A Meeting of the Minds: Farmer, Extensionist, and Researcher

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Abstract
This paper constitutes a formative look at how local knowledge and western science, both social and natural, might be integrated for the benefit of smallholder agriculture in developing countries. The question addressed is: How can research and extension be more responsive to the needs of local farmers and what are some possible elements of a responsive approach? A comparison of local knowledge and western science is given. Constructivist, experiential learning approaches such as Participatory Technology Development (PTD), Participatory Rural Appraisal (PRA), Farmer Field School (FFS) and Promoting Farmer Innovation (PFI) that use the farm as a learning system and farmer-driven on-farm trials are among the qualitative and quantitative methodologies that can contribute to the knowledge and needs of researchers, extensionists and farmers. Using case studies from East and West Africa and a review of the literature, this paper addresses issues related to strengthening effective linkages between farmers, extension professionals and researchers.

Keywords: Experiential Learning, Farmer-Extension-Research Linkage, Local Knowledge, Participatory Technology Development
Background

Along with constructivist, experiential learning of agriculture and natural resource management in higher education institutions, innovative pedagogy is needed in the meeting between researcher, extensionist and farmer (Doolittle & Camp, 1999; Van den Bor, Bryden, & Fuller, 1995). Farmers’ knowledge and experience, the farm as classroom and laboratory form elements of a constructivist approach to learning.

In a study of Sahelian countries by CILSS and Devres, Inc. (1984) poor linkages between researchers, extension services and farmers were cited as major constraints to enhancing agricultural development in Africa. It recommended agricultural professionals to improve their understanding of and communication with farmers. Twelve years later, a study of Sub-Saharan Africa by Wallace, Mantzou, and Taylor (1996) found that higher education and non-formal training both lacked dynamism and were often isolated from research and extension as well as from the “rich learning resources” inherent in local communities. Despite massive financial investments, agricultural education and training was unresponsive to changing realities in rural economies. The authors argued, among other things, for closer integration of agricultural research and extension. They recognized exceptions but noted a general ignorance of the needs of vulnerable target groups, adult learners, local production systems and indigenous knowledge. This view is shared by Freire (1997), who relates how as a consultant for the Chilean Ministries of Education and Agriculture, he came away from field visits impressed with how much more the peasants knew than the experts.

Integrating Local Knowledge and Western Science

To date, the roles local men and women play in preserving, developing, promoting and practicing local knowledge are not sufficiently incorporated into development policies and practices. A fundamental feature shaping world development has been the faith that science can find technological solutions for most problems. Science has brought spectacular successes to humankind, not least in agricultural production and productivity. However, there is now a general recognition that many problems have arisen as well. Pests and diseases are becoming more resistant to chemical treatments, food production increases through technology packages have not necessarily benefited the very poor, and other technological advances have led to pollution and environmental degradation. In short, western science by itself does not sufficiently accommodate all the realities of those affected (Brokensha, Warren, & Werner, 1980; Molteberg & Bergstrøm, 1998; Warren, Slikkerveer, & Titilola, 1989).

Indigenous and local knowledge is location-specific, based on close personal observation and experience over generations. As Sillitoe (1998) argued, local knowledge is generally conditioned by one’s socio-cultural contexts. It is also embedded in value, production and consumption systems, as well as ways of relating to the natural environment. Local knowledge is generally transmitted orally from one generation to the next and the concept of “Mother Earth” is central. Western scientific knowledge on the other hand is generally perceived as analytical, impersonal, universal, logically deducted from self-evident principles and transmitted in written form (Häusler, 1996). Table 1 displays dichotomies between local knowledge and western science.
Table 1

