

# Working Document

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No. 21  
Farmer Processes of Experimentation  
and Innovation  
A Review of the Literature



FUTURE  
HARVEST

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# Farmer Processes of Experimentation and Innovation

## A Review of the Literature

### Introduction

‘Lay’ experimentation<sup>1</sup> in agriculture and natural resource management dates as far back as the stone ages. It has led to the domestication of today’s crops and landraces, to the development of numerous traditional agricultural practices, and to the existence of a substantial body (or bodies) of Indigenous Knowledge. Something is happening in the field; farmers are not passive. Their cropping patterns and genetic materials are in a constant state of flux. They discriminate what they need from what is less useful. They actively test new and different ways of managing their natural resources; and they continuously apply selective pressures on their crops, and test materials obtained from natural crosses, or from other farmers. Often all this is done without the participation of formal research and extension systems.

Indigenous Knowledge has been interpreted and represented (in the literature) in three different ways. The first, dating back to the colonial era, is the thinking that farmers’ knowledge and practices are ‘primitive’, based on superstition, unscientific, and hence basically wrong and needing correction. This perspective, although still held by many scientists, is slowly being discredited. In the early 1980s<sup>2</sup> some scientists began proposing that farmers’ practices are rational and that their knowledge and capacity can be an enormous and as-of-yet inadequately tapped resource in agricultural research. Key to this representation of local knowledge is the idea that it can be removed from its context and applied and replicated in different places in the way formal science is expected to. Many proponents of this perspective have scientifically validated indigenous knowledge or have sought similarities and complementarities between their knowledge and farmers’ knowledge. Naturally, Farming Systems Approaches and Participatory Research and Development are largely a product of this thinking.

A third interpretation of indigenous knowledge that has yet to gather widespread support in the development community is the idea that local knowledge is based on empirical experience and embedded in both biophysical and social contexts from which they cannot easily be separated without losing meaning (Scoones and Thompson, 1994). This representation asserts that the process by which indigenous knowledge is created is as important (if not more important) than the products of this research. Those who adhere to this view propose that indigenous research should be supported as a parallel and

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<sup>1</sup> This phenomenon has been given many names in the literature including, among others, farmers’ independent experimentation (FIE), local or farmer experimentation, indigenous, folk, or ethno-science, farmer innovation, local creativity, traditional plant breeding, farmer-led research etc. For the purposes of this paper I will stick to one term: farmer innovation and will be talking strictly about the activities that farmers engage in independently of the formal research sector.

<sup>2</sup> This thinking is new as a trend but its proponents, albeit isolated at first, date to the early 1900s.

complementary system to formal agricultural research (Bell, 1979; Berg 1993; Eyzaguirre & Iwanaga, 1996; McGuire et al, 1999).

Some participatory research projects, particularly those that use an ‘empowering’ style of participation attempt to do this. Their approach has been to enhance farmers’ capacities to experiment through training in basic scientific and organizational principles. These skills variably include problem solving ability, analytical dexterity, and communication capacity and are often geared toward adaptive experimentation and technology dissemination. In most instances however projects of this sort have superimposed a Western scientific method of inquiry over local innovators’ procedures (Bunch 1989; Settle, 1997; Okali & Sumberg 1997: 27) without first assessing local knowledge and understanding the processes that generate it. The possible outcomes of such interventions are the following:

- ✓ Innovative farmers recognize that what outside agents bring is very different (and possibly not even comparable) to their own practice and thus ‘play along’ or ‘participate’ but do not internalize nor adopt any elements of their message.
- ✓ Innovative farmers abandon their practices and start researching as they are taught by outside agents (researchers, extensionists, development practitioners etc.) in part because they see these agents as being more knowledgeable (and powerful) than they are.
- ✓ Innovative farmers adopt western scientific modes of research (or parts of it) adapting elements as they go.

