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Editor:
Paul-Mathias Braun

Author:
Carmen Hess (Mail@carmen-hess.de)

Published:
Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH
Postfach 5180, 65726 Eschborn
Internet: http://www.gtz.de

Contact:
Paul-Mathias Braun
T (+49 61 96) 79 1443
F (+49 61 96) 79 7162
E paul-mathias.braun@gtz.de
I http://www.gtz.de/agriservice

Commissioned by:
German Federal Ministry for Economic Cooperation and Development (BMZ)
Division 314 – Rural Development; Global Food Security
Postfach 120322, 53045 Bonn, Germany
T (+49 228) 535-0
I www.bmz.de

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I Introduction

The term “extension” holds different connotations, depending to some degree on the history, tradition and values of the natural and agricultural sciences in a country. The Neuchâtel Initiative (2000:11) specifies three elements, which may well characterise individual extension approaches.

- Transfer of technology: supporting farmers improve their ability to use new technology.
- Advisory work: supporting farmers to solve their own problems now and in the future.
- Facilitation: supporting farmers to become more actively embedded in the agricultural knowledge and information system.

The relative strength of each element depends largely on the objectives of extension.

Between 1975 and 1995, the World Bank promoted an extension approach known as Training and Visit (T&V) (Benor and Baxter: 1984). T&V was basically a transfer of technology approach. Being the principal lender and donor to most developing countries, the Bank’s recommendation had powerful consequences. More than 70 countries used the T&V approach for running public extension organisations. In 1995, the World Bank reacted to negative evaluations about the effectiveness of T&V and withdrew financial support. Subsequently, public extension organisations collapsed in many countries. Two decades of T&V have left their traces in the way policy-makers and agricultural professionals think about service provision to the agricultural sector. This is why we include the description of T&V extension in this Reader, although the approach has been officially abandoned.

Under Structural Adjustment Programmes in the 1980s and 90s, public spending for rural services was cut down. Logically, extension and research systems became affected by financial cutbacks too. Nowadays, Northern donors, including the World Bank, show renewed interest in providing support to demand-led agricultural extension and research systems. They agree that services must be provided in a fundamentally different way than in the past. In fact, they have put a lot of effort into conceptualising frameworks for agricultural service provision that might be effective under current circumstances in developing countries. These frameworks put agricultural extension into a much broader context of a demand-led service market. The term “advisory services” is used instead of “extension”, to include the many non-traditional tasks, such as market information, micro-finance, health issues (AIDS), farmers’ self-organisation and the like. (See Reader on Service Reforms). Even though the search for clear concepts is still ongoing, some thoughts are common to all approaches:

Firstly, donors agree that the demands of agricultural producers must be the starting point for any extension or research approach. Service demands must be analysed, identified and voiced by the farmers. In many cases, neutral facilitation will be very helpful for sound and transparent analysis and decision-making on most important service demands. Once demands are defined, the public and private service providers must try to satisfy them.

Secondly, in order to keep a check on costs and to be efficient in thinly populated rural areas, it was necessary to work with larger farmer groups. Farmers should therefore be organised in cooperatives, associations or groups sharing a common interest, e.g. in a specific agricultural product. Traditional groupings such as communities, tribes, or clans should be targeted too. Important is that the target group is clearly defined, for example, predominantly as commercial farmers, small and medium commercial farmers, women farmers, or subsistence farmers and live in a determined region. “Emerging farmers” are those who are in transition between subsistence and commercial farming – a large group in many developing countries.

Thirdly, extension and research systems need to concentrate on working towards positive socio-economic impacts. Impact can be documented in terms of cash income, productivity, food security, health or wellbeing (livelihoods); in some countries, ecological sustainability may be another indicator. At the end of the day, the target groups must evaluate if the services provided have indeed improved their lot.

A fourth common feature, and in fact a result of demand-orientation and reduced public funding, is the contribution of farmers to the services rendered. Complete public finance of rural services is neither possible in most countries any more, nor desirable from the demand-orientation point of view. Farmers need to contribute to the financial sustainability of services either in sharing costs, or at least in substantial labour and land-use. The more market-oriented and commercial the farming system is supported by extension and research, the more such services should be financed by the farmers themselves. Public goods or interests, such as environmental protection or food security, may still be financed entirely by public funds.

The fifth feature is the pluralism of extension and research services. Classical public extension tasks are now also performed by NGOs, consultancies, companies and as embedded services by e.g. agricultural input dealers. In francophone Africa e.g. NGOs have taken over to a large degree the role of former public extension in rural areas, creating a “pseudo-private” service sector. In commercial agriculture, embedded services by lead companies (contract farming) or by input dealers play an

increasingly important role. In transition countries, public extension services take on new regulatory roles, such as control of environmental or quality standards.

These principle elements of current extension and research systems are elaborated as well in the publications ("Common Frameworks") of the Neuchâtel Initiative (www.neuchatelinitiative.net), a network of donor organisations.

Having introduced just a few features of contemporary thinking about extension and research, we will turn to the main purpose of the Reader, namely to provide an understanding of important agricultural extension and research approaches. Summary descriptions contain information about the objectives of each approach, adequate setting, process of service delivery and criticisms. There will be no recommendation favouring one approach over the other. They all possess positive and less positive characteristics. For policy-makers, government, and development agents it is fundamental to understand that each target group, and region, each problem-to-solve or development goal will require a specific extension approach that has to be tailored to satisfy the demands of the target group; such a specific approach may be eclectically assembled from different components. Current development theory considers "best fit" solutions instead of "one approach fits all" (Birner et al.: 2005).

The Reader presents summary descriptions of 11 extension and research approaches. The approaches are grouped under four headings, which unveil a typical approach quality: transfer of knowledge, diffusion of knowledge and problem solving.

Section 2 contains descriptions of extension approaches that transfer predetermined agricultural knowledge and technologies top-down to farmers. These are Training and Visit, Contract Farming and Strategic Extension Campaigns.

