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Small-scale farmer innovation

How agricultural research works together with farmers

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PROLINNOVA
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in ecologically-oriented agriculture and natural resource management

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Innovation by a farmer-led action research group in Burkina Faso: this onion store ensures good ventilation while also protecting the onions from the heat.
Photo: Eva Wagner/Misereor

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Dear readers,

Africa's small-scale farmers have to compete more and more in globalised markets. Although they face decreasing land availability, declining soil fertility and unpredictable impacts of climate change, and have poor access to advisory and financial services, they must feed people in growing cities and must farm in such a way as to sustain their livelihoods. To accomplish this Herculean task, they need to intensify their farming as much as possible. In the past and today, many farmers have been innovative in trying to do this – doing their own informal experiments.

National and international agricultural research centres are expected to help them do this. However, many "solutions" developed by researchers have proven unpractical, inappropriate or too expensive for small-scale farmers. How should research be carried out so that it supports small-scale farmers effectively? How should research priorities and research questions be defined, and by whom? How can small-scale farmers' capacity to innovate be enhanced? These are some of the key questions addressed here.

The articles present different approaches to supporting farmer-led research, ranging from partnerships between small-scale farmer organisations and research institutions, to alliances of farmer groups, nongovernmental organisations and researchers, to constellations in which farmer organisations directly contract researchers. The articles highlight some innovations that have emerged from these processes and – more important still – show new ways of organising research so that it strengthens innovative capacities at grassroots level. All authors share a joint vision of agricultural research embedded in society, working with and through small-scale farmers who thus contribute to intensifying agriculture and alleviating poverty in a sustainable way.

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Unexploited opportunities

Agricultural research could contribute to intensification of small-scale agriculture in Africa – if it were organised participatively

Photo: Lorenz Bachmann

The international insect research centre ICIPE works in cooperation with farmers. It has developed an organic agent for pest control. So far, no company has come forward to produce this biopesticide commercially.

| Theo Rauch and Lorenz Bachmann

Africa's smallholders have an image problem. It is said that they are not even in a position to feed themselves, let alone supply enough food for the growing African population. And that they may not be capable of competing in globalised agricultural markets – as African politicians lament and many researchers and practitioners also fear. So must Africa's smallholders make way for large-scale agribusiness in order to combat world hunger, or can they be helped? And what does agricultural research have to do with this?

The agricultural sector in sub-Saharan Africa, with the exceptions of South Africa and Namibia, is based predominantly on small-scale farming: 65% of the population live from agriculture. The average farm size is 1.6 hectares; most farms are smaller. In international comparisons, African small-scale farming performs poorly at first glance. Average grain yields weigh in at 1.5 tonnes per hectare in comparison to 4 tonnes per hectare in South Asia. Sub-Saharan African countries import 10–20% of the cereals they need. A disproportionately high number of people

Photo: Lorenz Bachmann

A female farmer experiments with mulching techniques on a mixed-cropping plot planted with coffee, manioc and banana.

affected by hunger live in rural areas and work in agriculture.

But on closer examination, a different picture emerges. Africa's cereal production has quadrupled since 1960 and thus kept pace with population growth. Africa's small-scale farmers have largely adjusted to the increasing demand. Where foodstuffs are imported, this is because the populations of large port cities like Lagos, Accra, Dakar or Dar es Salaam can be supplied more cheaply with subsidised foods brought in by sea than from the remote and poorly accessible agricultural regions of their own hinterlands.

The fact that productivity per hectare is low and rising only slowly cannot be blamed on a lack of smallholder potential or natural resources. Africa's farmers have traditionally increased production by taking additional land into cultivation. Where there is still scope to increase production by expanding land use today, it is not necessary to invest in intensifying agriculture – particularly if it is unlikely to pay off in view of low producer prices and a poor market situation.

Likewise, when smallholder households fall short of self-sufficiency in food, the reason usually has nothing to do with inadequate production potential. Rather, households have seasonal needs for cash and must often sell part of their harvest cheaply, and then, when their stores have been used up and before the next harvest comes around, buy in cereals at higher prices on the market.

Thus, Africa's small-scale farmers have adjusted their production to the growing demand over the past 50 years by making the best possible use of their potential, despite generally poor market conditions and support services. If they could not increase their production further, this was mainly because they could not compete internationally, given low global market prices and high transport costs.

| Unexploited potential for intensification

Although unattractive prices and political neglect did not encourage intensification of African agriculture before 2005, things have changed markedly for the farmers, especially since the agricultural price boom of 2008 and the improvement in their terms of trade. Suddenly, Africa's agricultural resources are of interest to development policy, private capital and the governments of emerging economies concerned about feeding their people. In view of rising demand and soil degradation, many regions are now encountering limits to further production gains from the expansion of cultivated land alone. An intensification of production – an increase in productivity per hectare – has become inevitable, and could also be profitable. The question, however, is whether the vast majority of resource-poorer African smallholders are able to make this happen, or just the better-positioned farm enterprises?

Photo: S. Dorlöchter-Sulser

Seed – ready to be sown in field trials. The international crop research institute ICRISAT in Niger carries out participative research on agriculture in the semi-arid tropics.

It is generally true that, for many products, small-scale farming is more productive per unit area and leads to higher quality than large-scale farming. This is because family labourers generally bring more care, local knowledge, flexibility and adaptability to their work than do employed labourers and standardised mechanical cultivation. Advantages of farm size for use of machinery play a less important role because labour costs in Africa are low. These advantages on the production side are offset by small-scale farmers' disadvantages when it comes to marketing and access to support services. A marketing and support system for tens of thousands of farmers with five sacks of surplus apiece is a more onerous proposition than the marketing of 100,000 sacks produced by one large farm.

A further obstacle to the intensification of production is that resource-poorer smallholder households earn their living on the basis of mixed rural-urban livelihood systems, because neither the agricultural nor the urban sources of income suffice for a secure living. This is why most of the younger family members have gone to look for work in the cities. Many turn their backs on agriculture, frustrated at how rural areas and the agricultural sector have been neglected. Sometimes only the wives with small children and the old people remain behind in farming. Thus, many households do not have enough labour to intensify farming. Sometimes, local knowledge of farming techniques has been lost. Many African smallholders are thus "caught on the wrong foot" by the rising demand; the potential that they actually have cannot be mobilised quickly. Expressed in economic terms, their elasticity of supply is low.

The fact that African smallholders do indeed have potential for intensification is confirmed by numerous NGO-supported projects that are successfully helping farmers

boost their productivity with locally adapted innovations. The question that arises is what agricultural research is doing to mobilise this underutilised potential.

| Contribution of agricultural research to intensifying small-scale farming

The current range of new technologies offered by international agricultural research for Africa was evaluated in 2014 in a study commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ). A few key results:

- Agricultural research has specialised in the well-established, densely populated agro-ecological zones. It does not cover marginal areas such as arid zones and high mountains or less common production systems. Thus, an important segment of marginal smallholders who are not integrated into value chains "fall through the net", so to speak.
- the new technologies generated by agricultural research are affordable for only around one-third of small-scale farmers. Most of the technologies can be financed only by larger enterprises or require subsidies or loans. The most important reference criteria for the development of technologies are large comparative yield advantages and a moderate level of investment. The resource-poorer smallholders, who make up the vast majority of farmers in Africa, cannot afford even moderate investment and, if they do take the risk, interest rates of 20–50% can very quickly lead them into a debt trap.
- Since most research efforts are not specifically oriented to women, poor and female-headed households are particularly affected by this innovation gap.
- The evaluated "top innovations" of the international agricultural research centres were adopted by an average of only 5000 enterprises per "innovation", so the rate of practical application has been low thus far. There is insufficient provision of the inputs needed for wider adoption of the new technologies, such as seed and advisory support.

So agricultural research in Africa is predominantly geared towards the situation of more commercially oriented farmers in agriculturally favourable zones. It is less well suited to fostering the potential of resource-poorer smallholders and especially women smallholders.

| Demands on agricultural policy and research

To be able to mobilise their unexploited potential for intensification of agriculture, small-scale farmers need access to appropriate knowledge about more productive and resource-conserving practices. Private-sector service providers offer such services only selectively, for lucrative product groups and close to the urban centres. When it comes to food security for vulnerable groups or developing sustainable soil-conserving or water-saving agriculture, the task falls to the public sector. Socially and regionally inclusive agricultural services are needed that are financed and controlled by the State.

In view of the weaknesses of many African states and their bureaucracies, the resource-poorer small-scale farmers need to organise themselves in order to gain access to relevant knowledge. The organisation of farmers is necessary not only for them to be accessible and active partners of support services and to represent the farmers' interests effectively. It also allows farmers to exchange knowledge, to develop or adapt innovations, and to breed and distribute seed locally.

For the socially inclusive organisation of smallholders, an important function falls to non-governmental organisations. If smallholders are to be organised nationwide, public financing is needed for this. To ensure that research findings are adapted to local conditions, the process of agricultural research needs to be designed in a participative way. Practices need to be not only site-appropriate but, importantly, matched to specific target groups and able to address the constraints faced by resource-poorer households.

The bottom line is that a socially inclusive system of agricultural research and services geared towards ecological sustainability must involve the smallholders. While it should not eschew the inclusion of private-sector initiative, it is ultimately a task of the public sector. In view of the urgency of this task and the long-term nature of efforts for better governance in many low-income countries, international cooperation remains indispensable. | |

Translation: **Christopher Hay**

Reference

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Farmer innovation

A hidden treasure for agricultural research

Photo: Eva Wagner/Misereor

Proud of her innovation: a woman farmer in Burkina Faso presents mineral-lick stones made from local resources.