In the three instances above, tangible results have been achieved and have had important impacts on the lives of the rural poor by helping them to adapt to their environments. However, the results do not encourage a sustainable process of innovation by farmers themselves (Shah, 1995). The inherent risk is that the benefit of the intervention only lasts as long as the technology being developed does, and that local processes of innovation are displaced. Instead, more significant contributions to farmers’ livelihoods may emerge from stimulating processes that are already present in rural communities. Unlike the first two representations of indigenous knowledge which imply replacing local processes, the third demands that scientists understand, stimulate and complement it.

This article maintains that to effectively and sustainably support farmer innovation the formal system should understand how it works; in what ways it is similar, and how it differs from our processes of knowledge development. The main issue at hand is whether local innovators’ procedures are significantly different to those employed by western-trained scientists. If they are, then “enhancing the capacity” of farmer innovators by introducing them to western scientific methods could effectively erode the procedures by which farmers have developed agricultural practices and genetic materials that are quite different (in form and value to human societies and to nature) to those being produced by formal research institutions. If farmers’ methods are not substantially different from those of formal research, it should be relatively easy to identify farmers’ skill and knowledge gaps, fill or complement them, and effectively partner with local innovators to speed up

and scale out the benefits of participatory research in technology development. Until now the question of the similarity or difference between western science and local science has been addressed by the ideological and theoretical leanings of scientists engaging with the issue, with little or no empirical evidence to back up their findings.

It is probable that lay experimentation is not completely different nor completely similar to western science, but similar and different in particular ways, that if understood could help us to find the right balance of interventions in supporting and complementing local innovation.

The objective of this paper is to review the existing literature on farmer experimentation in order to gain insights on processes of innovation at the local level and on possible ways of supporting this important sphere of activity. What is local innovation and who are the innovators? What is the process of local innovation? How is local knowledge socialized? What are the gaps in our knowledge and understanding about local innovation?

## **Literature Consulted**

The literature that addresses indigenous knowledge and its creation can be divided into three general groups:

- ✓ One asserts the existence, value, and legitimacy of Indigenous Knowledge and gives concrete examples of it. Within this group are found numerous works on local classification systems of plants and animals and detailed descriptions of farmers' natural resource and genetic management practices.
- ✓ A second group looks at farmers' experimentation during and after participatory research and development experiences in which one of the partners was a formal research institution.
- ✓ A third looks specifically at processes of Indigenous Knowledge creation.

The third group is the one of interest in this paper but unfortunately the scarcest. For this reason, I have also referred to the first group in which relevant passages were found. The second group has been purposefully omitted from this review as most participatory research to date has been led by formal research institutions and has employed western scientific principles and constructs. A notable exception is the body of Farmer-Led participatory research projects in which formal sector scientists participate in research initiated, planned and implemented by farmers.

### **I. What is local innovation and experimentation?**

An innovation can be a new material or tool (e.g. seed, hand pump etc) or a new way of doing something (e.g. crop rotation). The novelty need not be new to the world, nor to science but new to the contexts where they are being used. Thus a farmer who is for the

first time using a new land preparation method, crop rotation, crop variety etc. is an innovator. Experimentation is the process by which the innovator generates, tests and evaluates an innovation.

It is important to distinguish between different types of experimentation. It is quite different to test a new variety or solution brought from outside than to identify a problem and test various dissimilar, locally-generated options to solve it. It is also different to practice mass selection on a population of plants for generations. While the first two can be considered trials, the third is rather an active process of crop improvement. All three are research. The difference lies in the motivations, type of result sought, source of new ideas and in the methods used for inquiry. In this light, western science has been classified into strategic, basic/fundamental, applied, and adaptive research<sup>3</sup>.