Section 3 portrays extension models that concentrate on the diffusion of knowledge and technology in a horizontal way from farmer-to-farmer. These are Farmer-to-Farmer Extension and Farmer Field Schools.

Section 4 introduces participatory and problem-solving approaches. Extension workers take over the role of facilitators to guide the target group through a self-help oriented cycle for action planning. Solving the most important problems shall result in synergies and economic advances for the target group.

Section 5 presents brief summaries of participatory research approaches. The degree of participation of farmers in research differs from one approach to the next. In Farming Systems Research (and Development), farmers are key informants about the ecosystem they live in. Other approaches involve farmers in defining the key questions for research. Participation of farmers can be enhanced by taking part in the planning process, using their own fields for conducting experiments, or by cooperating with agricultural researchers from the start to the final evaluation of research results. The main objective of participatory research approaches is to produce technologies that solve farmers' problems in practice.

We conclude with a fine sentence by Volker Hoffmann, a German specialist on Extension:

"There is no such thing as a better or best extension approach." (1992: 273)

Any extension and research approach must be tailored for solving the problems of a unique target group effectively. An approach may become the best one if rural producers use and apply the provided knowledge, technology and services and if the standard of living subsequently improves.

II Transfer of Knowledge

1. Training and Visit

Training and Visit (T&V) was an extension approach, which concentrated on the transfer of predetermined agricultural knowledge and technology from research institutions to farmers (Benor/Baxter 1984). The World Bank from 1975 to 1995 financially supported it. Consequently it became the principal approach for public extension provision in more than 70 developing countries.
The name “Training and Visit” illustrates to some extent the process of service delivery:

- Subject matter specialists (SMS) gave training to frontline extension agents on new but relatively simple technical issues.
- Extension agents visited contact farmers to deliver the technological messages.

This top-down strategy was based on the assumption that farmers lack technical knowledge for increasing productivity. The solution was therefore to provide them with modern technical knowledge. The Training and Visit approach corresponded to the so-called Transfer-of-Technology Model (ToT). The management of knowledge transfers concentrated on passing-on standardised extension messages concerning a selected crop or livestock, input supplies, or credit line. Research institutions produced the message and extension services transferred them to the farmers. Research and extension organisations were closely linked to each other. T&V was implemented in developing countries willing to use T&V nation-wide. The hierarchical line of command of the T&V extension system was seemingly fitting the political culture of many countries. However, many public extension services were poorly organised and were lacking standard sets of recommendations.
The following extension methods were used: group discussions, seminars and in-service training courses for extension staff and farmers, on-farm demonstrations and farmer field days. Specific tools were: contact to a determined number of farmers’ groups, handouts and technical fact sheets. T&V had been designed as a cost-efficient extension system. The delivery of messages was considered economic, as large numbers of farmers could be reached fortnightly.
The main objective of T&V was to increase commercial crop production, preferably in controlled environments (e.g. irrigation schemes). Early experiences have shown quick production increases in cotton, rice and wheat (e.g. Turkey, India). Nevertheless, critical voices rose from the start and some critics dubbed T&V to be “Tragic and Vain”. Not until the 1990s, evaluations by the World Bank indicated a lack of impact on productivity, for example in the case of Kenya (Gautam/Anderson 1999; WB-OED 2000). At the same time, running costs of public services with hundreds to even thousands of extensionists constantly on the move were exploding. Moreover, standardised technological solutions were not suitable in ecologically diverse environments and farming systems, for example in

tropical areas. Subsistence-oriented farmers with little commercial potential could also not be addressed adequately within this scheme. The World Bank stopped its financial support to T&V extension systems in 1995 and went into a reflection phase on a better framework for providing rural development services. Together with FAO, the Bank developed a framework for service delivery using the label AKIS/RD, i.e. Agricultural Knowledge and Information Systems/Rural Development. Our Reader about Service Reforms contains a summary description of AKIS/RD.

2. Contract Farming

Contract farming is a commercial arrangement between a company in the food business (e.g. processing, trading) and farmers (primary producers). Farmers (i.e. outgrowers) produce a certain quantity and quality of a crop, animal species or animal product, and sell it to the company which contracted them. In return, the company (sometimes also called sponsor or purchaser) provides inputs, credit, as well as extension, quality management (standards) and marketing services. Sponsors are often multinational companies, processing plants or government agencies. But also small companies, farmer co-operatives, or individual entrepreneurs can be running outgrower schemes. Under favourable conditions, contract farming may provide small farmers with an array of agricultural services to which they otherwise would have no access. All agricultural services are financed privately. Contract farming can be economically rewarding, even to smallholder farmers (Kessler 2005).

Sponsors of contract farming are often businesses, which have their own line of command. This influences the organisation of extension services, whose focus remains on transferring technology and knowledge to the outgrowers. In commercial supply chains they may also control the quality standards set by the business. However, even within rigid production schemes, it seems advisable to use participatory extension components in order to improve communication and relations between management and outgrowers. Such decisions depend on the insight and awareness of the sponsors, as to how they wish to interact with contract farmers.

This type of arrangement is becoming increasingly relevant as public service delivery to the agricultural sector declines and the involvement of the private sector in providing agricultural services is discussed. Therefore, governments might be interested in promoting contract farming related to certain agricultural products of high value (e.g. cotton, tea, oil palms, and organic products). With contract farming, governments can achieve three objectives:

1. Small and medium farmers gain access to a profitable market;
2. Small and medium farmers receive agricultural inputs, credits and extension advice by agricultural companies;
3. Large plantation production for multinational companies can be substituted by contracting out the production to small farmers.