Roch Mongbo und
Sabine Dorlöchter-Sulser

The image of Africa as an emerging continent is still based mainly on its untapped wealth of minerals and natural resources. The potential of its people is seen, if at all, in creative start-ups, young companies or artists in cities – but not in the men and women who are farming. Yet the resourcefulness and innovativeness of these small-scale farmers has long been an important asset for solving all kinds of problems in agriculture.

African smallholders' wealth of ideas and the originality of their solutions to the multitude of problems of African agriculture were reaffirmed once again at the regional farmer innovation fair in Ouagadougou, Burkina Faso, in May 2015. The event was an opportunity for around 60 farmers from eight West African countries to showcase their innovations to a wide audience.

They all have one important thing in common: they do not capitulate in the face of the myriad of problems they encounter in crop farming, livestock keeping, animal health and storing, processing and marketing their products. Instead, they seek practical solutions and make focused use of lessons learned from experience as well as their knowledge of active ingredients found in nature.

However, traditional knowledge – also known as indigenous knowledge – is just one aspect of farmer innovation: this is a creative process in which men and women farmers jointly experiment and develop new solutions. This happens far away from agricultural research institutes, which actually have the mandate to improve farming practice. But the technology packages developed by

Photo: Eva Wagner/Misereor

Photo: Eva Wagner/Misereor

Lively interest in new developments: visitors at the innovation fair (left). The ointment "Tao-Tao", a remedy for parasite infestation, is applied to a chicken. It was developed by women who raise poultry in Toeghin in Burkina Faso.

formal agricultural research, which are usually aimed at boosting productivity, are in low demand by small-scale farmers because the research programmes continue to take little notice of these farmers' practical problems in agriculture.

Only in the 1980s did there gradually start to be an increasing recognition of what small-scale farmers are achieving: indigenous knowledge was rediscovered; the importance of flexible small-scale farming systems in fluctuating environmental conditions was revealed, particularly in arid and semiarid areas; and there was rising interest in participatory approaches to agricultural research and supporting farmer-led innovation processes. In the meantime, such approaches are found not only in the practice of non-governmental organisations and national and international research institutions but also up to the level of research programmes supported by the World Bank. However, although they may be in the "mainstream" of agricultural research, they are not yet firmly institutionalised.

But do farmers' innovations even need to be recognised by agricultural research or do convincing innovations spread anyway by themselves, as was the case, for example, with the "zai" technique to reclaim degraded land in the Sahel? Institutional embedding of farmer innovations in formal agricultural research is desirable for at least three reasons. Firstly, even farmer innovation(s) run the risk of not becoming as geographically widespread as they theoretically could be. Secondly, innovations are taken up into the programme of the state agricultural advisory service only after they have been validated by state agricultural research institutions. Moreover, scientific research has the appropriate means to rule out potential risks of innovations, particularly in plant and animal products destined for human consumption. This in no way implies any superiority of formal research over farmer innovation. Rather, the verification of all innovations is a necessary precondition for making available public funding and personnel to disseminate them. Thirdly, it is only by taking men and women farmers' priorities into account and involving them actively in the programmes of the research and development institutions that agricultural research can gear its work to the real needs in small-scale farming.

The following examples show what interest the African states might have in making use of the small-scale farmers' innovative capacities.

By means of research approaches that put men and women farmers at the centre (see box), the non-governmental organisations Diobass in Burkina Faso and ADAF-Galle in Mali support farmers' groups in developing solutions to the problems of small-scale farming. In this way, numerous promising local innovations have already been developed.

| Example 1: Accessible and affordable solutions

Post-harvest losses rank as among the main causes of Africa's low agricultural productivity. Year after year, the onion producers of Noungou – not far from Ouagadougou, Burkina Faso's capital – lost out on higher revenues from their onions at the end of the dry season. The major reason was that, for want of an adapted storage technology, their onions always rotted during the hot months. Building on their knowledge about traditional cereal storage, a farmer-led action-research group developed an onion store that ensures good ventilation while also protecting the onions from the heat. Using the locally built storage facility, onions can be stored for up to ten months. To handle different production capacities, models with storage volumes of between two and ten tonnes were eventually developed – at affordable prices ranging from €43 to €230. Today, men and women who are growing onions on farms of different sizes and with different levels of income can benefit from the innovation.

| Example 2: Testing the medicinal ointment "tao-tao" for effectiveness

When agricultural research institutions verify the effectiveness of an innovation, it can be a fertile source of learning for researchers and farmers. This is demonstrated by the example of the women raising poultry in Toeghin. In the past, they made constant

Farmer innovation development: the Diobass approach

The approach of the non-governmental organisation Diobass in Burkina Faso combines the principles of action research with elements of participatory innovation development. First, it works with farmers to collect and describe farmers' initiatives and innovations in the domains of plant and animal production. These are reviewed by a committee with equal representation of farmers and advisers, and a selection is made on the basis of criteria they predefined together. Men and women farmers can then enrol in groups for the innovations of their choice with a view to testing them in field trials. In this case, the farmer-innovators are called upon to formulate open questions and factors to be considered, which are then translated into an experimental setup and methodology. All this is documented in a research protocol. The field trials are carried out by the men and women farmers in conjunction with the research scientists, the state agricultural advisers and the advisers from Diobass. This multi-stakeholder strategy makes it easier to disseminate farmer innovations after successful conclusion of the series of trials.

Léon Zongo (Diobass)

complaints about the high losses of birds resulting from infestation with fleas, ticks and bugs. These parasites can transmit diseases, which can lead to severe weight loss or even bird death. The women therefore developed an ointment to combat parasite infestation, particularly in chickens and turkeys. The ointment was subsequently tested by the state agricultural research institute INERA for effectiveness, tolerability and toxicity. In comparison with an imported veterinary medicine, the ointment proved to be not only equally good but also cheaper to produce. INERA plans to refine the innovation into a spray so that it will also appeal to more commercial poultry farmers.

| Example 3: "Potocolonimbo" or innovation by understanding nature

The women in a Malian village observed that tomatoes growing right beside the plant they call "*potocolonimbo*" remained undamaged, whereas the rest of their tomato plants were infested with parasites. The women inferred that *potocolonimbo* had an anti-parasitic effect and successfully carried out initial trials with infusions made from the plant. When ADAF-Galle made its first inventory of small-scale farmer innovations in its project area, they became aware of these women farmers, who had a reputation in their village for developing solutions to problems in vegetable growing. ADAF-Galle put the women in touch with a female entomologist from the Malian research institute IER. She not only confirmed the plant's anti-parasitic effect but also carried out joint research with the women on the dosage and optimum timing of application. As in formal research, observations on the interaction of plants, plant diseases and other natural phenomena are a significant source of ideas in the development of farmers' innovations.

| Example 4: Exploring new horizons

Some local innovations can pose a challenge for formal agricultural research. Two cases in point are a plant-based remedy for Newcastle disease, a virus infection causing high mortality in chickens, and a powder to control the weed *Striga hermonthica*. Although both products developed by farmer-led action-research groups supported by Diobass have proved extremely effective in poultry farming and in the farmers' fields, formal researchers have not succeeded in their scientific trials to explain the mode of action of these products. Scientists still regard the vaccination of chickens is the only way to prevent Newcastle disease. If an infection breaks out, all animals in the infected flock are killed to prevent the disease from spreading further. However, when the local plant-based remedy is used, the farmers observe that the disease can be treated successfully as soon as the first symptoms appear. Similarly, scientists' laboratory experiments on the effectiveness of *songkoadba*, a plant powder to control Striga, have not yet yielded meaningful results. Such farmer innovations seem to operate at the external limits of what is currently known to science – and could pave the way for completely new approaches in the fields of veterinary medicine or crop protection.

What is clear is that farmer innovations harbour a sizeable and so far insufficiently exploited potential for African agriculture. The integration of men and women small-scale farmers into agricultural research on an equal footing with formal researchers would allow the development of relevant, accessible and, above all, affordable innovations. The farmers' creativity, resourcefulness and understanding of complex ecosystem interdependencies could open up new avenues in agricultural research. And if this research were oriented towards the development of innovations with and by the farmers, not only would it help to incorporate the specific concerns and potentials of small-scale farmers with differing social status, but it would also help to embed the research itself more strongly in the midst of society.

The experiences with farmer-led innovation development show the importance of taking farmers' priorities as the starting point for research, gearing lines of enquiry and experimentation to the farmers' observations and bringing in different perspectives for the sake of cross-fertilisation of knowledge. In this way, the potential of all men and women small-scale farmers could contribute effectively to making an emerging Africa into a reality. | |

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Photo: Felix Clay/Duckrabbit

Homestead pond near Khulna, Bangladesh, not only to produce fish but also for diverse other uses – a result of "Research in Development"

Beyond the pipeline model

New paths for agricultural research to enhance capacity to innovate

| Boru Douthwaite

In October 2015, the CGIAR – a consortium of international agricultural research centres – decided to close down a programme meant to promote applied, problem-solving research. What did the programme achieve and why did institutional support for this ebb away?

Most agricultural research for development carried out since the 1960s assumes that researchers develop new technology and pass it down through a chain of actors to farmers. Often called the "pipeline model", this approach can undervalue and undermine farmer innovation. The model has been successful, albeit often contested. This was how, for example, CGIAR research provided the new technology for the "Green Revolution".