Several authors have attempted to classify different types of farmer research. While some draw parallels to the classifications of western science, others outline separate categories for local research. For example Millar (1993) cites *curiosity, problem solving, peer pressure and adaptation experiments*. Biggs (1980) observes *yes/no trials* performed by farmers in order to determine whether an area of research is worth pursuing. Okali, Sumberg and Farrington (1994) distinguish between *proactive* and *reactive* research. Addressing crop improvement (recurrent selection) some authors such as Collins (1914) who writes about Pueblo Indian adaptation of maize varieties to arid regions and deep planting, suggest that it was a long series of *unconscious experiments* that led to the evolution and adaptation of maize. Also bearing on the type of research conducted, many motivations have been listed ranging from survival (Chambers and Jiggins 1986; Gupta 2000) and response to disaster, to social responsibility and peer pressure (Longley & Richards, 1993; Millar, 1993). In their recent study on farmer experimentation in Africa and East Anglia, Sumberg and Okali (1997) observe that the vast majority of local innovations (and, incidentally, of formal sector experiments too) are of an adaptive type. They seek marginal improvements on standard practice by testing variations of a limited set of elements that are either brought from outside or are already available in the system. In spite of the fact that practitioners have observed and been compelled to differentiate between types of local research, few go a step further to actually describe and distinguish the categories listed.

In his study on farmer experimentation in Cauca, Colombia, Patiño (1990) observed three general subjects of experiments conducted independently by farmers. The first and most common, representing 51% of the experiments in his sample had to do with trying new crops and new crop varieties. The second, representing 29% consisted in variations in fertilizer types, doses and frequencies. The third type of farmer experiment was on cultural practices (such as weeding frequency or land preparation method) and was

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<sup>3</sup> It is acknowledged that western scientific inquiry is not monolithic. Although most modern science is dominated by a positivist worldview, there are different styles and paradigms of science and research that can differ sharply in methods and principles. For an enlightening discussion of these please refer to Pretty 1994.

recorded to be 19% of the experiments in his sample. Patiño attributes the difference in frequency among these three types of farmer experiments to the levels of risk and investment involved in each. He also observes that the second type – fertilizers – is most commonly seen among wealthier farmers.

It has often been noted that the types of experiments that farmers conduct are limited by the small number of technological alternatives or options available to them. This has been the argument fueling the surge to increase the number of options/potential solutions available to farmers. In this vein many have argued that it is not enough to make research demand-driven. Instead, one of the ways in which the formal system can stimulate local innovation is by “widening the decision-making horizon of farmers” (Gupta, 1992: 395) or increasing the information available to farmers on possible alternatives. As we will see below, farmer innovation is more frequent and active in areas where natural and/or sociopolitical conditions provide options that farmers feel compelled to try.

Another often cited limitation in the scope of farmer innovation is what farmers are able to observe, or physically see with the naked eye. Bentley (1989) notes that Honduran farmers are far more knowledgeable about certain domains (i.e. plant species and phenology) than others (i.e. plant pests and pathogens) – the distinction being mainly the ease of observation. He concludes that farmers’ “information gaps” are in predictable domains (those that are difficult to observe) and that scientists and field workers could improve the quality of on-farm research by identifying and filling these gaps while using farmer knowledge to fill their own knowledge gaps. While Bentley’s observations seem cogent in the case which he describes, the existence of a vast and intricate body of indigenous medical knowledge around the world – often regarding ailments whose causes are not easily observable - challenges his argument about indigenous knowledge existing solely in observable domains. Farmers are often keen observers and while they may not see the ailment immediately with their naked eye, they often observe an indicator or a symptom of the problem. A particularly interesting view on the subjects of farmers’ experiments is that different farmers/ groups have access to and interest in different knowledge and subject domains. This will be discussed below.

## **II. Who are the local innovators?**

The identity of local innovators – whether they are individual experts or whole communities, male or female, better off or among the poorest varies greatly according to the cultural context and the particular case. It may also vary according to the researchers’ perceptions and definitions of experimentation.

### ***Individuals or groups?***

In some instances farmer innovators are reported to be individuals who are easily distinguished from the group. For example Gupta (2000) calls farmer innovators the ‘odd balls’ in their communities suggesting that they are a handful of farmers who are different

from the majority. In other instances local experimentation is universal or more widespread than a single individual or handful of experts. In the Peruvian Andes, Salas (1994: 63) reports that knowledge creation is a social process involving the community rather than an individual. Among small farmers in northern Ghana, Millar (1994) explains that the family experiments in consultation with neighbors and elders. Sumberg and Okali (1997) conclude that there is no evidence of a well-defined group of farmers who experiment but rather that most farmers do.