In order to support contract farming, government should ensure that:

1. existing laws do not constrain agribusiness and contract farming development (Eaton/Shepherd 2001: 5);
2. contracts are backed up by law and an efficient legal system (ibid.);
3. the necessary infrastructure is in place;
4. farmers are protected from purely exploitative relationships with sponsors by
   - checking whether or not the financial and managerial capacities of the sponsor are adequate to make contract farming a profitable business for all;
   - increasing the negotiating power of the outgrowers.

Box II-1 Organisational Models of Contract Farming

Model	Description
Centralised	The sponsor purchases crops from farmers for processing, and markets the product. Quotas are distributed at the beginning of each growing season and quality is tightly controlled. Generally associated with tobacco, cotton, sugar cane, bananas, coffee, tea, cocoa and rubber as well as with certified conventional or organic products.
Nucleus estate	The sponsor owns and manages a plantation, usually close to a processing plant, and introduces standards, technology and management techniques to farmers (sometimes also called "satellite" growers). Mainly used for tree crops, it has also been applied to dairy production.
Multipartite	Usually involves statutory bodies and private companies jointly participating with farmers. Common in China, where government departments, township committees and foreign companies have entered into contracts with villages and individual farmers.
Informal	Supermarkets, individual entrepreneurs or small companies make simple, informal production contracts with farmers on a seasonal basis, particularly for fresh vegetables and tropical fruits. In the course of “supermarketisation”, these arrangements tend to become more formal and restrictive (“preferred suppliers”)
Intermediary	Formal subcontracting of crop production to intermediaries is common in Southeast Asia. In Thailand, large food processing companies purchase crops from individual "collectors" or farmer committees, who make their own informal arrangements with farmers.

Quoted from: Eaton and Shepherd 2001; FAO Spotlight 2001, with amendments

The FAO study by Eaton and Shepherd (2001) argues that contract farming works best as a partnership between agribusiness and farmers. Then, it does increase the income of farmers as well as their technical and managerial skills while reducing farmers' risks and uncertainties. Contract farming may also provide small and medium farmers with access to profitable competitive markets to agricultural inputs, technology and advice from which they would be excluded otherwise. However, agribusiness managers must have good financial, managerial and social competencies to serve not just their own interests but also the interests of contract farmers.

Contract farming has potential where small-scale agriculture is widespread and where high-value crops, animals and animal products are demanded on internal markets (supermarkets, fast-food outlets) or on external markets (export). High-value products are, for example, tea, cotton, rubber, bananas and fruits in general, tobacco, oil palms, baby corn, gherkins, milk, chickens, or swine.

From a development perspective, contract farming is more acceptable than plantation production in which companies often own large estates while middle and small farmers remain excluded from high-value production and from participating in profitable markets. If large plantation production is disliked, contract farming is an alternative, as the product volumes required are provided by medium-sized and smallholder farmers. The purchasers of large volumes of produce usually provide services like the coordination of production, the provision of extension advice on new cultivation/harvesting practices, use of chemicals and efficient farm management, inputs (seeds, chemicals, and mechanisation), credits and the transport of crops from the farm gate.

Good service delivery is a precondition for successful contract farming. Poor services, which jeopardise production, may lead farmers into the so-called debt-trap and/or to sub-standard products for the company. Sponsors must therefore take responsibility for coordinating production and marketing activities well. Managers must ensure the transparency of all interactions with the farmers and they have to make sure that farmers understand both their own obligations and those of the sponsor. The content of two services is described in an exemplary way below.

1. Coordination of production process involves:
    - identifying suitable production areas
    - selecting farmers
    - forming working groups (farmers)
    - providing material inputs
    - providing logistical support
    - setting and controlling product and production standards
    - purchasing the product.

2. The provision of extension advice involves:
    - good extension staff (knowledge, communication skills, empathy with farmers)
    - providing suitable and profitable technology
    - clarifying the timing of production and harvesting activities
    - clarifying and checking the standards required
    - organising training programmes for extension staff and farmers.

The extension methods are related to the transfer of knowledge and technology. Improving two-way communication between management and extension staff and farmers is crucial for making the commercial relationship successful and beneficial to all in the long run.

Methods used include:

- individual extension
- group extension
- field day
- demonstration, demonstration plots
- lectures
- handouts and handbooks
- training on technical (farmers, extension staff) and managerial issues, i.e. providing the knowledge about production timing, record keeping, product quality, and requirements of export markets.

Contract farming is a commercial arrangement between farmers and agribusiness, driven by economic interests. For sustainable reasons, the relationship should be profitable for both parties. Costs for the government are incurred in public infrastructure (e.g. sanitation, water, and streets), a reliable legal framework and protection of outgrowers against exploitative agreements. The costs for the sponsors include delivering extension advice, providing inputs, credits and sharing production and marketing risks with the farmers. Expenses for the farmers occur in using their own land for production, paying back extension advice, paying-off inputs and credits as well as sharing production and marketing risks with the sponsor. Contract farming can benefit small farmers under certain conditions which where already mentioned above. Some potential problems are:

- Farmers do not achieve the product quality demanded by the sponsor;
- Farmers fall into the debt-trap, if they cannot repay inputs and credits due to production losses, financial deductions, or lack of price guarantee by the sponsor;
- Farmers break the contract by selling the produce to a competitor of the sponsor;
- Antagonisms surface between men and women. Most contracts are made with male family heads while women - who do not receive adequate remuneration - often do the bulk of the work;
- Ecological damage is incurred by specific production, e.g. oil palms;
- Smaller farmers become excluded in the course of time from the scheme (efficiency issues).

Some of these issues can be avoided from the outset by clarifying and improving the contract between farmers and sponsors. Public administrations could supervise and monitor the development of such contracts.