Since the 1970s, CGIAR researchers have explored some alternatives to the pipeline model, including Farming Systems Research and Integrated Natural Resource Management. These have tried to make agricultural research more grounded in the context of technology application and more driven by engagement in problem solving. Gibbons et al (1994) described this as "Mode 2" research in contrast to "Mode 1" academic work initiated by researchers and producing discipline-based knowledge.

Despite the long effort to develop and embed Mode 2 research approaches in the CGIAR, none became mainstream. In 2011, the CGIAR funded the CGIAR Research Program on Aquatic Agricultural Systems (AAS) to change this – as the proposal made clear – "to move beyond traditional circles and change the way we do much of our research. By emphasizing approaches that call for research in development — rather than research and development or research for development — we will pursue a conscious change in emphasis and mindset, one that can help the CGIAR to conceive and deliver our research differently."

AAS, led by the CGIAR centre WorldFish, developed the Research in Development (RinD) approach to carry out Mode 2 research in five geographically defined "hubs" in Bangladesh, Cambodia, Philippines, Solomon Islands and Zambia. But, in October 2015, the CGIAR decided to close AAS down. This paper explores what the programme was able to achieve with senior-level support and why this support ebbed away. It then asks what it will take for formal agricultural research to enhance local capacity to innovate.

| Research in Development (RinD) approach

RinD involved building on local strengths and engaging with communities and other local stakeholders through participatory action research (PAR). In each hub, an AAS team and local people agreed on a pressing development challenge facing key aquatic agricultural systems and ways to tackle it. The team supported the communities to carry out PAR as researcher-led initiatives linked to achieving community goals.

Photo: M. Yousuf Tushar/WorldFish (CC BY-NC-ND 2.0)

A farmer in Bangladesh shows fish from her homestead pond.

The way RinD worked can best be understood with an example. In the Bangladesh hub, the RinD engagement process identified homestead ponds as an interest of both small-scale farmers and researchers. Homestead ponds have multiple uses, including keeping fish and using the water for washing and growing vegetables. They make up about one third of the area of small farms (less than 0.2 ha) in the hub. They are generally shaded by trees and climbing crops. Conventional research and extension promote the use of larger unshaded ponds for single-use aquaculture. Homestead ponds require greater farmer adaptation to meet individual household needs and so are less amenable to conventional Mode 1 research.

AAS formed a multidisciplinary science team that engaged with women in eight villages to form research groups, supported by a local facilitator. The science team and the women's research groups agreed on a PAR protocol to improve fish production in the ponds, while using these also for other purposes, and agreed on a set of treatments involving different fish species at different stocking rates, drawing on WorldFish expertise. Normal practice is to stock the ponds at low rates with a single species (Indian carp) or simply to grow and catch fish trapped in the ponds after seasonal floodwater recedes. Through PAR, the farmer-researchers learned to analyse their results and chose what worked best for them. They started sharing successful stocking strategies with neighbours. They gained self-confidence and the respect of their families and peers. Some took on leadership roles and were able to gain better access to the market and information. In turn, the scientists learned to respect farmers' ability to identify and solve problems. The success of the work led to more funding to continue PAR in several villages.

In terms of the theory behind how RinD works, PAR creates "safe spaces" for different stakeholder groups to learn with each other over a period of time. In the case of homestead ponds, the stakeholders were women farmers, local facilitators, and biophysical and social scientists including gender and PAR experts. A number of outcomes flow from these spaces, such as generation of new technology, increases in links between people, increases in self-confidence and motivation, better understanding of how research can support farmer innovation, and changes in norms that restricted women's access to and control over family resources and decision-making.

For the people involved and their networks, these changes can be regarded as increases in their capacity to innovate in an equitable way. RinD assumes that many of its outcomes come from having built such capacity. For example, in Zambia, PAR on salting fish led to better relationships between fishers, the Department of Fisheries and the traditional authority and this, in turn, led to better enforcement of a fishing ban to protect a collapsing fish population. In terms of Mode 2 research, the very work of solving problems in salting fish helped define a research agenda on fisheries protection and governance.

| The closing of AAS

In 2015, the CGIAR's core funding for its 15 CGIAR Research Programs (CRPs), including AAS, was cut by one third. The CGIAR decided to channel the reduced funding to better-established and more mainstream research. AAS was closed down, together with another "system CRP", and the RinD work stopped.

A main justification for closing AAS was an unfavourable review by the Independent Science and Partnership Council (ISPC), the ultimate arbitrator of science quality in the CGIAR. The ISPC concluded that AAS was an "excessive shift away from biotechnical innovation research toward an experiment in development process". It wanted AAS to demonstrate better how its research "adds value to the pipeline of biophysical technologies being developed in the commodities CRPs". In other words, it expected AAS research to enable the pipeline model rather than explore alternative models, as it said it would do in its proposal.

A knock-on effect of ISPC criticism of AAS was a loss of confidence of senior AAS and WorldFish leadership in the RinD approach. As a result, this approach – the main research output of AAS – was not mentioned at all in the 2015 proposal to continue the work.

Despite its premature closure, AAS has had some influence on the CGIAR. Together with the other system CRPs, AAS successfully lobbied to have building "capacity for innovation" established as an outcome in the CGIAR Strategy and Results Framework 2016–30. This sends an important signal to researchers and should help create an enabling environment for Mode 2 research.

| Conclusions

Some groups within international agricultural research have sought since the 1970s to mainstream research approaches better able to support local innovation. In 2011, the CGIAR launched its most ambitious attempt in this direction by funding the CRP on Aquatic Agricultural Systems to run for 10–12 years. By 2015, the programme had developed a research model that was building rural capacity to innovate and helped establish "capacity for innovation" as a measure of success of CGIAR research. Nevertheless, the CGIAR closed the programme.

This experience suggests that any future attempt to mainstream Mode 2 research in the CGIAR should be carried out only when two preconditions are in place. Firstly, those funding the work must understand that research embedded in local development processes follows a different dynamic in which the main outcomes flow from building local capacity to innovate rather than from adopting researcher-developed technology. Secondly, the basis on which the work is to be evaluated, and its underlying theory of change, should be agreed at the outset.

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The added value of collaboration

Researchers' perspective on partnership with small-scale farmers

| Anja Christinck, Brigitte Kaufmann and Eva Weltzien

Since agriculture began, farmers have innovated in farming practices and technologies, long before researchers entered the scene. The impressive diversity of crop varieties found in rural areas worldwide is a telling example of past and continuing farmer innovation. While farmers' own capacities to innovate are undisputed, the focus here is on the advantages of farmer–researcher collaboration – and how these can be systematically captured.

Since the early 20th century, progress in the scientific understanding of plant genetics, along with the possibilities to produce agrochemical inputs at industrial scales, led to increasing crop yields in industrialised countries.

The large-scale promotion of resulting agricultural practices, beginning most markedly in the 1960s, became known as the "Green Revolution". It included using seed of high-yielding varieties, synthetic fertilisers, and chemicals to control pests, weeds and diseases. As a result, yields of some major cereal crops increased about threefold. Raising agricultural yields was seen as the way to overcome food shortages and uplift rural economies. The Green Revolution relied on a "transfer-of-technology" model, with technologies being generated in research centres followed by transfer into practice. However, their final adoption by small-scale farmers in developing countries was often limited.

This was one reason why farmer participation came into focus, but several other paths also led towards it. In some developing countries, the objectives underlying common development strategies were seen as being imposed on the local societies; thus gave rise to approaches based on education and capacity building rather than on technology transfer. Increasing awareness of the limited availability of natural resources emerged as an issue of global importance, raising new interest in low-input farming systems. Further-

Farmer in Mali assessing new sorghum varieties. She puts a coloured piece of paper in an envelope hanging before the plot to show whether or not the variety should be further tested.

Photo: Ousmane Traore

Left: President of a seed cooperative in Wakoro, Mali, with the harvest from his field sown to hybrid seed.

Right: Training successfully completed: now these women and men are seed sellers for a cooperative in Nampossela, Mali.

Photo: Mamourou Sidibe

more, attention grew for local innovation processes, challenging the predominant perception of farmers being passive "adopters" of technologies.

In the 1980s, a group within the international agricultural research community developed the Farming Systems Research approach. Instead of focusing on single measures, they proposed taking a systems perspective. The active role of farmers as "managers" of agricultural production was recognised; for the first time, attention was given to farmers' own objectives in improving their farming systems.

The slogan "Farmer First!" summarised important criticisms of the technology-transfer model of agricultural research and called for broad participation of farmers. Participatory research approaches proved to be effective in various fields, including plant breeding and managing livestock and natural resources. Some methods, e.g. interviews and participatory communication tools, have become widely established, but a fundamental shift towards co-design, co-planning and co-implementation of agricultural research has yet to be made.

However, donor initiatives are increasingly demanding a clearer orientation of research towards the needs of "end-users". The European research funding initiative Horizon 2020, for example, builds on the concept of multi-actor projects: farmers, advisers, researchers, businesses etc. join in research to co-create innovations. Likewise, the McKnight Foundation's Collaborative Crop Research Program (CCRP) has based its agricultural research funding strategy on regional "Communities of Practice" through which small-scale farmers, researchers and development practitioners work together to address problems in farming and food systems.

| Complementary perspectives, resources and skills

The perspective of farmers is usually focused on the local physical, economic and sociocultural conditions in which innovations have to work. With regard to breeding crop varieties, the farmers' knowledge includes aspects such as the diversity of soil and climate conditions; available local varieties; interactions between different elements of the farming system, e.g. plants and animals, and needs of the farm household; as well as the diverse uses of crops in relation to local needs. Based on previous experience, farmers often anticipate how different plant types react to typical stresses such as low soil fertility, pests or drought.