Comparing Local Knowledge and Western Science

<table>
<thead>
<tr>
<th>Local Knowledge</th>
<th>Western Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Oral tradition</td>
<td>• Written tradition</td>
</tr>
<tr>
<td>• Learned through observation and hands-on experience</td>
<td>• Taught and learned abstracted from the applied context</td>
</tr>
<tr>
<td>• Holistic approach</td>
<td>• Reductionist approach</td>
</tr>
<tr>
<td>• Intuitive mode of thinking</td>
<td>• Analytic and abstract reasoning</td>
</tr>
<tr>
<td>• Mainly qualitative</td>
<td>• Mainly quantitative</td>
</tr>
<tr>
<td>• Data generated by resource users (inclusive)</td>
<td>• Data generated by specialists (exclusive)</td>
</tr>
<tr>
<td>• Diachronic data (long time-series on one location)</td>
<td>• Synchronic data (short time-series over a large area)</td>
</tr>
<tr>
<td>• Environment part of social and spiritual relations</td>
<td>• Hierarchical and compartmentalized organization</td>
</tr>
<tr>
<td>• Based on cumulative, collective experience</td>
<td>• Based on general laws and theories</td>
</tr>
</tbody>
</table>


There is growing recognition that the value of local skills and knowledge built up through the centuries and honed by harsh natural environments could, in combination with modern science, be a key element in devising workable decisions on research and extension interventions.

How Can Research and Extension be More Responsive to the Needs of Local Farmers and What are Some Possible Elements of a Responsive Approach?

A judicious integration of local knowledge and western science can lead to improvements in agriculture and natural resource management. Onduru, Gachini, and Nandwa (1998) provided an interesting example from Kenya. Small farmers from both high and low potential areas and researchers from the Kenya Institute for Organic Farming (KIOF) and the Kenya Agricultural Research Institute (KARI) worked together to diagnose local soils. They used Participatory Technology Development (PTD) approach which involved the major stakeholder stakeholders, including farmers, researchers and other end-users in the research and development process. Using quantitative and qualitative methods in an approach that included both social and natural sciences, a participatory soil diagnosis was carried out with selected farmers in Nyeri and Machakos.

Four main steps were employed in the participatory soil analysis carried out by KARI, KIOF, and local farmers. First, to encourage good two-way communication with farmers, the researchers were trained in the use of Participatory Rural Appraisal (PRA) techniques, including visual-aids for making objects, abstractions, and system linkages comprehensible. Second, an inventory of farmers’ knowledge through transect walks with selected farmers led to maps that delineated and colored all soil types according to the farmers’ own knowledge and typology. These soil types were qualitatively analyzed using pair-wise and matrix ranking based on the farmers’ views on relative importance, use intensity,
crops cultivated on them, as well as positive and negative attributes. Third, the researchers conducted quantitative soil analysis for each of the soil types identified by the farmers to assess the major nutrients, organic matter content, and soil pH. Colored bar charts were made depicting soil nutrient conditions for each farm and symbols were used to represent symptoms (e.g. stunting, purpling, chlorosis, etc.) of deficiency or sufficiency of nutrient elements. Finally, each farmer’s own colored soil map from step two was compared to the researchers’ analysis visualized in the colored bar charts from the step three. Data for Nitrogen, Phosphorus, Potassium, Organic Matter, and pH were presented for all soils identified by the farmers. Farmers and researchers jointly discussed the results and implications of their respective soil analyses. A number of recommendations on how best to resolve nutrient deficiencies were suggested and compiled by both farmers and researchers.

This participatory soil diagnosis clearly showed that there was considerable correlation between the results of the two. It was concluded that although farmers use qualitative means to diagnose their soil types, they generally know the types and nutrient status of their soils to ensure sustainable agricultural practices. For their part, the scientists were able to advice on new sustainable agriculture practices that would enhance farmers’ soils and production (Onduru et al., 1998). This process complemented and increased the knowledge of participating farmers and researchers.

These results are consistent with results of a seminal study by Richards (1986) that showed that African farmers have always been and continue to be great agricultural innovators and experimenters and that much can therefore be learned from them.

**Farmer-Extension-Research Links**

One of the challenging problems of agricultural development efforts in developing countries is ineffective working relationships between farmers, extension staff and researchers (Kaimowitz, 1990; Merrill-Sands, Kaimowitz, Sayce, & Carter, 1989; Zinnah, 1994). Linkage problems not only reduce efficiency, but also impair performance and the impact of agricultural research and extension services. There is the need to strengthen the linkages between these supposedly interrelated subsystems.

