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The Role and Function of Agricultural Extension

Towards a New Paradigm

Over the past few decades, central governments of most countries have curtailed their direct involvement in agricultural extension. In industrialized countries, advisory services[(4)] have been "privatized", and farmers, as clients, have to pay for most extension activities. In developing countries, there has also been a move to privatize, outsource or regionalize extension and to demand that farmers pay for services, which in the past were provided free-of-charge by governmental agricultural advisory services.

Under these circumstances, it is only natural that farmers who have to pay for services should have a voice when extension goals and means of delivery are discussed. Thus " " extension becomes " " or " " advice. Agricultural advisors have not only to bring relevant knowledge and practical solutions to farmers; they must also ensure that farmers' problems are brought to researchers, who can work towards feasible and economical solutions. Agricultural extension is becoming more pluralistic, with different actors concurrently using different approaches and extension methods. Hopefully, this pluralistic approach will lead to a generation of custom-made, environmentally-friendly and economically sustainable solutions based on farmers' involvement in agricultural innovation systems.

At the same time, different environments demand different solutions. Where soils are poor and depleted, as in many parts of Africa, fertilization is an urgent need. In regions with moderate fertilizer usage, an improvement in nutrient management hand in hand with other practices is required.

In the past, private advisors could be paid only by wealthier, more prosperous farmers and by corporate farms. With the trend towards privatization, the roles of public and private (commercial) extension has had to be redefined. Umali-Deininger (1997) suggested that where the knowledge being communicated is embedded in, or closely associated with, market goods (e.g. tractors, hybrid seeds, fertilizers etc.), the delivery of relevant advice can be left to the private sector, within an appropriate regulatory framework. However, where the technology or practice being promoted is associated with a toll good (such as farm management or marketing information), the delivery of extension advice is best handled by a judicious combination of public and private entities. If a common-pool good (such as soil, water and air resources, community forests, fisheries, common pastures etc.) is involved, it is highly beneficial to connect the advisory activities closely with cooperative or voluntary action. Where market and participation failures are high, for instance where subsistence farming dominates, a public sector approach to agricultural extension is required.

In any of these scenarios, it remains the responsibility of the government to ensure that agricultural advisory services adhere to quality standards, which should be clearly stated in the contracts provided by chosen extension providers.

The Role of the Private Sector

Private sector extension existed long before governmental extension systems were heavily curtailed, leaving a vacuum in many areas.

Four groups of firms provide the majority of private extension services:

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1. Private (individual or corporate) extension firms. Private extension firms often hire the best public extension services advisors, as they are able to pay more than the State and provide better working conditions. Sometimes, a public sector authority contracts a private party to join it in a public-private partnership (PPP) consortium. In other cases the government outsources its former extension responsibilities to a private firm. And in other instances, extension agents “set up their own shop”. However, the need to work hard to make the business profitable can prevent them from acquiring newly emerging know-how. Therefore, some kind of quality control or certification by the State is required.
2. Factories that process farm produce into higher value products, e.g. canned, dried or frozen foods. These factories contract farmers to follow strict production methods. In return, the factory offers extension advice and guarantees to buy the produce, often guaranteeing a minimum price. The factories employ highly trained and experienced extension agents.
3. Farm input supply firms (selling fertilizers, seeds, pesticides, feeding stuff, implements and other supplies). These agro-dealers often include pre-sale advice and sometimes ongoing extension advice as part of their services. They have the advantage that their personnel can specialize in a specific field of knowledge, compared to the field extension workers of public extension providers. In the past, advisers in official extension services often viewed input supply dealers, and the private sector generally, as competitors, who had only their narrow business interests in mind. However, where joint knowledge platforms with other stakeholders have been set up, this negative attitude has disappeared. Input dealers with ethical standards can play an important role in the building of trust between them and farmers.
4. Marketing chains often indicate what produce they prefer (e.g. organically grown vegetables) or what specified product might get a higher price. This kind of advice is less obligating than the instruction of food processing firms, but it informs farmers about up-to-date market trends.

Training Modes and Models

While subject matter specialists in advisory and related services are able to use scientific publications and contact applied research institutions in order to update their specialist knowledge, input dealers and enterprising farmers need training to access these sources. Special attention should be paid to the training of lead farmers, who are known to influence other farmers and can serve as multipliers of relevant agricultural knowledge and practices.