Scientific plant breeders, in contrast, have highly specialised knowledge in genetics, statistics and trial design. They can screen large numbers of plants for specific qualities, increase the frequency of desired traits in plant populations or evaluate their performance across environments. Furthermore, they have access to breeding materials and information from all over the world and can spend much more time on plant breeding and targeted provision of information than farmers can.

| Creating added value through partnership

Participatory plant breeding show how the complementarity between farmers' and researchers' knowledge, resources and skills creates added value in practice. One example is the sorghum and pearl millet breeding programme for the Sahel region of West and Central Africa, implemented by ICRISAT

Photo: Ousmane Traore

(International Crops Research Institute for the Semi-Arid Tropics).

Farmer organisations in Mali, Niger and Burkina Faso and plant breeders from ICRISAT, together with national partners, have established a long-term cooperation to develop locally performing varieties that serve farmers' needs. Arriving at a joint understanding of the complexity and variability of conditions that farmers in these areas face was a key first step. The farmers' own coping strategies, e.g. seed management practices, served as entry point. For example, by observing and understanding which traits farmers are looking for when selecting seed, the scientists could learn which traits are of relevance to them, and why.

The partners further established a decentralised system of variety testing, where farmers and scientific plant breeders could observe a large number of varieties grown in so-called "mother trials" to evaluate the outcomes jointly. Individual farmers could then select a set of 3–5 varieties for testing ("baby trials") on their own farms. Here, farmers could subject the selected varieties to their own management and test them for various purposes and uses.

After 15 years of collaborative breeding, varieties have been co-developed that perform well even under unpredictable rainfall patterns and low soil fertility. Besides offering a range of improved open-pollinating varieties, landrace-based sorghum hybrids are now available with up to 30% higher yields compared to local varieties, even under low-input conditions. Selling seed of these hybrids is a new incentive for farmers to maintain local landraces, which are required as pollinators and used as food crops.

Some of the participating farmers started engaging in farmer-managed seed enterprises in order to ensure seed production in the longer term and on a legal basis, based on official certification requirements. Members of these seed enterprises produce and distribute seed of various crops and variety types – including hybrid seed. Based on an understanding of weaknesses found in existing seed systems, innovative approaches for seed marketing were co-developed, including new distribution pathways such as mobile shops.

Conclusion

In this work, the farmer–researcher collaboration allowed many farmers to apply and enrich their knowledge, so that the range of options available to them increases and they can take better-informed decisions.

At the scientific level, existing concepts were developed further, e.g. with regard to the interactions between the performance of plant populations and the environment. Targeting objectives of plant-breeding programmes not only for specific agroecological conditions but also to specific needs of people is a rather novel concept in plant breeding and requires integration of methods from other disciplines such as social sciences.

Particularly in Africa, new challenges arise from regional initiatives for introducing new legal frameworks for intellectual property rights and seed laws. Hence, research partners need to consider from the outset how varieties can be protected against misappropriation while, at the same time, ensure access to seed of the co-developed varieties for all farmers.

Lastly, the added value of farmer–researcher collaboration depends not only on "who participates" but also on "how the collaboration is organised". A strong focus on developing sound concepts and methodologies for collaborative research could become a shared interest of farmers, researchers and donors alike. This could include steps such as establishing and institutionalising cooperation, facilitating dialogue, co-designing experiments and applying the results in the form of new products, knowledge, services or forms of organisation. | |

Dr. Anja Christinck
is agricultural scientist focused on communication and extension.

Prof. Dr. Brigitte Kaufmann
is agricultural scientist focused on social ecology of land-use systems in the topics and subtropics.

Dr. Eva Weltzien
is agricultural scientist focused on participatory plant breeding and seed system development for tropical grains.

“We need research without walls!”

Interview with Omer Agoligan, Benin

More than two-thirds of the population in Benin derive their living from agriculture. What is the best way to describe the agricultural system?

The government in Benin promotes conventional agriculture based on certified seed and subsidised chemical fertilisers and other inputs, not only during farmer training but also in practice. The agricultural policies of the African states in the Economic Community of West African States (ECOWAS) are converging: the main focus lies on promoting agribusiness. To boost the sector, Benin relies on international cooperation with funding from Belgium, France and Germany. A big assembly plant for tractors from India has already been set up here. At the same time, a large proportion of Benin farmers, in particular here in the north, focus on traditional agricultural practices and local seed.

What do you think of the agricultural policy of your government? What consequences does this policy have for men and women farmers in Benin?

Until a short time ago, I would have assessed it as positive because seeds were free. However, step by step, the government has increased the prices. Now only chemical fertilisers and pesticides are subsidised. In the past, the state took out loans to finance subsidies meant to motivate farmers to use certified seed. But how much longer can this go on? Only with subsidies can farmers generate a small profit and, even then, only those who cultivate large areas. That is why farmers are increasingly going back to the cultivation practices and seed they have used for generations, without expensive pesticides and fertiliser. In the meantime, the government can less and less afford to subsidise its farmers.

Initially you were a conventional farmer and then you switched to organic farming. Why?

We were referred to as the young, modern farmers in contrast to those farmers who rejected the state’s agricultural advice.

I have always been interested in agricultural biodiversity, but I was also convinced that pesticides and chemical fertilisers could be used more profitably. During the food crises of 2007 and 2008, the FAO in Benin launched an emergency food-security programme, PUASA, which also provided farmers with seed free of charge. PUASA enabled me – as a member of a group of six farmers – to manage a farm covering about 1000 hectares of land that was provided by the state. We produced maize and rice seed for the government. The revenue was very good. In 2009, the Senegalese association of small-scale-scale seed producers (ASPSP) invited us to a forum in Djimini, where for the very first time I really started to understand the interdependencies in global agriculture.

Men and women farmers all over the world are facing the same problems, with seed, with pest and disease management, with access to water for irrigation, with regard to the workload and also market access.
I was really shocked. I hadn’t realised that European farmers have been literally dispossessed because seed production has been taken over entirely by industry. I thought, that’s exactly what’s happening here with us! I no longer wanted to be part of a process that was playing a major role in the erosion of our crop diversity. In 2009, I then gave up the production of conventional seed and left the 1000-ha farm. There was a great deal of outrage about the “betrayal of the comrades”!

What personal experience did you have with the state agricultural research?

I worked as a conventional farmer together with agricultural researchers for rice and maize, but it was the researchers who determined how we went about it. The whole thing was very technical. They recommended that we reduce the distance between the rows of seed and sow the maize more densely. At that time, we were using around 200 kilos of fertiliser per hectare; they made us use a further 100 kilos. The researchers wanted to use us to test their results under farmers’ conditions. We were

Photo: Cécile Van Espen

helping the scientists with their research but they spoke of “participatory” research. What we are doing today in our work I would not call participatory but rather joint research. In our project “Laboratoire Hors Murs” (laboratory without walls), the farmers themselves define the procedure, the production constraints such as pest infestation or plant disease, as well as the focus of our research. They contribute their knowledge to the process, together with the scientists.

The “laboratory without walls” was established by ORAD in cooperation with BEDE, an organisation that promotes ecological farm-

ing and the conservation of biodiversity. Can you explain the concept to us?

We think it is time for agricultural research to leave the research centres, in which they decide what farmers need and should cultivate. We believe it is time for researchers to go to the fields and work together with the farmers. The "Laboratoire Hors Murs" is the start of a democratisation of agricultural research. The researchers have a great deal of book knowledge but there are some things that only we know. And you can't always find an explanation. But if something can't be explained, it doesn't exist for researchers.

Photo: Anne Berson/BEDE

Omer Agoligan is a farmer and chairperson of the Rural Organisation for Sustainable Agriculture (ORAD) in Benin. In a state that promotes the modernisation of farming and industrial agriculture, ORAD advocates sustainable and organic farming. This means protecting not only seed diversity but also the rights of men and women farmers to participate in decision-making in agricultural research. "It is time for research to leave its confining walls and for the farmers themselves to decide what they need and want", emphasises Omer Agoligan (left).

Open-air research: Omer Agoligan with students and farmers in Djougou, Benin (above).

Young farmers in Benin learn how to prepare biopesticides from local plants (below).

Photo: Omer Agoligan

Take okra, for example. If farmers want to take eggs from guinea fowl to hatch under chickens, they use okra to ensure that the chickens accept the other bird's eggs until the chicks hatch. This cannot be explained scientifically, but it works! If researchers want to work here together with us, then only on the condition that no-one appropriates and patents the results, but rather that everyone can use them.

Can you name an example of joint research between farmers and researchers?

The niébé or cowpea is a staple food in Benin. Many farmers use chemical products to control pests when they grow cowpeas, because the state's extension services have advised them to do so for many years. Together with researchers, we have been seeking alternatives. What did our parents do? They didn't use pesticides. Using pesticides has led to the disappearance of the beneficial insects that used to control pests in the past. As a consequence, the pest level has become higher and higher.

Together with the scientists at the University of Cotonou, we therefore did research on a product made of locally available ingredients that protect the cowpea. We have sown various different varieties of niébé, some of which were not treated. The farmers who took part in the project brought together their knowledge about which local plants could be used to control the pests. As a result, we treated the cowpea with neem oil extract, with a variety of bushmint (*Hyptis suaveolens*) and with Ethiopian lemongrass. In the untreated patches, we looked at the resistance of the individual varieties of cowpea to pests and disease. After 18 months, we arrived at two main conclusions. One, that neem oil and *Hyptis suaveolens* are particularly effective against pests and, two, that we also have highly resistant local varieties of cowpea that grow well without treatment. However, treating the cowpea with neem oil and *Hyptis suaveolens* is very time-consuming. But the main thing isn't maximum yield but meeting the population's needs and providing good nutrition for all Beninese people. This is the stage we are at right now. Research, as you know, takes time; it is a continuous process.