Studies on returns to investment in agricultural research and agricultural extension have been conducted in both industrialized and less industrialized countries. Most of these studies report high rates of return, probably more favorable returns than on other investments in agriculture, such as irrigation (Pinstrup-Andersen, 1982; Ruttan, 1982 in Van den Ban & Hawkins, 1988). Studies of the economic returns to investment in agricultural extension across several continents—Africa, Asia, Latin America, USA and Japan—have consistently shown positive results on agricultural production and productivity, especially where farmers have access to education and new technology, and strong linkages between national research and extension programs (Bindlish & Evenson, 1997; Evenson, 1997). However, a study by Evenson (1986) found that investments in agricultural research did not increase the returns on extension investments in less industrialized countries because of an often poor linkage between research and extension in those countries.

There is a tendency for government extension services to provide traditional types of rehearsed, production-oriented, technical training approaches that are out of reach for marginal farmers. The approach is often top-down, with little effort to draw out local indigenous technical knowledge or to adopt “farmer-first” approaches. Commonly, the skills and information that would be of help to subsistence producers, rural women and part-time farmers get little or no attention. Many extension services still do not include emerging improved technologies
such as integrated pest management (IPM), agro-forestry, low external input farming (LEIF), and integrated aquaculture that contribute to sustainable livelihoods (Chambers, Pacey, & Thrupp, 1989; Doppler & Maurer, 1992; FAO, 1992; Wallace, 1986).

Recent extension approaches such as Farmer Field Schools (FFS) and Promoting Farmer Innovation (PFI) that emphasize experiential education, community development, and organizational issues have galvanized a great deal of enthusiasm among farmers and development practitioners in a number of Asian and African countries (Anandajayasekeram, Davis, & Workneh, 2007; Critchley & Nyagah, 2000; David, 2007). However, there are disagreements about the advantages of these interventions such as the lack of a monitoring and evaluation system at the farmers’ level that both farmers and researchers find user-friendly and functional, how to bring research agencies more into the researcher-extension farmer triangle, high cost in terms of time and effort, and how to involve more women and youths into the process (Feder, Murgai, & Quizon, 2004).

Effective Communication
Research findings are useless if they are not communicated effectively, and research itself cannot be effective without two-way communication between farmers and researchers. Extension is meant to provide a key communication link here, conveying information about the farmers’ situation, the problems they encounter and their own experience with research (Van den Ban & Hawkins, 1988). Extension methods are those ways of communicating that are used for influencing farmers and researchers. The success of extension work, whether it is encouraging farmers to try a new technology or passing vital information from farmers to researchers and decision-makers, depends on good two-way communication (Simbowo & Campbell, 1992). Swanson (1997) also stresses the need for research and extension leaders and practitioners to develop the skills of listening in order to understand what farmers are communicating to them via informal and formal means.

Farmers are experts in their own eyes. If information presented does not relate to their experience-based knowledge and skills, it is most likely that the information will be judged as irrelevant. Therefore, communication with farmers should entail a process of bringing to light tacit knowledge, while at the same time generating a learning process in which new knowledge is created or generated through increased consciousness (Vedeld, Moulton, & Krogh, 1998).

New Competencies are Required
Just as the ability to convey technical skills will always be important, so will the extension officer’s social competence. Conceptual frameworks and theories on social construction and the enhancement of social organizations and institutions and participatory types of field work are of key importance in meeting the research and extension challenges of rural development. The capability to create common meeting grounds with rural men and women needs attention and improvement. Experience from research in Norway indicates that this kind of competence development must be based on making participants utilize their practical experience and knowledge in developing a better theoretical understanding of their daily work life. This takes time, and efforts should be made by researchers and extensionists to interact closely with rural dwellers in developing and implementing such learning processes (Vedeld et al., 1998).

Many authors concur with the need for new competencies for a new generation of agricultural professionals by emphasizing the need for conventional approaches to agricultural education, research and extension that reduce and divide knowledge into neat departments and disciplines and
then treat such knowledge as a dispersible commodity will need to be modified (Antholt, 1994; Knipscheer, Zinnah, & Mutimba, 2002; Sriskandarajah, Bawden, & Packham, 1989; Van den Ban, 1998; Zinnah, Steele, Carson, & Annor-Frempong, 2001). They argued that tertiary agricultural education institutions have critical roles to play in ensuring that the new generation of agricultural professionals, including researchers and extensionists, acquire these emerging competencies and skills which include, among other things, the ability to: be critical and systems thinkers; work in participatory modes; diagnose clients’ needs effectively; listen to and learn from clients; communicate clearly; facilitate experiential learning; mobilize technical and political and other support; identify opportunities for training; work in a rapidly changing and complex environment with little supervision; and present practical options to clients based on sound agricultural practices.