In most cases researchers have concluded that while the majority of community members do experiment, only a few specialize and/or are considered experts. Box (1986) and Franzen et al (1996) assert that while there may be widespread experimentation among farmers, only the few 'expert cultivators' are really innovating. Bayush (1991) states that whereas all farmers select seed, the level of sophistication in selection methods and criteria vary from farmer to farmer. Herein may lay the difference among types of experimentation. It may be that most farmers practice an adaptive type of experimentation trying out new seeds and imposing selective pressures on their populations, while those farmers who are recognized as being experts may be engaging in a type of experimentation that is more proactive in seeking new solutions to specific problems or constraints. Although this is plausible, the information in the literature is not detailed enough to confirm this hypothesis.

### ***Socioeconomic Status***

The socioeconomic status of farmer innovators varies greatly again from one context to another and from case to case. Are most farmer innovators those who can afford the time, resources and the risk to experiment? Or does necessity force poorer farmers to become innovators as well? As mentioned above, many of the poorest farmers in the world constantly experiment as a survival strategy. There is no doubt that this is so. However many cases have also been documented of wealthier farmers being the main protagonists in local innovation (Berg et al. 1991; IDS Workshop, 1980). Longley and Richards for example document experimentation in the Mende and Susu areas of Sierra Leone where the wealthier farmers - those who can afford the time, inputs and risk- are those who experiment. In Northern Shoa and Southern Wello in Ethiopia GebreMicheal (2000) found that most innovators are elders, richer, and full time farmers with an "ethic and devotion to the land".

Again it is very plausible that local experimentation is happening at a variety of socioeconomic levels. An important question to ask is what are the similarities, the interactions and broader applicability of the results of experiments conducted by richer and poorer farmers. Do they respond to the same constraints and target the same objectives? Do results flow easily/freely across socioeconomic barriers? Interestingly, de Boef and his colleagues (1993) observe that different individuals or groups have different degree of access to specific subject areas. Amanor (1993) says that richer farmers in southeastern Ghana experiment with varying levels of inputs while poorer farmers

experiment in natural resource management. Both of these works indicate that there is often an important distinction between the subjects and objectives of experimentation of different socioeconomic groups.

### ***Personal profiles***

In order to select farmers to take part in their participatory research, scientists often draw up lists of criteria that they find are key (Okali et al, 1994). Sometimes these criteria include personal characteristics like communication facility, innate curiosity, or patience that could be important character traits of an innovator. Do most farmer innovators have personal characteristics that fit within a range of personal descriptions or profiles? Is it possible to recognize an innovator by these profiles?

In an effort to identify and forge partnerships with local innovators, the Indigenous Soil and Water Conservation Program (ISWCP) in Tanzania created innovator profiles from which they drew the following generalizations (Kibwana, 2000 in ILEIA):

- most innovative farmers are motivated by a persistent problem that they want to solve
- most are inspired by their own ideas and curiosity
- most have some kind of recognition in their communities for their activities
- both better-off and poorer farmers innovate although the type of experiment varies according to the resources they can put into it. Many of the poorer innovators have improved their economic status through their innovations
- while most innovators are middle-aged men with families those who are the most innovative are men in their early 30s

While the literature does discuss various aspects and methods for farmer participation selection (Patiño, 1990), very few works look specifically at the personal profiles of farmers who engage in innovation without the intervention of formal scientists.

### ***Gender of local innovators***

Many researchers and development practitioners have thought that women may be the main protagonists in local innovation. Prain (1992:16) noted that “it is the observational powers of women who historically have been most associated with seed selection and therefore with noticing “new varieties” which spontaneously appear in the field”. Collins talks about the *corn matron* in the Pueblo Indian culture taking the lead in seed selection. In Southern Sudan, Berg (1993) found that women were in charge of selecting sorghum seed before harvest. Children – who are posted in the fields to scare birds and to harvest edible weeds and intercropped vegetables - and men also carefully observe sorghum heads throughout the cycle and inform the women of their options, however it is the women, exclusively who select seed. Richards (1986) notes that Mogueama farmers in northern Sierra Leone consult the women of the household before making the decision to sort planting material for the next season and that the women then supervise the harvest

to make sure that the sorting is done well (142). The same has been found in various parts of the world and for different crops (Bellon, 1995; Sperling et al. 1993; de Boef et al., 1996).