We also had support from an entomologist from Burkina Faso who practises organic farming. That was interesting because we farmers really don't know so much about what insects are beneficial or harmful. We need bees to pollinate the cowpea. However, using pesticides kills not only the harmful insects but also the beneficial ones. The entomologist showed us what kinds of insects protect the crops and help us control the pests. We will continue to research this matter and work together with colleagues from Mali, Senegal and Burkina Faso. Agroecology is still uncharted territory for research institutes, because we have forgotten how to manage without chemical products. Here in Benin, we are only beginning to develop ideas and it is only recently that researchers have wanted to be involved in this work.

Which are the prospects for agricultural research with and by farmers?

As a representative of farmers, I was invited to the General Assembly of the FAO, the Food and Agriculture Organization of the United Nations. I quickly realised that the countries that have a say there, such as the USA, Australia and Norway, have a high commercial interest in the seed and food sector. In these circumstances, it is very difficult to realise the objective of providing good food for humankind. In the end, the FAO as an institution is dependent on their money. From their point of view, participatory agricultural research is surely not desirable. However, agricultural research must meet the needs of all people. For example, wheat is not grown in Benin or in West Africa. But wherever you are in Africa, the people eat food made of wheat. In our opinion, something is seriously wrong! Agricultural research should serve the country. As long as states do not finance their research themselves, we will not solve these problems.

For me, the prospects of agricultural research lie in the fact that it can increase people's resilience to climate change. Agricultural research that is biased by the interests of the agricultural industry is not interested in agroecology. But if our world is to become sustainable, then we all have to be involved in developing our agriculture: producers, consumers, everyone. We want to eat well, to provide good food, but the current system contributes nothing to reflecting about what sensible agricultural research could be. | |

Translation: **Lis Liesicke**

The interview was conducted by **Rebecca Struck** (Communication Department, Misereor) in French. This text is an extract of the one-hour interview.

The concept "Laboratory without walls"

The research concept "Laboratoires Hors Murs pour l'agro-biodiversité" (LHM) was first developed and tested between 2013 and 2015 by the organisation BEDE in cooperation with the Fondation Sciences Citoyennes, two research groups from Montpellier and the Universities of Abomey-Calavi (Cotonou, Benin) and Béjaïa (Algeria). The aim of the approach is to bring men and women farmers from various regions and countries together with national research institutes to boost biological diversity in ecological farming by small-scale producers. The focus lies on the farmers putting forward their own questions and problems and being involved in deciding on research content and objectives. Initial results have been obtained relating to cowpea pests in the Djougou Region (Benin), autonomous water management in Minervois (France) and increasing the date-palm biodiversity in Mzab (Algeria).

Farmer organisations taking a decisive role in agricultural research

The case of FUMA Gaskiya in West Africa

| Bettina I.G. Haussmann and Ali M. Aminou

In West Africa, farmer organisations are contributing increasingly to decision-making in agricultural research and development (ARD). Here, we describe the development of a farmer federation in Niger – Fédération des Unions de Producteurs de Maradi (Federation of Farmer Unions of Maradi) FUMA Gaskiya – from a research project partner to a research project leader, the positive changes this brought, challenges faced and a possible way forward to further improve the present ARD system using a "Farmer Research Network" approach.

Photo: Bettina Haussmann

In a field experiment, women farmers discuss the advantages of different millet varieties. A federation of farmers in Niger leads the research project.

| FUMA Gaskiya

The farmer federation FUMA Gaskiya was created in April 2002 in the city of Maradi in Niger. The federation now consists of 21 unions, 420 local farmer organisations and a total of 12,131 members, of which 55% are women. Since its creation, FUMA Gaskiya has been a partner in several ARD projects funded by a wide range of donors. Since 2012, FUMA Gaskiya has also been leading a research project of its own.

In 2014, FUMA Gaskiya received the Equator Price from the United Nations Development Programme (UNDP, http://equatorinitiative.org) together with a special recognition for Sustainable Land Management in Sub-Saharan Africa. Both awards recognise community-based organisations that demonstrate leadership in advancing local innovative solutions for people, nature and resilient communities.

| Key success factors

In the initial ARD projects in which FUMA Gaskiya was associated as partner, scientists wrote the project proposal and then involved FUMA Gaskiya farmers in the on-farm research activities. Scientists developed the research protocols, and farmers were then able to choose which agricultural options (e.g. new crops or cultivars and/or soil fertilisation techniques) they wanted to test, using the scientists' protocol. Scientists took farmers' preferences into account while moving ahead in the design of further activities.

Because the on-farm testing of new crops and cultivars went hand in hand with community-based seed production, local seed marketing at affordable prices, seed fairs and mobile seed shops, farmers' adoption of the new options to diversify their farming systems was facilitated, even in remote areas. The year-by-year increase in amounts of seed produced and sold illustrates the sustainability of these research efforts. By facilitating inventory credit (i.e. credit on the basis of stored agricultural products) using revolving funds, FUMA Gaskiya supported its farmer members during difficult times, e.g. after harvest when crop prices are low. Keys to success were the signed partnership agreements clarifying the roles and responsibilities of each partner, the longer-term engagement by donor agencies that enabled relationships of trust to develop between farmers and researchers, and the local leadership by FUMA Gaskiya's Executive Director Ali M Aminou.

The wide participation of the federation in different research projects put FUMA Gaskiya in a position to attract own funds: in 2012, the McKnight Foundation Collaborative Crop Research Program (www.ccrp.org) granted a research project to the farmer federation.

| Research led by FUMA Gaskiya

In the still ongoing research project led by FUMA Gaskiya, farmers set the priorities and objectives of the research, whereas local or international scientists support the farmers in implementing their agenda and analysing the results. This constellation represents a drastic change from usual ARD procedures. It was also a new "experiment" for the McKnight Foundation as a donor organisation. Conventionally, scientists write a project proposal and decide on the research agenda, which they then may implement with farm-

Achievements of FUMA Gaskiya and its research partners

The collaboration between FUMA Gaskiya and research scientists contributed to various outputs, such as participatory pearl millet breeding and variety selection; farmer-based seed production and marketing; identification of options to diversify farming systems; small-scale off-season gardening by women; soil fertilisation technique using locally available wood ash and sanitised urine from humans (easily accessible by women); time-saving technique of partial weeding; and use of community radio stations to share information and knowledge about agricultural innovations.

"Our relations with research have improved in the sense that our ideas, concerns and know-how are much more taken into account". **Ms Hadjara Oumarou**, Vice-President of FUMA Gaskiya

"What struck me the most is that the researcher comes to us and reports on the task we had given him; it's amazing but true". **Ms Tsayaba Adamou Garin Maigar**i, FUMA Gaskiya farmer

"When the women in this project say that it is 'our project, unique in Niger and unheard of before', we are proud!" **Ms Balki Laouali**, FUMA Gaskiya farmer

ers. Here, a farmer federation decided on the research agenda, which scientists are now supporting.

The research project led by FUMA Gaskiya focuses on women's fields and gender issues related to agriculture. Options for diversifying and intensifying farming systems are being developed and tested that are specifically adapted to the context of women farmers in Niger. This context is characterised by women's access only to the poorest land, limited or no access to external agricultural inputs, and time constraints. In the project, several crops and varieties were identified that serve especially women's needs (e.g. okra, hibiscus, cassia, early-maturing varieties of cereals rich in micronutrients). Soil fertilisation techniques were developed using wood ash and sanitised urine from humans as local resources that women can access. Using these resources as fertiliser for pearl millet, sorghum, groundnut and cowpea offers a form of nutrient cycling in ecologically oriented agriculture and contributes to increases in productivity and in grain quality. One scientist suggested a partial first weeding just around the planting hills (instead of the usual complete weeding of the field) at early stages of crop growth, in order to reduce the workload of the women. This method has proved to be beneficial not only in terms of saving women's time but also because the remaining weeds between the planting hills help to reduce soil erosion during early-season sandstorms.

| Differences between farmer-led and conventional research

Some differences perceived by both scientists and farmers in the research project led by FUMA Gaskiya include:

- higher relevance of the research for local farmers, especially women farmers;
- maximal ownership by the farmers, leading to higher motivation and engagement;
- more farmer-to-farmer learning and communication of research results in a more farmer-friendly manner, for example, using community radio programmes in local languages, farmer exchange visits, video clips, and sharing of results at the FUMA Gaskiya annual assembly;
- change in power relations: previously, scientists had the money and therefore the power; with FUMA Gaskiya being responsible for allocating funds to researchers, the power relations became quite different, i.e. researchers need to respond better to farmers' needs.

One challenge encountered by FUMA Gaskiya as leader of a research project was the members' limited knowledge about experimental designs, data collection tools and data analysis. It was initially also difficult for the farmers in the federation to find truly participation-minded researchers who were willing to support them. The McKnight Foundation Liaison Scientist for West Africa had to encourage researchers to engage with the farmers. Having good researchers working directly with the farmers is important, as the researchers can more easily link also to the global knowledge base to support the farmers' experimentation.

| A possible way forward

Farmer organisations working together with development agencies form a collective infrastructure that could cooperate with agricultural researchers to support testing and refining of farming options, to understand patterns of crop performance, and to match options to the contexts and needs of specific farmers. An approach being developed within the McKnight Foundation Collaborative Crop Research Program (CCRP) – Farmer Research Networks – represents a strategy for building on this existing infrastructure in ARD. In the context of the CCRP, such Farmer Research Networks aim at linking problem-solving research with action that can provide a context-specific evidence base for agroecological intensification, facilitate positive changes for farmers at scale and meet requirements of mutuality, reciprocity, co-creation, beneficiary ownership and local agency.