3. Strategic Extension Campaign

The Strategic Extension Campaign (SEC) is an approach and a methodology to plan and carry out agricultural campaigns. It is of project-nature and "strategic" in that SEC disseminates only strategic information; i.e. information, which answers the main questions and concerns of the targeted beneficiaries' vis-à-vis the campaign topic. Typical topics include: rodent control, tick-borne disease control, or contour tillage. SEC claims to be useful for improving existing extension programmes and planning new ones. A SEC approach describes a complete cycle of problem-oriented and participatory planning, implementation, and evaluation process. One of the most prominent extension method used by SEC is the development of audio-visual campaign material. SEC has been used in FAO-assisted public extension programmes in many countries since the 1980s (Adhikyara 1994). The underlying objective of a Strategic Extension Campaign is based on surveys of farmers' Knowledge, Attitude and Practice (KAP) regarding the recommended technology, e.g. rodent control (Adhikyara 1994: 9, 16). In contrast to technology transfer approaches (e.g. T&V), SEC does not assume that small farmers lack knowledge. Rather, SEC is based on the assumption that farmers have knowledge, experiences and certain attitudes about the recommended technology, which must be taken into consideration for campaign planning. The so-called KAP survey identifies economic, ecological and cultural barriers that prevent small farmers from adopting technologies offered by a programme. It also determines the farmers' information needs. Therefore, a campaign strategy will take the following steps:

1. Identify farmers' information and knowledge needs;
2. Tailor the extension messages to the farmers' cultural concerns;
3. Deliver the extension messages in a way that provides acceptable answers to farmers' questions;
4. Involve representatives of farmers and other stakeholders in the planning, implementing, and evaluation processes.

SEC should be an integral part of an existing extension programme to support the ministry of agriculture's policies, strategies and priority programmes. An existing programme must provide a minimum number of staff trained in extension planning, training, media planning and production as well as regular extension workers who can be trained in SEC methods. Furthermore, it must provide facilities for media design and production, a technology package that will be subject to a SEC review and a subject matter specialist related to the campaign topic.

In the first place, the setting for SEC is influenced by the Government's decision to carry out a campaign. Farmers must also consider the problem urgent; secondly, the transfer of knowledge and technology should be restricted to a narrow topic, as a campaign has a limited time frame (e.g. six months). In the past, campaign topics have included rat control in rice, line sowing in rice cultivation, maize production, cocoa cultivation, tick-borne disease control, contour tillage, population education, and ploughing with draft animals. Thirdly, there should be the possibility to deliver extension messages through mass communication channels, in order to reach a large number of farmers.

A planning process goes through 10 operational phases (Adhikyara 1994):

1. Technology, problem identification, and information needs assessment;
2. Campaign objectives formulation;
3. Strategy development and information positioning;
4. Audience analysis and segmentation;
5. Multi-media selection;
6. Message design, development, pre-testing and production of materials;
7. Management planning;
8. Training of personnel;
9. Field implementation;
10. Documentation and summary evaluation.

Typical extension methods are: campaigns, message delivery via mass communication channels (printed material, television, and radio), group extension, and field demonstrations. The delivery of messages requires visual materials, written media like brochures, leaflets, and oral communication via local radio or brief lectures to groups of farmers. For the evaluation of the campaign an Information Recall and Impact Survey as well as focus group interviews are needed (see Framework on Effective Rural Communication for Development, FAO/GTZ, 2006).
SEC tries to ensure the participation of the intended beneficiaries in planning, implementation and evaluation procedures. It takes the human and cultural issues related to the non-adoption of technology seriously and strive to tailor extension messages understandably. SEC represents a people-oriented development approach. SEC methodology is recommendable for campaign planning. SEC stresses the need to provide "quality" rather than a "quantity" of information, avoiding socio-psychological, socio-cultural and socio-economic pitfalls (Adhikyara 1994: 10). SECs are, however, limited in scope as they relate to confined technologies and are of short duration. The assumption of the FAO is that governments will finance the lion's share of the campaign expenses. The campaign topic must be of importance to the government so that public funds are released and the government is interested in improving the performance of an existing extension programme.

III Diffusion of Knowledge

1. Farmer-to-Farmer

Characteristic to the farmer-to-farmer extension approach is that farmers learn from each other about new agricultural technology or practices. The dissemination of innovations may develop spontaneously when one farmer has successfully tested a new practice or technology, attracting the interest of fellows. If the innovator is willing to share his knowledge, a farmer network may develop. The largest spontaneous network of this sort is the movimiento de campesino-a-campesino in Central America. However farmer-to-farmer extension can also be a planned activity.

The approach is based on the conviction that farmers disseminate innovations better than public extension agents because they have an in-depth knowledge of local crops, practices, culture and individuals; they communicate effectively with farmers, and are almost permanently available in the community. Innovations can be provided by agricultural research institutions, tested and adapted by selected farmers (called promoters or trainers), and, if considered valuable, passed on by hands-on experiences to fellow farmers. Farmer-to-farmer extension contains elements of the Transfer-of-Technology (TOT) model, but farmers play the crucial role in technology development and dissemination. Successful farmer-to-farmer extension should observe principles (Bunch 1982) like:

- the innovation should produce rapid and recognisable results;
- start small, follow a slowly process;
- limit the introduction of technology;
- use small-scale experimentation;
- develop a multiplier effect.

Agricultural innovations become disseminated among farmers horizontally, because the enthusiasm of innovators convinces their fellows. In the campesino-a-campesino movement, farmers were directly involved in all stages of the generation and transfer of technologies for sustainable agriculture. This includes the adoption and adaptation of appropriate modern techniques, as well as traditional practices (Holt-Gimenez 1997: 36). They are the main actors, decision-makers, researchers, testers, adapters, and promoters. Campesino-a-campesino brings together hundreds of volunteer and part-time promoters. External support provided by official extension agents, development organisations, and professionals is geared to selected issues only e.g. how to set-up a small research project, technical input during a training workshop for farmers, or financing cross-visits among farmers.