The most effective and economic means to spread specific extension messages is through campaigns, using well publicized meetings at demonstration plots and appropriate mass media. However, such campaigns should not replace regular training for developing a deeper understanding, for example, on the roles that fertilizers play in plant husbandry.

Descriptions of relatively recent training schemes for input dealers in Ghana, India and an introduction to Farmers’ Field Schools are described in Appendix I.

Assessing the Impact of Agricultural Extension

Agricultural advisory services are under an obligation to demonstrate that they have made an economic and social impact on the well-being of the farmers they serve, mainly through the quantitative and qualitative enhancement in crop productivity and in farmers’ net income. This impact should be environmentally and economically sustainable.

Although hundreds if not thousands of agricultural extension services and

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projects have been developed since the end of World War II, only in rare cases has a rigorous attempt been made to assess the economic return or the impact of extension efforts on farmers' productivity and income. Project completion reports cannot be counted as impact evaluation, because they do not study what happens after the external project funding has ceased and local authorities are unable to afford the cost of impact evaluation. Too many agricultural development projects that were funded by international aid agencies failed in the end, because the developing country could not afford the expenses after the donors ended their financial support.

In addition, it is extremely challenging to find two groups of farmers who are "equal" enough to set-up a controlled experiment. Models developed for experiments with genetically identical plants are not necessarily suitable for measuring human behavior. Trying to differentiate between the separate contributions of research and extension to a new agricultural practice is very problematic. Furthermore, a rise in productivity could be the outcome of many factors: Extension interventions, different levels of farmer's education, better market opportunities, availability and low prices of inputs, optimal weather etc. The nature of agricultural extension interventions makes randomization difficult. Several meta-studies have shown different types of biases in the selection of the samples (Romani, 2003).

In spite of these challenges, various economic models for assessing the impact of extension have been developed and used mainly in high income countries. However, meta-studies have shown that these impact studies were either designed to be statistically rigorous, but with limited scope, or comprehensive, but with limited coverage (Waddington 2010). At present, a major "International Initiative for Impact Evaluation" (acronym: 3ie) is making a major effort to develop more rigorous impact evaluation techniques. A draft report is expected to be released by the end of 2010. The recently founded Global Forum for Rural Advisory Service (GFRAS) is also working to develop a toolkit for evaluating extension systems.

Four meta-studies on the economic rate of return of extension projects are of special interest. Birkhaeuser (1991) identified 48 studies conducted in 17 countries assessing the effect of several aspects of extension, including knowledge diffusion, adoption of improved technology and productivity. Their analysis suggests that extension can have a significant relationship with these outcomes and, while only five studies from developing countries included estimates of the rate of return to investments, these suggest that rates of return to extension can be very high. However, the authors of the meta-study found that often there was an inadequate control for sample selection biases.

More recently, Purcell and Anderson (1997) assessed the impact of World Bank support to the development of national research and extension systems in the 1980s and 1990s. This study concludes that despite serious limitations in the systems receiving support, there have been significant positive outcomes of World Bank interventions. However, this study is also based on a review of project completion reports, rather than evaluation evidence.

Evenson (1997) found rates of return to extension greater than 50 percent for the majority of countries, but the rates varied widely.

Alston (2000) produced the extensive review of over 1,100 estimated rates of returns for the economic returns to investments in agricultural research and development. About half (512) of these were for research and extension combined, but only 18 were from extension-only investments. The meta-analysis showed an average rate of return of 47 percent for research and extension investments, while for extension-only investments the rate of return was 80 percent. The authors found that only a few rate of return studies had used a high quality methodology.

In the past, most of the economic models also tended to ignore long-term effects of extension, such as farmers' increased technical and communication

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skills and experience in decision-making. These factors can increase farmers' negotiation power in the market and thus also their income. Economic rate of return studies do not take into account important indirect benefits to "public goods" such as improvements in health and the environment, for instance when farmers spray less than in the past. For example, as a result of training, rice farmers in Indonesia, Vietnam and Bangladesh moved from prophylactic spraying against brown rice hoppers to Integrated Pest Management (IPM) and reduced the use of pesticides by 35-92 percent. In Sri Lanka, rice farmers trained more than five years previously in a Farmer Field School (FFS; Van den Berg and Jiggins, 2007) used only a third of the amount of pesticides used by the control group. Recent results on cotton from China, India and Pakistan indicate 34-66 percent reductions in pesticide use, while cotton yields rose by 4-14 percent.