The vision of Farmer Research Networks is to transform the way that much of ARD is done and to use modern information and communication technology to engage more people (i.e. a representative set of stakeholders such as through a crowd-sourcing approach) in prioritisation, observation, experimentation and utilisation of agricultural research. Because of the participation of large numbers of farmers in such an approach, scaling is embedded in the process, which is expected to enhance impacts. | |

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Promoting farmer-led innovation

The role of multistakeholder partnerships

Photo: Laurens van Veldhuizen

Joe Ouko, Kenyan farmer, developed a new goat feed mixture.

| Gabriela Quiroga Gilardoni and Ann Waters-Bayer with Prolinnova–Kenya

How can partnerships of farmers, researchers, extension agents and other actors with a stake in agricultural research and development work? Above all, it is key that the stakeholders form the partnerships themselves, with good facilitation.

The Kenyan farmer Joe Ouko innovated in mixing feed from local resources for dairy goats. In 2015, at an international consultation in Geneva on "Small-scale farmer innovation", he was strengthened in his conviction that "if we really want sustainable food security, researchers and small-scale farmers should not work in their own cocoons but need to work together and complement one another".

Exactly such multi-stakeholder partnerships are promoted by the international network Prolinnova for joint learning and action focused on discovering and encouraging innovation by small-scale farmers. It is a positive approach that builds on farmers' creativity rather than the common negative approach that dwells on their problems. It seeks to enhance local strengths and help farmers explore site-specific opportunities, drawing from local and other sources of ideas.

It recognises the dynamics of indigenous knowledge – how local people improve their farming through their own informal experimentation. This recognition transforms how formal researchers and development actors view small-scale farmers – and how these view themselves. It changes the relationship between these actors and can stimulate interest to engage in Participatory Innovation Development (PID), integrating local innovativeness with formal science.

The multi-stakeholder partnerships at national level are known as Country Platforms (CPs). A CP is self-initiated, convening at least three different stakeholder groups in a National Steering Committee (NSC). The CP partners jointly plan and implement activities financed partly from own resources and partly from external funds.

| Creating social capital: example from Kenya

After learning about Prolinnova at an international symposium in Uganda in 2006, some Kenyans decided to set up a CP involving NGOs, universities, government research and extension, and community-based organisations. In its agenda to promote farmer-led innovation, the CP focused on joint learning about PID, communication, advocacy and fundraising. From the perspective of creating social capital to enable collective action for mutual benefit, the CP was able to build trust among the partners, promote reciprocity and exchange, agree on norms and actions, and marshal internal and external resources for joint work. This long process (see Figure 1) was strengthened by the CP's reflection on what was happening and why.

According to Bruce Tuckmann, who in 1965 developed a phasing model for group development, the "storming", "norming" and "performing" phases of a group bind the members. In Kenya, over 50 people from diverse organisations came on their own resources to the workshop to form the CP. They "stormed" in intensive exchange, getting to know each other and the Prolinnova approach. When they noted the guidelines defined by the international network members, some organisations left, especially those whose initial interest was to access funds. After this "norm-

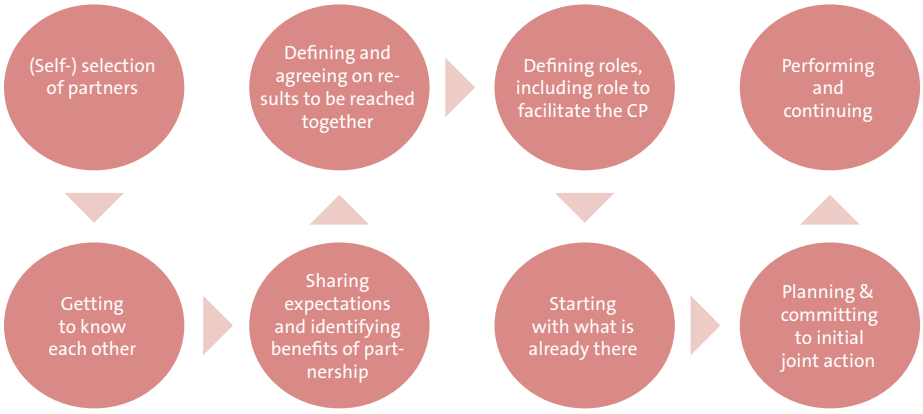

Figure 1: Main elements during CP storming, norming and performing

ing" phase of stabilising with rules and norms, the group started "performing" in joint activities. This phase awakened new interest and attracted new partners with similar aims. Effective collaboration started to happen.

From the beginning, the partners knew they had to generate own funds to realise their plans; this helped build ownership. The task force formed to constitute the CP and link it to the international secretariat became a strongly committed NSC that took firm steps in guiding the CP and ensuring good coordination.

The Kenyan CP became part of a multi-country Prolinnova project for farmer-led research to enhance resilience to change, using locally managed innovation funds. This drew national and international attention to the CP and increased the partners' confidence. It also translated into funded projects such as JOLISAA (Joint Learning in Innovation Systems in African Agriculture) and holding several international events on farmer-led research including the Eastern Africa Farmer Innovation Fair. These events triggered Kenyan farmer innovators to form their own association (Farmer-Led Innovators Association of Kenya; FALIA-K) and stimulated the Kenya Federation of Agricultural Producers (KENFAP) to join the CP.

Working directly with small-scale farmers has been key to the CP's success. As soon as the local innovators realised they are "farmer researchers", they quickly identified other innovators. The recognition given by fellow farmers and "outsiders" to their creativity strengthened bonds between them. It amplified their voices in policy dialogue in their own areas and in national and international meetings to express what they expect from agricultural research and development (ARD). After Geneva, Joe Ouko felt encouraged to devote even more effort to promote farmer-led joint innovation with researchers through FALIA-K, which he chairs.

| Engaging the scientists

In 2015–16, a self-assessment of the Prolinnova's achievements showed that CP functioning depends on the leadership and commitment of the host organisation and NSC and their ability to find a capable coordinator. Handling the diverse motivations and interests of the partners is a balancing act that requires sensitivity and moderation skills, and mentoring is essential to strengthen leadership capacities.

The Kenyan CP is co-hosted by an NGO and a research organisation; this favours linkages among state and non-state actors. Putting the secretariat in the research organisation helped make the CP better known among other researchers.

Multi-stakeholder partnerships were formed also in the districts where local innovation funds operated. The Local Steering Committees (LSCs) organise their own activities, such as local innovation fairs and farmer-led experiments. They invite decision-makers from the local government to join their events. In turn, LSC members are invited to join county development committees and can draw attention to local initiatives.

In developing methods to strengthen farmer-led innovation, the greatest challenge has been the work on PID involving formal researchers. Much still needs to be done in research centres to encourage and enable staff to engage in PID and to accept farmers in the lead. In Kenya, individual researchers are engaged, but the PID approach is still on the margins of formal research. It has been difficult even for these researchers to shed their habit of deciding what to investigate and how to assess the results ("validate"), which demotivates farmers, who then prefer to continue experimentation on their own.

PROLINNOVA in a nutshell

The network "Promoting Local Innovation in ecologically oriented agriculture and natural resource management" was born in 1999, when several non-governmental organisations (NGOs) from North and South and some like-minded researchers pledged to scale up participatory approaches to ARD based on local innovation processes. A Global Partnership Programme under the Global Forum for Agricultural Research (GFAR), the network envisions "a world where women and men farmers play decisive roles in ARD for sustainable livelihoods". Multi-stakeholder platforms are now active in several countries in Africa, Asia and Latin America. The secretariat is hosted by KIT (Royal Tropical Institute, Netherlands) with support from IIRR (International Institute of Rural Reconstruction, Philippines). An Oversight Group elected by the Country Platforms governs the network.

www.prolinnova.net

The Prolinnova network has managed to make its approach fairly well known in international ARD fora but integration of PID into national policies and organisations, including tertiary education, has yet to be achieved. This will be a main agenda in the coming years. | |

Links

Prolinnova guidelines: www.prolinnova.net/content/prolinnova-guidelines
JOLISAA: www.jolisaa.net
Eastern African Farmer Innovation Fair: http://aisa2013.wikispaces.com

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Farmer innovation contests

What can researchers learn from them?

| Tobias Wünscher

Contests show that smallholders have developed diverse innovations by themselves without any external support. These innovations often use very simple means. Because such innovative practices are easy to access and be implemented, they offer a huge potential for development in poorer rural areas.

Upper East, one of the poorest regions in Ghana, lies in a semi-arid savanna, where most of the people live on the land and make their living from agriculture. In 2012, the Center for Development Research (ZEF) and the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL), together with local partners from the Ghanaian Ministry of Food and Agriculture (MoFA) and NABOCADO, a local non-governmental organisation, began to systematically seek innovations developed by small-scale farmers in Upper East by inviting them to enter a contest. The aim of this exercise was to find new development approaches.

Farmer innovations were defined as technologies or practices that

- are used in the value chain for agricultural products
- differ from traditional or common farming practice
- have been developed by one or more farmers without external help.