Some farmer-to-farmer movements developed where no alternative extension services were available. Language barriers, social and cultural distance, unfavourable natural environments, or a lack of infrastructure make farmer-to-farmer extension an alternative to official extension services. The

campesino-a-campesino movement started among subsistence farmers on ecologically fragile hillside plots and forest perimeters of the tropical regions of Central America. A farmer network or movement may develop if:

1. one or more farmers have learned about a new practice or technology, or created one, tested it, and are convinced of its effectiveness;
2. innovators are willing to act as promoters (extensionists) who share their knowledge with fellow farmers. It is worth noting that farmers with a strong religious background are often more altruistic than "rational" farmers, and therefore more willing to share their experiences with others.

Governments must at least tolerate a spontaneous farmer-to-farmer movement and they should be willing to consider farmer promoters (trainers, extensionists) as the main actors in designing, implementing, testing, and disseminating agricultural innovations. They should limit their influence on the farmer movement to providing appropriate support on selected issues only.

A key service of farmer promoters is to disseminate technical improvements among farmers. Other important services are the adoption, testing, and adaptation of an innovation, to provide training to other farmers and to share their experiences at meetings, workshops, and training courses. A review of the first steps of the campesino-a-campesino movement in Chimaltenango in Guatemala provided an impression of the delivery process (Holt-Gimenez 1997: 8-35):

1. Select a few agricultural innovations, which are of interest to poor farmers. In Guatemala, Don Marco Orozco, a retired soil conservationist, proved that contour ditches and organic soil amendments improved corn production. He thought that this might interest Mayan farmers in his neighbourhood. But he could not communicate with them in Spanish, as they are Cachikel-speaking Indians.
2. Carefully select promoters who are motivated and capable of passing on technical information to fellow farmers. Don Orozco started to work with Spanish-speaking Indians on reducing erosion, improving soil fertility, diversifying production, and improving local seed.
3. Test and adapt the innovation with promoters. Don Orozco helped his collaborators to experiment on their own land. After experiencing the value of the new practices, the collaborators applied them to their own land.
4. Provide training to farmer promoters and farmers. Other farmers became interested in the new techniques. The best way to convince them was to work with them on the fields of the collaborators and to test the alternatives through small-scale experiments on theirs.
5. Support the sharing of experiences among farmers. At some point, demand for the innovations of the small group of farmers outstripped their capacity to respond. Numerous farmers wanted to learn about the new practices on the fields of the innovators, or at meetings, symposiums, and workshops. The farmer promoters themselves increasingly needed more knowledge and

skills relating to technical and ecological issues, farmer communication, and the management of farmer demand.

6. Obtain outside support to the movement. World Neighbours and Oxfam UK were among the first development organisations to recognise the potential of the farmer movement. They sponsored farmer-to-farmer workshops, technical fairs, technical training, and provided seed money for agricultural cooperatives.

The two main pillars of the campesino-a-campesino methodology are

- farmer innovation and
- farmer solidarity.

Farmer innovation can be fostered with small-scale experimentation on farmer fields and by farmer-to-farmer training (hands-on learning). Farmer solidarity can be enhanced during field visits, farmer-to-farmer seminars, meetings, symposiums, and workshops led by farmer promoters.

This extension approach puts emphasis on increasing farmers' self-confidence and autonomy. It sees farmer promoters as a source of innovation. The voluntary sharing of information and skills among farmers is vital. External support should provide back-up for the movement, but not seek to control it. If possible, farmer promoters should not be paid for their work with fellow farmers. They invest time, knowledge, and skills on a voluntary basis. If demand increases and farmer promoters have to neglect their own duties, the issue of compensation or payment will arise. Then, governments and development organisations have to consider the issue by assuming the costs of:

- compensating or paying part-time and full-time promoters,
- organising training programmes,
- paying professional inputs,
- and logistics.

Nevertheless, three issues appear critical. Firstly, it is important to identify farmers who are motivated, qualified, and accepted by the entire community as farmer promoters. One option is to start with several volunteers for the first year of the programme in order to identify the most committed and effective ones. Secondly, if farmer promoters provide services on a regular basis, it appears essential that they be offered some form of compensation; unfortunately salaries trigger jealousies in the communities. Modest salaries coupled with good training and technical and motivational support offers a way out of this dilemma. Thirdly, farmer-to-farmer extension finds it difficult to incorporate women, both as promoters and as members of the movement. Typically, women promoters have to shoulder the burden of family, agricultural production, and promoter work. This may cause conflicts with their husbands and families. Female promoters need special support and especially adequate scheduling of meetings at times when women can attend.

2. Farmer Field Schools

In Farmer Field Schools (FFS) farmers learn about sustainable agricultural practices. Land, pastures and livestock may belong to an experimental station or to a community. There, farmers meet regularly for the duration of an entire cropping season. They learn by observing what is happening on the field, by discussing in groups what they have observed, and by hands-on management of the field from pre-planting to harvest. The most prominent topic of FFS used to be Integrated Pest Management (IPM). It is now often termed Integrated Production and Pest Management (IPPM), in order to move away from the notion that farmers' education is limited to pest control only (Gallagher 2000: 61). Farmer Field Schools combine elements of different extension models: they offer technology (IPM practices) to farmers, facilitate experiential learning, and integrate farmers' knowledge for participatory technology development. They apply a holistic adult education concept, from the training of extensionists, via the conducting of field schools to the evaluation by farmers.

The FAO developed the original FFS/IPM approach in rice production, initially in the Philippines and Indonesia, where success stories have been reported. Within the Indonesian context, the objective is to reduce losses due to pests. IPM is intended to ensure a sustainable production with a minimum of external inputs. In Indonesia, FFS are the main pillars of an educational strategy based on the assumption that farmers lack adequate knowledge about ecologically sound plant production, and the proper use of fertilisers and pesticides. The basic elements of the adult educational strategy in Indonesia are awareness creation about IPM issues, the use of FFS as the principal approach for adult education on IPM, the training of qualified full-time trainers to implement FFS, the generation of a multiplier effect by educating farmer trainers to take FFS into their communities.