The Farm as a Learning System

Reductionist education, research and extension approaches tend to separate knowledge into discrete components and distribute it as a commodity. But as some authors argue, research and extension should focus on the farm as a learning system because this enables them “to create new learning systems – new ways for them to learn how to create new sets of persistent relationships between themselves and the bio-physical and socio-cultural environments which surround them” (Sriskandarajah et al., 1989, p. 5). Each situation is unique and experiential learning is a necessary ingredient for designing new learning systems that will encourage co-learning relationships between the main players of the agricultural knowledge system-extensionist, researchers and farmers. Nevertheless, there are methodological challenges in developing learning systems. To overcome these challenges, Sriskandarajah et al. also recommended a shift from viewing farms as production systems that are constant victims of adverse environmental forces and constant threats to the environment, to viewing farms as learning systems in constant co-evolution with their environments.

In a similar vein, Christoplos and Nitsch (1993) opined that it is less important that the complexity of farming becomes a subject for research, than that it becomes a subject for joint reflection and action among farmers, researchers and extensionists and that the dialogue between them is strengthened. They argued that when this shift is realized, education, research and extension become complements of one process of learning, and knowledge ceases to become a commodity for transfer from researchers to farmers, and this ultimately results in mutual collaboration between co-learners. The Experiential Learning Circle in Figure 1, which is a modified version of Kolb’s (1984) seminal work on experiential learning as modified and adapted by Christoplos and Nitsch, Sriskandarajah et al. (1989), Veil (1996) and others, best illustrates the need to make experiential learning the main ingredient for enhancing co-learning relationships and meaningful linkages between researchers, extensionists and farmers.

![Figure 1. The experiential learning circle.](image-url)
Conventional, reductionism result-oriented training programs are usually measured by how the recipients or trainees are affected or influenced. Understanding-oriented pedagogy, on the other hand, is based more on mutual and open communication. A balance needs to be struck. Too much emphasis on result-oriented training risks closure. Important ideas and information will not be brought up and shared. Equally important, the agricultural professional’s competence may not be satisfactorily challenged and enhanced as it would when confronted by the knowledge, experience and criticism of others. Operating with and reflecting over the essence of “tension zones” can, in the experience of Vedeld et al. (1998), promote an understanding-oriented competence development. Table 2 illustrates dichotomies in themes and participants, the reflection on which may also contribute to a productive meeting of the minds involved in participatory agriculture and natural resource development actions.

Table 2

*Tension Zones between Different Dichotomies*

<table>
<thead>
<tr>
<th>Theory</th>
<th>Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural science</td>
<td>Social science</td>
</tr>
<tr>
<td>Modern knowledge and technology</td>
<td>Indigenous knowledge and technology</td>
</tr>
<tr>
<td>Exploitive use</td>
<td>Sustainable use</td>
</tr>
<tr>
<td>National policy</td>
<td>Local interest</td>
</tr>
<tr>
<td>Extensionist</td>
<td>Farmer</td>
</tr>
<tr>
<td>Researcher</td>
<td>Farmer</td>
</tr>
<tr>
<td>Higher education</td>
<td>Farmer</td>
</tr>
<tr>
<td>Higher education</td>
<td>Researcher</td>
</tr>
<tr>
<td>Higher education</td>
<td>Extensionist</td>
</tr>
<tr>
<td>Researcher</td>
<td>Extensionist</td>
</tr>
</tbody>
</table>


**A Simple, Scientific Farm Classroom**

Earlier in this paper, a participatory soil diagnosis in Kenya by Onduru et al. (1998) was presented. This section, which relies heavily on Mutsaers, Weber, Walker and Fisher (1997) and their experience from West Africa, provides some guidelines for running farmer-driven trials, in which the farmer’s own practical expertise is combined with simple Western science, contributing to the enlightenment of all participants, including farmers, researchers and extensionists. The objective would be to test the performance of external technology in comparison with the farmers’ own practices, on the farm and under farmer management. Researchers would help farmers with the external technology while not interfering with otherwise sound practices of the farmers. As for the technology, it should start with the elementary, that is it should not consist of more than one innovation, for example, a new crop variety or fertilizer applications to one crop. The target population for the technology needs to be defined and a representative sample of trial farmers selected, including women. A fixed and random sampling approach is used: fixed in the sense of defined categories, such as
women and/or villages, with random selection within such categories. Farmers should actively participate in formulation of hypotheses for and the design of trials.