Awards such as motorbikes, water pumps and galvanised roofing sheets were offered as an incentive to take part in the contest. An independent local selection committee made up of farmers, scientists and staff from MoFA and NABOCADO assessed the innovations on the basis of four criteria: originality, economic potential, dissemination potential and environmental sustainability.

Three contest rounds were held from 2012 to 2014: in total, 222 applications were made and 19 prizes awarded. Three impressive examples are presented below.

| Example 1: Using waste from sheabutter production to fight the sweet potato weevil

The importance of the sweet potato (also known as batate) has grown significantly in Upper East Ghana in the past few years. Batate grows under very diverse conditions with relatively little effort, is resistant to drought and is a good source of vitamin C. The sweet potato weevil (*Cylas formicarius*) can cause devastating damage to the roots. Many farmers cannot afford to treat the plants with insecticides. The small-scale farmer Akologo Anyagri from Garu-Tempane discovered that sheabutter waste reduces the pest infestation. Sheabutter is widely produced in the region and the waste resulting from production, for which there is no other use, is easily accessible for many land users. Field tests conducted by the Savanna Agricultural Research Institute (SARI) validated the effect of sheabutter waste. Although the impact is not as high as with conventional insecticides, the success rate is still remarkable.

Photos: Tobias Wünscher

The sweet potato weevil causes severe damage. Waste from sheabutter production can be used to reduce pest infestation (photos above).

| Examples 2 and 3: Onion leaves and neem seeds to suppress striga in grain fields

Striga is probably the most problematic parasitic weed in cereal production in Africa. The weed can be controlled only with a great deal of care and by using various crop-management strategies. One essential element in fighting the weed is the use of fertiliser, but this is exactly what many small-scale farmers often lack. Through the contest, two alternative approaches to controlling striga were identified.

The young innovator Abdul Rhaman Abieli from Missiga observed that no striga was growing on some areas of his millet and sorghum fields where he had discarded leafy residues from his onion harvest. He then started to experiment deliberately with small quantities of onion leaves to fight striga and discovered that the effect was the same. Today

he dries and pounds onion leaves to a powder that he mixes together with millet and sorghum seeds. The low quantity of onion-leaf powder used rules out any fertilisation effect. Experiments conducted by SARI confirmed that treating the cereal seed with pulverised onion leaves indeed suppresses the emergence of striga.

Likewise in the fight against striga, Mallam Anas Wechu from Kassena Nankana East tested the effect of powdered neem seeds. The

Biological control of weeds. The striga plant, which destroys a large part of the cereal harvest in Africa, can be controlled with onion leaves (photo right).

Photo: Tobias Wünscher

Also pulverised neem seeds help control the „witchweed" striga: Mallam Anas Wechu uses this as herbicide.

fruits of the neem tree (*Azadirachta indica*) are already known for their therapeutic properties for humans and for their pesticide effects in farming. Mallam Anas Wechu used neem seeds as herbicide, burying them into the earth in the direct proximity of young maize plants. In the experiments carried out by SARI, this practice likewise restricted the occurrence of striga.

| Characteristics of innovations identified through the contest

Two-thirds of the innovations identified during the contest addressed pest and disease management in livestock and crop production and in storage of the products. This can be seen as a contribution to adapting to climate change, as changing environmental conditions can lead to an increase in pest and disease pressure. Other areas of local innovation were related to crop and livestock husbandry techniques, animal feed and soil fertility. Only two contest participants addressed the production of technical equipment (such as solar incubators). Costly and time-consuming innovations, such as seed breeding, were not among the applications submitted. Although expressly requested in the application form, no organisational or institutional innovations were submitted.

The common element of most innovations was the use of locally available materials and low investment. This shows that it is very difficult for farmers in these poor regions to take advantage of external inputs. Many farmer innovations provide solutions to problems for which "modern" solutions already exist, but these are often not available on the market or cannot be afforded by small-scale farmers. Local innovations thus provide a less expensive substitute for modern products.

Furthermore, the innovations are step-by-step improvements on existing production systems that do not require fundamental restructuring of the farm. They can be tried out in small "portions" and integrated into the running of the farm, so that the risk for farmers adopting the new method is low. This can all be understood as a direct message to formal research that it is imperative to take the specific requirements of small-scale farmers into account.

| Path to an inclusive research approach

In their totality, farmer innovations probably offer considerable development potential for poor rural areas. Important tasks of formal research are to recognise local innovations, to validate their relevance and effectiveness and, if required, to develop them further to ensure that they are included in agricultural extension just like innovations coming from formal research.

An overview of farmer innovation activities also provides formal science with indications of areas where further research is needed and identifies research gaps beyond the innovation capacity of farmers. In the example described, this includes long-term investment in techniques such as the development of seed as well as organisational innovation and new technical equipment.

The importance of farmer innovation for agricultural research can be grasped effectively only through intensive communication between farmers and researchers. Close cooperation between scientists, farmers, agricultural advisers and development organisations is therefore absolutely imperative and should start already at the time of seeking farmer innovations. One task of scientists must be to actively involve innovative farmers in the research process, so that their knowledge is used optimally in agricultural research. This paves the way for inclusive agricultural research that systematically integrates the innovation potential of the farmers. | |

Translation: **Lis Liesicke**

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Beyond "the Answer is 42"

Changing policy and practice in agricultural research

| Ann Waters-Bayer and Fetien Abay

Most agricultural research is still carried out in a transfer-of-technology mode and most of the new technologies emerging from this "pipeline" are suitable mainly for better-off farmers. This is because the scientists producing such technologies are operating like the computer in the science fiction classic *Hitchhiker's Guide to the Galaxy*: "the Answer is 42 but what was the Question?" In agricultural research, the most important thing is which questions are posed – and by whom.

The "Answer is 42" is still widely regarded as what formal research should be producing. However, rather than adopting a specific technology developed by researchers and disseminated by extension agents, it is far more important that farmers become better able to solve problems in dynamic innovation systems within ongoing development processes that benefit from and enhance farmers' own knowledge and creativity.

This locally enriching approach calls for research that does not seek Answer 42 for the entire world of small-scale farmers but rather recognises local agroecological and socioeconomic differences. Also within a village, subgroups of farmers differ in their access to resources and their motivation for farming. It is therefore impossible to identify "small-scale farmers' priorities" for research at a large scale such as a whole country. A highly decentralised approach to research is needed, in collaboration with different types of farmers to meet their differing needs.

A farmer-led approach also calls for recognition that scientists and farmers assess research outcomes differently. Even among scientists interested in farmer innovation, their first kneejerk reaction is to want to "validate" what farmers have developed, using scientific methods and facilities and criteria. They need to look beyond this narrow perspective, explore farmers' criteria and jointly assess the new ideas. An outstanding example is the System of Rice Intensification (SRI) – an innovative method of growing rice – which basically requires tender loving care: the way that farmers (who live from the rice) apply the techniques, e.g. in transplanting, will be quite different from how a hired labourer on a research station would do so. SRI needs to be assessed in research by and with farmers – and according to their criteria regarding labour inputs (and by whom), risk management, water use and much more, in addition to yield.

| Key recommendations for ARD managers and policymakers

What could ARD managers and policymakers do differently so as to deepen the inroads of farmer-led research approaches into the work of their institutions? They could, for example:

- Reward staff for identifying initiatives of small-scale farmers to improve their farming through own experimentation and innovation, including social and institutional innovation
- Encourage and enable staff to engage in research with farmers in ways that enhance local innovative capacities, e.g. by increasing local skills and confidence in experimentation and linking them with diverse information sources
- Encourage and enable staff to recognise diversity within rural communities in terms of assets, societal position and motivation and to give particular attention to resource-poor and women farmers, who may not stand out as innovators but are making incremental changes to improve their farming and could provide ideas for others in a similar situation
- Ensure that staff at all levels in their institution understands the underlying principles of supporting farmer-led research and can provide support at their respective levels
- Work closely with universities, colleges and training centres to prepare not only potential new but also existing staff to interact with small-scale farmers and other local stakeholders in joint experimentation and innovation. This requires focused attention

Photo: Sibylle Nickolmann

Farmer representatives read out the Ouagadougou Declaration on farmer-led research.

The Ouagadougou declaration on farmer-led research

At a workshop on farmer-led research before the West African Farmer Innovation Fair in Burkina Faso in May 2015, participants from farmer organisations, national and international research and development organisations, and donors reflected on experiences with different approaches to farmer-led research and development in West Africa and formulated the following recommendations:

To government decision-makers:
- Institutionalise research by and with men and women farmers within the national and subnational agricultural strategies and policies, while recognising the importance and value of local innovation
- Assure access to national funds for research by and with men and women farmers to support small-scale farmer innovation
- Set up a national support fund for research by and with men and women farmers, where such a fund does not already exist
- Provide space for representation of small-scale farmers in the governing bodies of research institutions.

To formal researchers:
- Consider men and women farmers as innovators and legitimate partners in agricultural research and no longer simply as recipients of the results
- Strengthen researchers' capacities in approaches to farmer-led research, with a view to changing attitudes and behaviour in favour of collaboration with farming communities.

To development support organisations:
- Engage, as much as possible over a long term, in supporting initiatives in participatory innovation development
- Facilitate access of small-scale farmer organisations, formal researchers and trainers to funding for farmer-led research.