In Indonesia, full-time trainers are independent of the public extension organisation and belong to the Directorate of Food Crop Protection. They receive a three-seasons training course, complemented by a one-season course at a State University. Training includes facilitation, communication skills, and group dynamic exercises. Trainees also cultivate their own paddy fields, which are used for ecological analysis, field studies, and experiments. Under the guidance of a mentor, the trainees conduct two FFS as part of their training. From each FFS two competent graduates are selected to become farmer trainers themselves. They are trained to conduct the next FFS in their communities.

In general, FFS on IPM were triggered by serious pest problems, excessive use of pesticides or by structural adjustment programmes, which led to shifts in the system of agricultural subsidies. In Indonesia, on-station research revealed the detrimental results of insecticide use in rice, which prompted policy decisions to ban pesticides. Consequently, the Indonesian government launched a training programme for farmers on natural pest control (IPM). Since 1989, FFS has been the principal educational approach for IPM training. Many other Asian countries have followed the Indonesian example.

A favourable policy environment is required for the introduction of IPM, IPPM and FFS. Governments and sections of civil society must be aware of the need to change current crop management towards sustainable alternatives. They must be willing to accept an FFS approach to non-formal adult learning among farmers. Continuous lobbying for IPM among policy-makers and mid-level public functionaries is highly advisable as they often have vested interests in continuing the use of pesticides (Schmidt et al. 1997). FFS services are adult educational in essence. They aim to increase the technical competence of farmers concerning one crop (e.g. rice, cotton, beans) or livestock, and to strengthen the social competence and confidence of farmers.

Service delivery is done in the following way. One FFS offers field-based learning experiences to 25 farmers; it lasts for a full cropping season or livestock cycle and meets at least 12 times. Each meeting (4 to 5 hours) comprises three activities: agro ecosystem analysis, special topic, and group dynamic exercise. The agro ecosystem analysis is the core activity. It follows through four learning steps:

1. Small groups of five farmers visit the rice plots and observe e.g. pests, natural enemies, size/stage of plant growth, plant colour, damages, and water level.
2. They return to the meeting place and draw on a large piece of paper what they have just observed in the field. While drawing, the farmers discuss the collected information.
3. Farmers make decisions on what action is to be taken.
4. A member of a small group presents the findings and decisions to the large group. The floor is opened to questions and discussions. The cycle of presentations, questions, answers, and discussions is repeated until each group has presented its results.

Then farmers turn to a special topic; depending on the farmers' interests, it may focus on IPM principles, plant physiology, insect life cycles, rats, economics, or on a basic experimentation method (or, alternatively livestock husbandry and veterinary issues). The entire group examines a special topic. A problem is presented, which the group has to resolve. This helps group members to gain a better understanding of their behaviour and increases their willingness to change. A group dynamic exercise completes each meeting.

The extension methods used in FFS take into account the improvement of technical and social competences of the farmers. Technical competence of farmers is increased by:

- Hands-on learning about agro-ecosystem concepts;
- Experiential learning in small groups: group members observe the happenings on the field, reflect together, decide together, and observe the results during later meetings;
- Combining farmers' knowledge with scientific ecological knowledge.

Social competences of farmers are fostered by:

- Group discussion and reflection processes;
- Presenting and explaining small group decisions to a larger audience;
- Energising exercises for group building.

General awareness about FFS education and IPM is created by mass media at a national level.
The tools of extension methods in FFS/IPM are:

- Learning contracts: prospective participants are informed about the objectives and methods of FFS. They are given opportunity to either agree on or withdraw their participation.
- Hands-on learning in a rice field (up to 1000 m²) divided into several plots. One set of plots receives IPM treatment and another set conventional treatment in order to observe the differences.
- Drawings of what has been observed.
- Small-scale experiments (insect zoos, disease incubators, seed banks). The relation between trainers and farmers is founded on mutual confidence and partnership. Trainers are facilitators of the learning process but not teachers of IPM issues.

The World Bank, USAID, national and local governments, NGOs and multi-national companies sponsored IPM/FFS. The FAO provided technical assistance. (For a synthesis of impact evaluations, please consult van den Berg 2004). In order to highlight positive as well as less positive aspects, we are going to refer to one project: The Integrated Pest Management Training Project formed the backbone of the IPM Programme in Indonesia. The plan was to train 800,000 farmers, 25,000 farmer trainers, 1,100 field extension workers, and 520 pest and disease observers. The costs of a Farmer Field School were put at USD 500. With a farmer trainer, the costs could be further reduced to USD 50 per FFS. Evaluations of FFS and IPM were positive according to the following indicators in Indonesia (Schmidt et al. 1997: 17-19):

- By 1996, 600,000 farmers had been trained in IPM FFS;
- FFS farmers apply 80 to 100% less insecticide;
- Rice yields remain stable or increase, which implies improved benefits for IPM farmers;
- Health hazards due to pesticide application are reduced;
- Environmental pollution is reduced;
- Local governments increasingly contribute to the funding of FFS.

In a study for the World Bank Quizon et al. (2004) criticised that firstly, IPM/FFS costs 62 $ USD per farmer and secondly, the diffusion of knowledge from FFS-participants to fellow farmers is too limited.

The main weaknesses of Farmer Field Schools are:

- training costs per extensionist;
- imited outreach per extensionist;
- and the concentration on one crop or animal species.

Together, they make service delivery expensive, especially in Africa, where farmers grow a large number of crops and live scattered over vast areas (see Fleischer et al. 2002). However, FFS is strong on good adult education that allows capacity development of farmers in complex topics, where simple technology transfer fails. Meanwhile, there are a number of adapted approaches to overcome the weaknesses, such as in Ghana (see Kwarteng et al. 2004).