Realizing that the gender of researchers often affects the type of farmers and information a researcher can interact with, the Indigenous Soil and Water Conservation Program, after trying with their usual staff, and obtaining information exclusively on male innovators, decided to recruit and train 15 women researchers in order to identify farmer-women innovators. 31 women innovators were identified – most were over 40 year of age and illiterate. All of them were farmers but their experiments also encompassed other areas in which they work: animal husbandry, cropping, handicrafts, use of medicinal plants, efficient use of charcoal and improved stoves and milk processing (Nsar et al. 2000).

In acknowledging that innovation is gendered, it is important to ask the same questions as with the different socio-economic groups: are women's experiments different to men's? Do they address the same issues? Are results and information shared? etc.

## **II. Where and when is local innovation probable to occur?**

### ***Natural and Biological Conditions***

Rhoades and Bebbington (1995) have proposed that local innovators and active experimentation are most likely to be found in vegetative transition areas (where one biome meets another). Regions undergoing environmental change are also likely to have significant innovative activity. Although some authors argue that environmental crisis deals a blow to farmer innovation, areas undergoing degradation such as the vicinities of the Volta lake in southeastern Ghana (Amanor, 1993) and those hit by natural disasters seem to harbour innovation. In addition, areas that undergo extreme seasonal climate changes and places characterized by highly variable growing conditions (typically "marginal" areas) are also probable experimentation hot spots.

Biological factors also play an important role in stimulating farmer experimentation. It is not a coincidence that areas with a lot of biodiversity are often associated with indigenous knowledge. Writing specifically about farmer breeding, McGuire et al.(1999) mention the visibility of diversity to farmers, and a long/historical association with a crop (leading to greater knowledge and interest in breeding it) as factors that could spur interest in farmer breeding. Ironically although many mention it as a factor, scientists differ on the effect of crops' different reproductive systems on farmers' propensity to experiment with them. While McGuire and his colleagues assert that crops with low rates of outcrossing (i.e. self pollinating crops) are easier to work with and thus more likely to be the subject of farmers' experiments, Box (1986) attributes the low rate of farmer experimentation in rice in part to the complexity of its reproductive system.

Clearly a crops' reproductive system will have a bearing on farmers' interest, ability and success in breeding or adapting it; however it is not clear in which way. Are there more farmers experimenting with vegetatively propagated materials than with those that are reproduced by sexual seed? Are farmers more likely to take an interest in breeding self pollinating than cross pollinating species? While there is little information in the literature to answer these questions, it also should be considered that crops differ in aspects other than their mode of reproduction and nature of pollination. These different aspects – such as genotype x environment response, or mono-vs-heterozygosity - also have a significant influence on plant performance and breeding outcome and also it can be hypothesized, on the incidence of farmers' experiments with them.

### ***Socioeconomic and Political Conditions***

As with natural disasters, violent conflicts are thought to be associated or followed by a heightened interest in innovation due to the need to adapt to rapidly changing conditions (McGuire et al 1999). Gupta (1992) hypothesizes that experimentation is often a necessity for survival of new settlers and refugees who have moved from one environment to another. Experimentation is also likely to be found in areas where market forces are in transition (i.e. new opportunities opening or consumers changing preferences).

Many scientists have observed that the incidence of local experimentation is inversely related to the level of contact that farmers have with the formal research system. Some have argued that bringing the formal system closer to the informal system of research could stifle local experimentation (Box 1986: 87; Amanor, 1993; GeberMichael 2000: 17). This is a very controversial point that assumes an inherent fragility in local knowledge systems, which is not immediately credible regardless of the obvious power imbalances involved. It is an issue however that should be addressed and observed if we propose to strengthen local research capacities.