Because of the weaknesses of purely economic impact evaluations, extension systems often use more sociological impact evaluations, in which farmers' experiences, expectations, opinions and other non-economic factors are considered. Pope (2007) suggest that for the more complex questions facing policy- and decision-makers, a myriad of other forms of evidence in the widest sense will potentially be relevant. These include qualitative research, non-trial based quantitative research and the observations of stakeholders and expert panels.

Lessons Learned from Project Failures and Successes

Unfortunately, many agricultural development projects financed by foreign donors, failed once donor funding ended, usually because national governments did not have the budget or the political will to continue. These projects were either too expensive for a developing country or they did not fit

the national development programs. Some lessons can be learned:

- Plan and execute a project within a budget that is affordable for the host country or region to continue activities after the culmination of the project.
- Coordination with the responsible civil servants should be carried out in the initial planning stage to explore how the project will be integrated into national development plans, after the project ends.
- Coordinate with those responsible for infrastructure development; there is no sense introducing export or perishable crops if the necessary infrastructure is not in place, or in the process of being developed.
- Set up a stakeholder "platform" involving farmers' organizations, extension officers, researchers, suppliers, credit banks, environmentalists and other stakeholders, who can be involved in planning processes as well as have an opportunity to learn from each others' knowledge and experience.
- Ensure that the project fits within national policy priorities (as long as they are morally defendable).
- Train local people at an early stage, which will enable them to lead the project as part of their national development plan.

All these will provide higher probability for success.

Synthesis on the Opportunities for IPI in Agricultural Extension

- IPI is a highly specialized entity that manages the knowledge of one specific plant nutrient: Potassium (K). As such, IPI plays a vital role in the optimized use of potash fertilizers by farmers, helping them to increase their income from agriculture. Appendix 2 features two accounts of successful involvement of IPI in extension intervention.
- K-fertilization is a vital part of balanced plant nutrition; however its assessment is complicated and farmers often fail to correctly recognize and attribute the beneficial effects of potassium.
- Balanced plant nutrition contributes to poverty alleviation through optimizing sustainable crop production.
- Spreading specific extension messages can be done through special campaigns, and capacity building

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aimed at dealers, advisors and groups of farmers who learn through experiments and frequent training.

Within this context, IPI:

- with its central role in the potash knowledge and information system, functions through regional coordinators, who mediate between farmers' needs, researchers' findings and the interests of other stakeholders (e.g. extension providers);
- translates research results and field experiences into a set of "best practices";
- conducts applied research to constantly generate validated results under different soil, crop rotation, climatic and socio-economic conditions;
- cooperates with existing extension field services, mainly at the level of subject matter specialists and at training institutions, in order to serve smaller farmers;
- emphasizes in-service training of trainers and farmers and long-term capacity building within its activities, in order to help build social capital;
- publishes scientific reports for researchers and subject matter specialists in extension organizations, popular articles for extension workers and literate farmers, and flyers using pictures to convey messages for non-literate farmers, especially those attending farm days and demonstration plots;
- strives to develop partnerships with other stakeholders for developing and participating in extension initiatives using advanced technologies to disseminate the messages widely.

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The paper "The Role and Function of Agricultural Extension" appears also at:

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Appendix 1: Successful Training Models

GADD: The Ghana Agro-Dealer Development Project

One of the central objectives of GADD is to provide capacity building to 2,200 agro-dealers. So far some 600 agro-input dealers have received their Basic Training Certificate and were recognized by the Ministry of Agriculture as certified agro-dealers. The certificate is awarded to those who attend a three-day technical and business management training course. In this short course, the dealers learn about traditional and modern methods of information delivery using ICT. Course participants learn how to obtain acreage intentions of farmers prior to a cropping season, to estimate from this data the input requirements and to convey these to the respective service providers. The dealers are encouraged to obtain information on the volumes harvested. Special attention is given to the setting up of sales points for the last-mile delivery of goods. These points should also serve as a first-mile request point for information, goods and services.

As another incentive, certificate holders have access to a loan from the Unique Trust Bank, which is guaranteed by the Ghana Agro-Input Dealers' Association. As a result, agro-dealers are able to "set up their own shop" or enlarge their business. GADD is working to increase the number of agro -dealers in rural areas so that farmers do not have to travel such long distances to purchase inputs.