IV Problem Solving

1. Partner-Centred Extension

"Partner-centred extension" means that agricultural advisers and farmers shall behave like partners. It also means that advisers try to see the world through the eyes of farmers in order to perceive problems from a farmer's perspective. The objective is to gain first a good understanding of the farmers' views and then provide intellectual and structuring assistance for solving the most pressing problems of farmers.

Partner-centred approaches are predominantly problem solving and joint learning approaches. They begin to analyse local worries and concerns jointly with a farmer group. To facilitate reflection processes, advisers have to use various communication tools, such as techniques for individual and group counselling, or more complex tools such as Road to Progress, GRAAP, or SWOT, SWAP. The key assumption is that a participatory analysis will produce new insights about the problems, which will then pave the way for innovative and novel solutions.

The partner-centred extension approach has its roots in the work of the extension school of Hohenheim (Stuttgart, Germany) and the Swiss Centre for Agricultural Extension (LBL). It has inspired GTZ extension projects since the '80s. The approach shares fundamental assumptions with Participatory Extension Approach (PEA) and Participatory Technology Development (PTD).

Preconditions for a successful development strategy are:

- to ensure the participation of representative social farmer groups (young/old people, women/men, farmers/others) at all levels of decision-making: problem analysis and definition, planning activities, implementation and final evaluation, or technology development (see below PEA, PTA);
- facilitators who possess adequate skills and attitudes as well as methodological know-how for joint problem analysis, planning, and evaluation;
- service demands by farmers that result from joint analysis must be attended properly and as quickly as possible.

Partner-centred extension requires special attention at two levels:

Level One: Organisational structures and functions must become farmer- or client-oriented, flexible and responsive to farmers' demands. The service agency must be able to manage service provision to farmers as quickly and little bureaucratically as possible.

Level Two: Extension personnel are mainly advisors to farmers. They should feel sympathy and respect for this clientele. They must also be well trained and manage competently group communication and facilitation as well as tools for participatory problem analysis, decision-making, and evaluation.

In an ideal setting, farmers are willing to assume responsibility for their own development. Infrastructure and budgets shall allow strong cooperation between farmers and agricultural advisers. Government and extension agency must be truly interested in building-up an extension system that is able to provide services demanded by farmers. Government and extension agency should be willing to support farmers' organisations, not fearing them. Agricultural research institutions should be willing to search for solutions to specific issues raised by farmers.

Important services include:

- motivating self-help-oriented farmer organisations and encouraging founding of new ones;
- guiding farmers through the stages of a problem-solving cycle;
- developing extension contents and messages together with farmers;
- providing or arranging services (appropriate information, technology, infrastructure, inputs, credit, and others which are indispensable for solving the problem at hand)

The advisor has to facilitate group discussions, reflection, and decision-making in 10 steps (Box IV-1).

Box IV-1 Problem-solving stages and advisor functions

Problem-solving stages	Functions of the adviser
1. Perception of the problem	to listen to the farmers
2. Description of the situation	to listen, to ask, to summarise, to give feed back
3. Review of the perception	to ensure that farmers and adviser share the same problem perception
4. Search for objectives	to support an identification of objectives by the farmers
5. Problem definitions and analysis of causes	to facilitate an in-depth analysis of causes and consequences of a problem; to facilitate a problem definitions by the farmers; select most important ones
6. Search for solutions	to facilitate a list of alternative solutions; to help to select some solutions; to point out existing (technical) solutions; to channel farmers' questions to researchers; to facilitate joint action planning
7. Select solutions	to facilitate a discussion about the pros and cons of each potential solution in order to make the ultimate selection a reasonable one
8. Implementation	to provide practical support for implementing the action plan; to arrange complementary services (e.g. input supply, etc.) required for solving the problem
9. Description of outcomes	to facilitate the description of outcomes by farmers
10. Evaluation of outcomes	to evaluate the outcomes together with the farmers

In addition, advisers offer complementary services such as

- providing information, advice, and technology, where these can help farmers in making wise decisions (stage 3 or 6).
- passing on farmers' questions to agricultural research institutions (stage 6).
- arranging services from other service providers, if these are indispensable to resolve the problem on hand (stage 8).

If doubts arise at any stage, then one has to go back several stages, and start the analysis again. If the final outcomes are considered to be negative, the problem-solving process should start all over again using the gained insights (Hoffmann 1994: 5-163).

Extension methods within this approach have the purpose to improve (two-way) communication between adviser/facilitator and farmers, to transfer (one-way) extension messages from extension agency to large farming populations or to improve the problem-solving capacities of farmer groups. Extension methods can be broken down into three groups according to the number of addressees: individual, group, or large populations (masses). The following overview shows the tools for each situation.

Individual → individual counselling

Tools:

- techniques for improved two-way communication and dialogue
- RRA tools.

Group → group counselling, demonstration, field day, training courses etc.

Tools:

- facilitation and visualisation (Metaplan techniques)
- focus group interview
- Road to Progress
- GRAAP
- SWAP/SWOT/SEPO
- PRA tools
- RRA tools.

Masses → campaign, competition, exhibition, radio and TV production, rural newspaper

Tools:

- participatory problem definition
- participatory development of extension messages
- participatory design of pictorial representations
- pre-testing of extension messages.

Equal partnership between advisers, extensionists, facilitators, and farmers is of greater importance than any particular methods or tools. Another assumption of the approach is that people will become more innovative, changing their behaviour once they gained new insights into the causes of their problems.

Governments should be willing to finance extension and adviser staff, service provision, technology development, and agricultural research. A donor or implementing agency usually assumes the costs of introducing and testing the partner-centred extension approach, and provides training courses (e.g. social skills, communication, and extension methods). Regular backstopping to supervise the cooperation between farmers and advisers is recommended. Farmers contribute their time, interest, and natural resources. However, they are required to pay for a service if it has a measurable economic benefit for the individual.