Whatever the factor combination, single or more, the important thing is that farmers should be able to comprehend exactly what is being tested and be able to evaluate the results. Farmers’ own assessment of the trials is probably the most important evaluative element in such trials. Monitoring farmers’ adoption of new technology will indicate their conviction of its worth. Quality results and solid conclusions from the trials depend on the collection of good information. Mutsaers et al. (1997) recommend the following data set as the minimum necessary for farmer-run and farmer-managed on-farm trials: (1) Plot Level (stand counts at establishment, midseason and harvest, density of secondary crops, pest and disease scores (ordinal), weed scores (ordinal), repeated a few times, or number and times of weeding, shade scores (if applicable), crop yields, inputs which differ between treatments, including labor, and farmer assessment of treatments; (2) Field Level (depth of soil profile, soil texture (sandy, medium, heavy) at two depths: 0-15 and 15-30 cm, soil pH at 0-15 and 15-30 cm, slope and position on slope, crop management information which is not part of the treatments (date of planting, field history, land preparation, varieties, plant arrangement), and age and sex of farmer and origin (indigene or immigrant); and (3) Village Level (rainfall (daily, mm), prices of inputs, wage rate during the season, output prices at end of season).

Conclusion: Challenges Abound

Innovative experiential approaches that successfully integrate local knowledge and western science, such as Participatory Technology Development, Participatory Rural Appraisal, Farmer Field School, Promoting Farmer Innovation, farmer-managed experimentation and the farm as a learning system have been very useful in various developing country settings. They contribute to the knowledge and needs of researchers, extensionists and, not least, farmers. As such, they should continue to be promoted and evolved. However, even the best methodologies will have little impact if the national policy environment is non-conducive to agricultural and rural development. Education, extension and research are but components of a larger structure. Issues such as land tenure, access to credit, inputs and markets, gender anomalies and structurally adjusted budgeting all affect the performance of agricultural development efforts.

In many African countries, the national extension services are so run down that they often neglect the poorest. The need for requisite funds and manpower to make the services effective is urgent. Innovative approaches cannot flourish without strong, supportive institutions to serve them (El Feki, 2000; Øygard, 1999).

It is also vital to recognize that agricultural colleges and universities have a critical role to play in the process, especially by incorporating new participatory extension approaches into their academic curricula. Educating agricultural development professionals to enable involvement of farmers in joint validation and experimentation is innovative in itself. However, as Knipscheer et al. (2002) and Zinnah and Mutimba (1998) point out based on their work with selected universities and colleges in sub-Saharan Africa on an innovative training initiative for mid-career agricultural extension professionals under the auspices of the Sasakawa Africa Fund for Extension Education (SAFE) program, many challenges persist. Generally, there is a low level of formal training of agricultural extension staff in comparison to their research counterparts. Financial support from domestic sources for training programs aimed at strengthening effective farmer-extension-researcher interactions is scarce. Such responsive training initiatives are largely supported by external funds.
Inadequate facilities and motivation in universities stunt the promotion of innovative farmer-driven and learner-centered training and outreach programs. Current trends of deminishing budgets for tertiary institutions in Africa require that alternative, innovative, non-governmental sources of funding need to be developed if universities and colleges are to be more engaged in offering responsive, experiential and participatory extension training programs.

With better linkages between research, extension and the farm, Evenson (1997) estimates that it would be profitable for developing countries to invest about one per cent of the gross value of agricultural production in agricultural extension services. Even so, the lack of support resources may dictate that just as resource-poor farmers must adapt to their local environments, so must resource-poor extension services adapt to their local constraints.

References