DAESI: Diploma in Agricultural Extension Services for Input Dealers in India

The 280,000 Indian agro-input dealers have, on average, a higher formal education than their Ghanaian peers, but none are trained in agriculture. Generally, Indian dealers also have useful information on market conditions and credit opportunities. However, these dealers have insufficient knowledge on the laws relating to handling agricultural inputs and agriculture generally, and even less about agricultural extension. Yet, agro-input dealers often have closer contact with farmers than extension advisers. With this context in mind, MANAGE - the National Institute of Agricultural Extension Management in Rajendranagar, Hyderabad - has initiated a special one-year diploma course for input dealers who had 12 years of education (many of these have a university degree, but not in agriculture).

The course methodology is based on a Distance Education mode with classroom interactions and field visits on 48 Sundays. Course participants are supplied with study materials; they use multi-media instructional devices and receive support from resource personnel.

The DAESI course covers four blocks:

1. Agro-climatic conditions; soils and soil analysis; Integrated Nutrient Management; manures and fertilizers; crop production technology for all crops grown in the district, including high-value horticultural, vegetable and floricultural crops; plant protection with an emphasis on Integrated Pest Management; farm mechanization.
2. Extension and communications methods (demonstrations, field trials, exposure visits and farmers' training); mass media (the role of radio, TV and print media; information technology and cyber extension).
3. Principles of business management, business ethics (creating a "win-win" relationship with farmers), financial management, and community organization. More recently, the importance of meditation for mind control and thought processes have been added.
4. Laws relating to seeds, fertilizers, pesticides and other agricultural aspects, as well as Acts on consumer protection.

The organizers of the course expect that course participants will develop the technical capacity and communication skills to be able to impart appropriate technical advice to farmers. At the same time, diploma holders should be aware of their regulatory responsibilities.

The course is evaluated by conducting six bi-monthly tests, half-yearly and annual examinations with questions requiring descriptive answers and a final practical examination consisting of skill demonstration. Course participants have to maintain a record book for all practical classes. Those participants who successfully complete the course receive a Diploma

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in Agricultural Extension.

The DAESI program is constrained by the course fee of 20,000 Rupees (approximately US$400) - a large sum for small dealers in rural areas of India. Financial support is sought from the government, and multi-national companies who employ local dealers. A further concern has been expressed over whether it should become compulsory to have a diploma before one obtains a license to become an agro-dealer. In a national workshop held in 2005, the individual responsible for extension in the Indian Ministry of Agriculture expressed his opinion that this issue should be reviewed after training 30-40 percent of dealers. So far, 1,500 agro-input dealers (5.3 percent of the target group) have received the Diploma in Agricultural Extension. As a next step, all State Agricultural Universities are expected to offer the DAESI course and use its reference materials. This could also help to lower the course fee.

Farmer Field Schools (Van den Berg and Jiggins, 2007)

Farmer Field Schools (FFS) were first developed in 1989 in Indonesia to train farmers how to control the main pest in rice ( ), using Integrated Pest Management methods. Groups of farmers meet once a week in one farmer's field to discuss their observations. Farmers are supported by professionals, but also encouraged to learn from peers and to develop their own experiments. By 2005, FFS programs had been initiated in 78 countries with a total of around four million graduates (90 percent in Bangladesh, China, India, Indonesia, Philippines and Vietnam). Over the last 15 years, the FFS approach has been adapted to other agricultural commodities, soil fertility management, aquaculture and others. The educational approach is interesting because unlike most extension practices, farmers are not "told" what to do; farmers learn from each other, under the guidance of an extension adviser.

Appendix 2: Success Stories of IPI Involvement in Extension

The Transfer of Technology by an IPI Project in India Helped Farmers to Improve Yield and Profits

Although only covering two percent of the geographical area of India, Punjab state contributes more than 50 percent of the country's food grain. As a result of highly intensive agriculture with 186 percent cropping intensity, Punjab soils are now under fatigue and multiple nutrient deficiencies are emerging. Farmers in Hoshiarpur district of Punjab are growing three crops in maize-pea (green)-sunflower rotation. Soil test reports of this area show that 78 percent

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of soils are low to medium in available potassium (K). With the exception of potato, almost no K is applied to any crop. The application of negligible amounts of K is considered as one of the major constraints on higher production of crops in the area.