In a case study comparing cassava and rice farmers in the Dominican Republic, Box (1986) observes that experimentation is universal and continuous among cassava farmers whereas it is considerably less important for rice farmers. He attributes this difference to the minimal influence of the formal system in cassava improvement (and to the ease of vegetative reproduction) and to its strong presence in rice cultivation (and the higher complexity of rice breeding) where it has released several modern varieties and distributed them through the extension and credit system. Rice farmers according to his article do not experiment as much nor as consistently as cassava farmers (with the exception of poorer rice farmers who have not had access to modern varieties). Active farmer experimentation has been observed in many areas where the formal research sector has had little influence or success (McGuire et al 1999; Berg et al.1991).

It is important to note that in certain circumstances, particularly in cases where participatory research has been of a collegiate or empowering type, farmers are thought to have increased their rates of experimentation (Bunch & López, 1999). In some instances,

this can be an explicit objective of the research. Unfortunately there are few cases that have monitored this outcome closely and objectively. Valuable information that could be sought from cases that document an increase in farmer experimentation and innovation as an outcome of participatory research is whether farmers eventually modify the method or process of experimentation. If they do, in what ways do they change it? It should also be asked whether these changes affect the validity of the results in the perspective of formal trained scientists?

Another important socioeconomic and political condition that comes to bear on farmer experimentation – especially with genetic resources – are possible barriers to seed distribution and multiplication. Where enforced, restrictive policies and regulations (as well as biological manipulations) could slow down farmer breeding (McGuire et al 1999).

### **III. What is the process of farmer innovation?**

Does farmer innovation follow the same general principles of inquiry as western science? Do farmer innovators identify a specific problem or opportunity, collect existing information, formulate a hypothesis, design an experiment to prove it (or to disprove its converse), collect data, analyze the data and draw conclusions? How similar is the process of innovation at the local level to western scientific processes? An evident difference between the two systems of innovation that stands out in the literature is that farmers most of the time do not see their experiments as such. For them, experimentation is rather a part of normal every day activities on the farm and does not have much consequence unless the results show a clear improvement over their current practice (Patiño, 1990).

Many scholars believe that farmers' experiments have inherent differences to formal scientific trials, and are based on categories and constructs that are fundamentally different to western science (Chambers and Jiggins, 1986; Salas, 1994; Kronik, 1996). Longley and Richards like many others assert that indigenous knowledge is socially embedded and needs to be understood within its cultural context before it is decoded.

Taking a view characteristic of the rational (and functional) interpretation of Indigenous Knowledge discussed in the introduction of this paper, Sumberg and Okali (1997) argue that if local research is socioculturally embedded, so is formal research. However, they argue that what the two have in common is that they seek practical solutions to real problems (of poverty and environmental degradation) and hence the origin and framework behind the research, although they may be different, are not significant. This argument evidently bears the bias of value attributed only to (or in greater proportion) the products of research and not the process in and of itself. It is appealing for its simplicity but overlooks the possibility that one of the main 'intervention points' for formal science in helping to overcome poverty and resource degradation in a self sustaining and long lasting way is precisely in enhancing and encouraging local processes of innovation.

Another group of authors interpret farmer experiments as being quite similar to western scientific trials. For example, Millar (1994) compares the steps in farmers experiments to a generic conventional research method: problem definition, testable hypothesis formulation, experimental design, testing, validation, evaluation and use of results. These authors assert that while farmers' ways of performing some of these steps bear a resemblance in logic to western inquiry, some of the steps are implemented differently. For example experimental design among the farmers who Millar observed in Northern Ghana includes consideration of experiments being performed by different members of the community and their results; and careful decision of the indicators to be measured to determine success or failure. On the other hand, the final steps (testing, validation, evaluation and use) unlike most western scientific experiments often occur simultaneously. Stolzenbach (1994) also reports farmers' tendency to fold together what in formal science are distinct steps.

