenter of innovation but considered one of various sources. Knowledge and information may spill into the innovation system from other sources than the NARS, and, perhaps even more crucially, knowledge and information may emerge

outside the realm of formal research because of on-farm as well as off-farm learning (way up and down the agricultural production chain) by doing, using, or interacting. Particularly institutional, organizational and managerial types of innovation have more their origins in on-site learning processes rather than off-site formal research. These forms of innovation are also far more difficult and complex because you cannot experiment and fine-tune them off-site.

One of the difficulties that ISNAR encounters when preaching an innovation system approach is that traditional agricultural research organizations feel very uncomfortable with it because it expands their agenda beyond their present capabilities. The knowledge and expertise on institutional innovation is very limited not only among NARS, but also among the CGIAR centers. In that sense, even the current request for inputs into a new CGIAR strategy jumps straight into an inventory of S&T demands. However, if we want to achieve more impact we have to pay attention to both technological *and* institutional innovation.