IPI in collaboration with Krishi Vigyan Kender, KVK (Agricultural Science Centre) of Punjab Agricultural University decided to lay out demonstration cum research trials at KVK farm Bahowal (Hoshiarpur) and in farmers' fields in different villages. The demonstration at KVK farm acted as a nodal point for showing farmers the benefits of K application on crop growth and yield. In addition, various presentations and sessions regarding the role of K to improve yield and quality were delivered by the IPI Coordinator for India in collaboration with partners. Experiments conducted in the farmers' fields acted as a catalyst for the adoption of the technology by farmers visiting the demonstration plots and seeing the results, as they were then convinced about the usefulness of K application to crops.

The results of the experimental cum demonstration plots showed that on average the sunflower yield increased from 10 q ha^{-1} (without K) to 15 q ha^{-1} with the application of 60 kg K_2O ha^{-1} (a 50 percent increase). Similarly, oil yield increased from 4.2 q ha^{-1} to 6.4 q ha^{-1} and the benefit to cost ratio was 14.7:1.0 with farmers obtaining extra net return of Rs. 6,840 per ha (US$150). The results were so encouraging that Punjab Agricultural University included the application of 60 kg K_2O ha^{-1} to sunflower in its book "Package of Practices for Crops" for the benefit of farmers.

The maize grain yield, on average, increased from 40.9 q ha^{-1} (without K) to 47.5 q ha^{-1} with the application of 60 kg K_2O ha^{-1} (a 15 percent increase). The benefit to cost ratio was 12.9:1.0 and farmers achieved an additional income of Rs. 5,940 per ha (US$130). Between maize and sunflower crops, farmers were encouraged to grow an extra crop of (green) peas. The peas are sold as green pods and farmers receive a good return in a short period. Farmers do not normally apply K to green peas. However, there was a substantial increase in the yield of fresh pods with the application of K, which not only improved the yield of fresh pods from 35.2 q ha^{-1} to 41.1 q ha^{-1} (a 17 percent increase), but also increased the length and development of the pods thus fetching a higher price for the produce and providing a higher profit to the farmers. The benefit to cost ratio was 15.3:1.0 and farmers achieved an additional income of Rs. 7,080 ha^{-1} (US$157). The project is an excellent example of how farmers can benefit from technology transfer using extension methods implemented in their fields.

An Extension Success Story from Southeast Asia in which IPI is Involved

This is a case-study of a Filipino rice farmer, Mr. Johnny Tejeda, who took the risk of deviating from the traditional method of applying fertilizers by practicing site-specific nutrient management (SSNM), a new way of applying fertilizers. In 2007, IRRI scientists led by Dr. Roland Buresh, in collaboration with Dr. Greta Gabinete, a professor at the West Visayas State University, established an SSNM demonstration in Johnny's and a neighboring rice field for farm validation. An individual demonstration plot was 100 m². According to Johnny, while the experiment was on-going, he quietly imitated the SSNM practice in the remaining larger portion of his field of about 1.2 ha. His farm neighbor, an agricultural technician, told him that SSNM validation experiments had worked in other villages. This farm neighbor gave him the SSNM recommendations. Trusting his farm neighbor, he took the risk because of the rising prices of fertilizers, the increasing cost of living, and the opportunity to improve his rice yield.

"When I first practiced SSNM in the 2007 wet season, I was not able to sleep well for around ten days after my first fertilizer application. I observed that the color of my rice plants was not green and they were not growing well compared to most farmers' fields; although, growth and color of the leaves were comparable with the neighboring SSNM demo plot and the experimental plots in my field. Before I slept, I kept on thinking and wondering why it seemed that there was no fertilizer response on my rice crop. I was really frightened and anxious that my crop might fail. So, within those ten days, I was uneasy and kept moving around the rice fields in the village, comparing the growth of the rice plants. But ten days after the second fertilizer application, I was so amazed because the growth stand of my rice crop was far better than those farmers' fields not applying the SSNM recommendations. The stems were so hard and the roots were so deeply rooted. Also, my plants were not infested with pests and diseases and did not lodge. Those plants that had accelerated growth and bright green leaves after the first fertilizer application had lodged long before harvest and were infested with pests and diseases. I realized that SSNM enabled the rice crop to take a balanced food or diet before "vitamins" or urea were supplied."

Typically, in Southeast Asia, SSNM can increase rice yields by at least 10-30 percent. More similar projects are needed, using the same model of science-based research, validation, and large-scale dissemination. ■