The idea of using a control to compare the results of an experiment is not foreign to farmer experimenters (Ashby, 1984). The majority of the articles reviewed state that farmers' experiments often (45% of the time according to Sumberg and Okali 1997: 99) involve a comparison to varieties and practices currently in use. However replications and checks are not always handled in the same way as formal sector scientists do. Some farmers do replications over time, testing to see if they obtain the same result in one year as the next (Rhoades & Bebbington 1995). Other farmers use different locations for carrying out comparisons. Sperling et al (1993) state that farmers in Rwanda "carry the check in their heads rather than the plot adjacent for comparison". This is similar to Sumberg and Okali's account of farmers' use and confidence in an "internalized historical control" consisting of their accumulated experience and memory of previous years.

An interesting difference that has been observed by some scientists is the choice of location of trials. While formal science has had the tendency to seek out "ideal" conditions for their experiments<sup>4</sup> – i.e. flat land, irrigation, fertile soils, minimal pest interference etc. – some farmers deliberately test in the conditions where they intend to continue planting if the results turn out favourable. These conditions can be far inferior to the ideal (Richards, 1985). For example Sr. David, a Brazilian farmer taking part in a participatory breeding project in the north east region of that country decided to test one of the promising cassava clones that he identified from the formal trials on his own. As he was trying to overcome root rot on his property he planted the clone in the area of his farm most affected by the fungi that produce this condition. If the plants survive at all he reasoned, then we will know with all certainty that this variety is resistant (Pers. Com. 2002).

One of the few points of unanimity in the literature on farmer innovation, is the observation that most farmers' experiments are started in home gardens or along the borders of their cultivated fields. They are almost exclusively small scale, low risk

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<sup>4</sup> This tendency is waning among formal research institutions targeting the poor.

experiments. This is evidently different to formal science where the scale of experiments and the number of replications have a strong bearing on their validity.

Unlike formal sector experiments, farmer trials often do not shy away from observing and testing several variables at a time. As Richards points out “farmers’ main concern is to cope with “complex interactions” and “unscheduled events” such as variable soil conditions or attacks of bad weather and pests while research station scientists seek to control all variables except the “one or two under direct investigation” (1985: 143). This has been one of the points that has lead research station scientists to dismiss farmer innovation (and some forms of participatory research for that matter) as invalid and nonrigorous. However the question of validity is key to both formal and informal science and it has been proposed that valuation criteria must reflect all the systems of knowledge and meaning that are involved in research (Pretty, 1994). This poses a significant challenge for both collaborative work that combines indigenous and formal research, and for projects that aim at supporting and enhancing farmer innovation. Often this aspect of research is implicit hence the lack of extensive discussion of it in the literature.

An important movement has been that of scientists experimenting to validate or to disprove the soundness of Indigenous Knowledge. Examples of this abound and are definitely of great interest to the topic of this paper. The sole difficulty again is that these deal with a finished technology and do not address the process by which the farmers arrived at it.

Time is another important factor in describing the processes of farmer innovation. Many authors point out that local innovation is a continuous sequence of events with no clear punctuations, beginnings or endings (Gupta 1992; Rhoades 1989). Interestingly, some authors assert that this is similar to formal science while the rest argue that it is yet another difference. This reflects the variable nature of formal science as it does the multiple interpretations of it (i.e. is each piece of research by western trained scientists a distinct and punctual experiment or do they build on one another?).

#### **IV. How is local knowledge distributed/socialized?**

Is local knowledge a public good? Do innovative farmers volunteer their inventions to the community? Do these experts derive benefits (social or economic) from this activity? Are these benefits shared?

The literature shows that in some instances local knowledge is considered a private possession that is guarded as a precious secret while in other instances farmers experiment as a service to their community and thus share their knowledge openly (Longley and Richards, 1994). In Northern Ghana, Millar (1993) explains how the subject and form of local experimentation is indicated by a soothsayer and farmers who duplicate their neighbors’ experiments are thought of as bad farmers who will be sanctioned with poor harvests. This makes farmers build on each other’s experiments and findings

creating, in a sense, a community research effort. The opposite scenario is also commonly found. In Cauca, Colombia Patiño (1990) found that small farmers often experiment individually and –to the extent possible- do not share their results. He attributes this to farmers’ desire for pay-back for the risk they personally put into their experiments. Pottier (1994) explains how in Rwanda farmers’ experiments and innovations are considered close family secrets and are only shared with close kin and neighbors.