To small-scale farmer organisations:
- Encourage research that is led by men and women farmers, within all small-scale farmer organisations in the subregion
- Strengthen the capacity of small-scale farmer organisations in advocacy with decision-makers
- Assure a strong representation of small-scale farmer organisations in advocacy for institutionalising farmer-led research approaches
- Contribute to a support fund for small-scale farmer innovation by mobilising financial resources generated through agricultural activities.

to developing relevant courses and teaching modules, and practical internships with farmer researchers.

| Key roles for NGOs

There will never be enough public resources to support farmer-led research in all parts of a country. However, NGOs – national and international – can play key roles in supporting grassroots initiatives of interested farmers in doing their own research, and linking these initiatives so farmers can learn from each other and share their learning with formal ARD institutions. This will help strengthen the voice of small-scale farmers in conveying their views and needs to formal ARD. To exert effective influence, it is not enough just to have one or two seats for farmers in decision-making bodies. The farmers should have a good understanding of research and the confidence to challenge formal researchers – and what better way to learn this than through farmer-led participatory research?

| ... and for donor organisations

Donors who want to support farmer-led research approaches need to be prepared for the long haul – not spending lots of money quickly but rather small amounts over longer periods, allowing time for all the actors (scientists, development agents, educators, local administrators, farmers, other community members etc) to build up relationships of mutual trust and respect and to learn new ways of working with each other. This will involve much learning by doing and then reflecting on how it was done.

Donors need to plan this work in an open way, allowing the specific focus of the work to be identified and agreed during the initial phase. They also need to accept the dynamic nature of the external and internal conditions of the groups they support and let the innovation processes follow unexpected paths. And they need to evaluate such projects not according to the rate of adoption of technologies but rather according to the increased capacity of actors within the locality to innovate together – continuously addressing new problems and new opportunities.

One way in which small-scale farmers can truly take the lead in decentralised ARD is by their having direct access to resources for experimentation and deciding how to use these resources. The Prolinnova network has made good experience with community-governed Local Innovation Support Funds. As this is still regarded as a radical change from conventional ways of funding research, where scientists have the final say, donor funding will be needed for several years until the effectiveness of farmer-led research with locally managed funds becomes widely visible. We will then find that there are multiple answers for the multiple situations of small-scale farmers – and the Question they are pursuing keeps changing as they advance. | |

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Recognising and valuing farmers' knowledge and creativity

The Farmer Innovation Fair in West Africa

| Aline Zongo

In the face of changing and increasingly difficult socio-economic conditions in rural areas, many small-scale farmers are adapting and developing their own innovations. How do these farmers receive the recognition and appreciation that they deserve for their innovation and know-how? And how can agricultural research and farmer innovation complement each other?

Photo: Eva Wagner/Misereor

François Lompo, the Minister of Agriculture of Burkina Faso (on the right), during his visit to the fair.

This was the focus of the Farmer Innovation Fair in West Africa on 15–16 May 2015 in Ouagadougou, Burkina Faso, following similar fairs in Nepal in 2009 and in Kenya in 2013. The fair put the spotlight on the important role of men and women farmer innovators in further developing agriculture and the use of natural resources and as partners in agricultural research and development. As Roch Mongbo from Abomey University said: *"It is possible for both schools of thought, that is, the approach of researchers and that of farmers, to converge... Coming into contact with researchers who do not simply appear with a preconceived scheme or process, but rather engage with the farmers' questions and ways of working was enriching for both sides."*

More than 500 visitors from numerous countries – Belgium, Benin, Burkina Faso, Cameroon, Germany, Ghana, Mali, Netherlands, Niger, Senegal, Togo and the USA – attended the fair and side events (http://fipao.faso-dev.net). Almost 60 innovative men and women farmers and representatives of more than 40 non-governmental organisations, development projects, research centres and universities as well as numerous journalists attended the fair. They took part in the various events such as the West African workshop on approaches to research and development by and with smallholders, the exhibition of innovations, mini-workshops and podium discussions as well as the screening of videos about local innovations to cope with the effects of climate change.

The fair provided an opportunity for men and women small-scale farmers and other actors involved in agricultural research and development to exchange experience and to network with each other. Fatou Seye, a participating farmer from Senegal who developed the innovation of making coffee from cowpeas, said: *"This is the first time I have travelled outside of Senegal and it is all thanks to my innovation. I have met up with other innovators.... I will continue to work on improving my innovations.... so that I can participate in other fairs."*

The criteria for invitation to the fair were uniqueness, relevance and transferability of the innovations and their technical, ecological, economic and social viability. The selected innovations reflect the great diversity in farmers' innovativeness. New products and processes were presented related to animal production, use of natural resources, processing of agro-silvo-pastoral products including conservation and storage, institutional innovation and innovations in the communication sector and in agricultural mechanisation.

The fair thus contributed to providing information and lobbying for measures to promote research approaches by and with farmers, where these are at the centre of the research. François Lompo, the Minister of Agriculture of Burkina Faso, said during his tour of the fair: *"If you look at all our techniques, for instance for fighting striga or for treating or feeding livestock, then you will see how much endogenous knowledge there is. This can be extremely helpful if it is used accordingly. It can improve our production considerably!"* The visits by the Prime Minister, Isaac Zida, and the Minister of Scientific Research and Innovation, Jean Noël Poda, revealed the interest of policymakers from the host country in inclusive rural development in which all kinds of knowledge and know-how are integrated, in particular the knowledge of the farmers.

Nevertheless, declarations of intent do not suffice to structurally integrate farmer innovation within formal research approaches. Not only must the protection of knowledge be ensured, but also concrete steps must be taken so that scientific research and farmer innovation can better complement each other in the future. | |

Translation: **Lis Liesicke**

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Reaching as many farmers as possible

What is needed to spread farmer innovation?

Photo: Kilian Kleffner

Radio programmes can be used to disseminate innovations.

| Anne Floquet

Small-scale farmers are constantly innovating, either inspired by practices they have seen elsewhere or, less frequently, coming up with their own inventions. However, it is only rarely that enough support is provided for these innovations to be validated and adopted by other small-scale farmers on a significant scale and with visible impact.

Innovations – particularly when taken up by many farmers – can bring about systemic change. In essence, the way that farmers' innovations spread does not differ from how any other kind of innovation spreads. It depends on the type of innovation. Basically three types can be differentiated, with increasing degrees of complexity and scale.

- **Type I:** Innovations that take the form of agricultural inputs or standardised processes can be transferred relatively easily from one person or place to another. This is the case, for example, with seed or a food-processing method.
- **Type II:** Innovations that are not easy to transfer from one place to another are those that farmers need to adapt to their local conditions. These innovations are often more complex and require a learning process. Most innovations related to the management of natural resources fall into this category. Obstacles hindering their use may be, for example, lack of manpower or of ready cash or because the farmers are operating in a high-risk environment.
- **Type III:** These involve a chain of innovations. Technical change often generates further technical, organisational or institutional innovations, some of which may go beyond the sphere of influence of individual producers and require linkages with other actors right up to high-level decision-makers.

| More complex innovations – more complex dissemination processes

Exchange of knowledge among farmers can be stimulated in many ways, for example, through farmer innovation fairs or exchange visits that allow a wide range of local innovations to be showcased. These events also reinforce the confidence of farmers and their supporters in the capacity of small-scale farmers to innovate. Another example: videos designed to share know-how from farmer to farmer, making use of commented images that show each step in implementing an innovation. Translations of these can reach potential users who would never have been able to communicate directly with the original innovators.

Such ways of sharing are good for Type I innovations but, for Types II and III, the exchange can serve only as a source of inspiration. Farmers can take up the principles they have observed behind a new technique but have to experiment to finetune it for their own farm. For example, integrated crop protection measures are developed by combining scientific findings about pests with the farmers' skills in assessing the condition of their crops. After groups of farmers have thus developed technical processes and have validated them, their findings can be shared in similar areas and among similar farmers. In a different environment, however, new adjustments will be needed.

Type III innovations can be supported by helping to forge linkages between all relevant actors to network and negotiate around the conditions for transaction, to lobby government authorities etc. Here, too, experiences made elsewhere can provide a source of inspiration but each new situation requires that the people involved create their own shared vision and agree on specific ways of interacting with each other.

Enabling conditions are needed to promote innovation among farmers or between farmers and other development actors. For researchers, working together with farm-

ers requires investment of much more time and effort to produce publishable scientific results, compared with doing on-station research. For agricultural advisors, the constraints are more of a structural nature. The extension agencies seldom recognise the capacity of farmers to innovate, particularly of small-scale farmers. The hierarchal structure of extension has difficulties in accommodating approaches that call for flexibility, initiative and the ability to respond to farmers' demands. The functioning of extension normally involves passing on centrally decided content in the form of simple messages.

In some projects, approaches of participatory development of innovations coming from farmers and elsewhere have brought together groups of farmers, researchers and extension agents in the stages of testing and learning about Type II and III innovations. Sometimes, the facilitation of the work in these groups has even been partly handed over to farmer trainers in order to increase the cost-effectiveness and sustainability of the processes.

| Spreading farmer-led innovation processes

In order to multiply farmer-led innovation processes and bring about change on a significant scale, several reforms are needed. Long-term and competitive funding mechanisms to support innovation should elicit proposals by farmers and their organisations to carry out the work with the support of service providers of their choice. The process should be funded until the phase of broad dissemination. This calls for recognising the farmers' innovative capacity so that they dare draw on their own experience and knowledge in formulating their demand.

Participation in such processes led by small-scale farmers needs to be attractive for agricultural researchers and advisers. For researchers, integration of different types of knowledge must become a plus point in their publications. To encourage agricultural advisers to work with numerous small-scale farmers (rather than a few large ones), incentive mechanisms must be developed within their organisations, such as awarding prizes for the outcomes of such processes. To be able to take on these tasks, agricultural advisers need to gain skills; their profession and training must be redefined. | |

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