If we take seeds to represent research products or pieces of information resulting from processes of inquiry, a look at the social norms that regulate – give or withhold access to - local seed systems could shed light on this. What is known about local or informal seed systems is that they are often not egalitarian and tend to include and exclude members and groups within communities.

### **How have local innovators been encouraged or supported?**

The idea of supporting local innovation is not new, nor is it exclusive to the proponents of the third representation of Indigenous Knowledge mentioned above. There are several instances of this sort of work going on in the field over the past decades. Notable examples include, among others, the soil recuperation work of the NGO COSECHA in Honduras and Guatemala (Bunch and López, 1999); the local agricultural research committees (CIALs) promoted by CIAT and their partners in Latin America; Farmer Field Schools (FFS) promoted by the Food and Agriculture Organization and several NGOs in various parts of Asia; the work of the Aga Khan Foundation also in Asia, and UNSO<sup>5</sup>’s program Promoting Farmer Innovation in Rainfed Agriculture. While these programs have delivered important results and lessons, it is important to note that many of them are grounded in a rational/functional interpretation of farmers’ knowledge systems and thus often teach farmers to be “pseudoscientists” following the “same inductive path of reasoning and discovery” (Settle, 1997) as formal scientists rather than supporting already existing local modes of research.

### **Conclusions**

This article has explored various aspects of farmer experimentation in order to shed light on the processes of innovation taking place at the local level. It has shown that there are different types and subjects of experiments and that these are sometimes conducted by different groups or individuals in rural communities. Rural innovators can be individuals or groups, can be highly integrated in their communities or rather isolated. They are women and men, and there is little indication that farmer innovators can be identified according to personal profiles. Farmer innovation may be more likely to occur in vegetative transition zones or areas undergoing environmental change, areas with high

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<sup>5</sup> UNDP’s Office to Combat Desertification and Drought

incidence of biodiversity, and places where farmers have a historical association with a crop. There is some evidence that farmer innovation is more active in areas where formal research has not reached or not been successful. However we cannot know if this is because of a stronger need for innovation or because there is no outside interference in local processes. There is much contention over whether the actual process of farmer innovation is similar or different to formal science. Some authors say that it is the same or very similar, while others maintain that it is completely different and not comparable. Still others assert that the similarity or difference does not have much significance as they both aim to solve real problems. Finally, very little was discovered about the distribution and organization of local innovations and research through this literature review.

Although there is a great amount of literature on Indigenous Knowledge and its possible uses in public agricultural research, the materials that elucidate *processes* of farmer innovation are relatively scarce and wanting (Rhoades 1989; Potts et al 1992: 20). The materials that do enter into the specifics or the intricacies of indigenous research contradict one another on almost every aspect making it difficult to draw generalizations on the nature of local research. At best we can conclude that farmer innovation can be found in a variety of circumstances. It can be quite complex and specialized and its nature can vary greatly according to a number of contextual factors. The implications of this for institutions and practitioners trying to support local innovators is that efforts must be made at the very beginning of any such initiatives or projects in order to find out who are the local innovators, what is their relationship to the community, what is their process of innovation, and how knowledge is socialized within the community and beyond. This literature review has shown that there is much more there than what initially meets the naked eye.

In concluding it is important to note that this literature review only scratches the surface of what researchers and development practitioners should seek to know before embarking on the complex task of encouraging or reinforcing local processes of innovation. In addition, there are several areas where further research could provide more insight. These include:

- ✓ Success, failures and challenges faced by projects that have attempted to support local innovation.
- ✓ The organization and distribution (both physical and sociological) of local innovation.
- ✓ Ways in which farmers have modified formal research methods – for example through work in CIALs or in FFSS.
- ✓ Government and organizational policies that support local innovation.
- ✓ Farmer preferences for local innovation versus formal research for various kinds of innovations.

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