Problematic issues related to partner-centred extension are that it is difficult to ensure a partner-oriented attitude among extensionists, especially within public organisations. Often they lack a service attitude as well as empathy for poor farmers. Moreover, quality trainings on advisory skills and participatory methods are relatively time-consuming and therefore costly. In general, ways for cost-efficient partner-centred extension should be tried and tested. Many current approaches include elements of the Farmer Field School concept.

2. Participatory Extension Approaches

According to a Participatory Extension Approach (PEA), the role of the extension worker is to facilitate an in-depth situation analysis by the farmers themselves at the beginning of their working relation. Once farmers have become aware of the causes of their problems and have identified the most pressing ones, the extension workers provide technical knowledge and technologies, which may be useful to resolve the problems identified. To perform well in a PEA, extension workers need not only agricultural expertise, but also good analytical, pedagogical, and facilitating skills. The "participatory" part of a PEA means that farmers are the principal decision-makers in defining goals, planning, implementing, and evaluating development activities. PEA puts emphasis on strengthening farmers' problem-solving capacities from the start. The principal instrument for practising problem-solving skills is the PEA learning cycle. The learning cycle makes flexible use of a variety of participatory methods and tools (e.g. Participatory Rapid Appraisal, Participatory Technology Development, or participatory action learning). The philosophy of PEA is strongly influenced by the Partner-Centred Approach, described above, and by the much-acclaimed work on "Training for Transformation" (Hope/Timmel 1984). The Department of Technical and Extension Services (AGRITEX) developed PEA in Zimbabwe in cooperation with two GTZ-assisted projects during the 1990s. Since then, the approach has been developed further in GTZ-assisted projects / programmes in Sub-Saharan Africa.

In many cases projects have succeeded slowly in adapting to more client- and demand-led modes of operation. This may be a painful process, advancing by trial and error. Crucial elements are shared

decision-making, flexible, and process-oriented management cycles that have built-in mechanisms for reflecting one's attitudes and behaviour. Participatory extension approaches require excellent facilitation skills - a factor which becomes all too apparent in relation to sustainable natural resources management. The facilitator has to be mediator of conflicting interests. Facilitation in participatory processes often builds on tools like Participatory Rural Appraisal (PRA), the GRAAP method, LePSA, SWAT/SWAP, or Training for Transformation.

Agricultural extension and participatory technology development projects had already started to apply parts of the toolbox by the 1980s. In relation to community development, the existence of a local government and a decentralised administration is a precondition. If the local government is not dominated by elites, then the accountability, effectiveness, and efficiency of local services can be substantially improved. Many governments nowadays stress the importance of popular participation. Reality still looks different, but too much political pressure from donors could mean that solutions are imposed, running the risk of being rejected, and subsequently degenerating into a mechanistic application of the instruments.

Experiences with PEA indicate that innovations or acceptable solutions for the problems of farmers or rural communities are best developed together with research and extension agencies to form an innovative system. Moreover, participatory approaches depend strongly on a conducible political and administrative environment. Many current approaches include elements of the Farmer Field School concept.

V Participatory Research

Research results turn into innovations only if rural producers apply them to practice. Researchers need to consult with farmers in order to identify the most pressing agricultural questions. Moreover, for finding appropriate technological answers to farmer questions, researchers must take into account local constraints, risks, and cultural preferences. Therefore, it is best to involve farmers at all stages of the research process, from the definition of research issues, through the planning phase, implementation, and evaluation of research results.

Participatory research is a generic term for a series of methods, which are designed to achieve research results of practical utility and affordable to farmers. Participatory research and technology development seek to create an equitable partnership between researchers, farmers, and other stakeholders in agricultural innovation processes.

Box 1 provides an interesting case, in which agricultural research was turned more demand-led.

Box V-1 Competitive Research Funds Benin

Vodouhe/Tovignan (2004) report on competitive funds for research in Benin. The National Agricultural Research Institute (INRAB) manages the funds and organises the selection of research proposals:

Workshops are held not only for researchers, but also for all actors in the national agricultural research system including NGOs, universities, and farmers' organizations. The first workshop is usually to identify priorities. The next steps include the following:

- Call for proposals related to priorities identified.
- Selection of the best proposals for funding.
- Monitoring and evaluation of the process.
- Workshop to present the results and identify new priorities.

Through this initiative, research is done not only by researchers, but NGOs as well. Three rounds of this national research cycle have already been carried out. Recent evaluations show that, for such a short time, a lot of useful results have been obtained in various domains of agriculture (crop production, animal production, socio-economy etc.). Unfortunately, these results are not yet translated into practical extension messages that farmers can use for production purposes.

This case demonstrates that demand-led agricultural research is relatively easy to establish. But it also shows that research requires a good linkage to farmers, organised communities or to farmers' groups from the start in order to become applied and useful.

For institutionalising participatory research approaches it will be necessary to upgrade them. Applied research, which is of utility to farmers, must be recognised as an important social and scientific achievement. Furthermore, it has to be rewarded either in terms of recognition as in terms of promotion, or both. Two fields of study may be regarded as intellectual sources of participatory research approaches: farming systems research and participatory action research.

1. Farming Systems Research (FSR)

Farming Systems Research recognises the complexity of agriculture by considering relevant factors: ecological, as well as social, cultural, and economic ones need to be analysed and understood in order to understand the system in place. Farming systems in the tropics are highly location-specific and varied, corresponding to the diversity of the ecosystems. Cultural traditions to manage these ecosystems often developed over a long period of time and are deeply embedded in the traditions of rural communities. FSR attempts to analyse these systems in a comprehensive way, combining ecological and social research. Empirical work on the ground, therefore, involves farm families and rural communities, leading them to analyse the farming system. Even more importantly, farming systems research strives to build on the wealth of local experiences in managing fragile ecosystems. The incorporation of local knowledge and experience is considered fundamental for finding suitable and appropriate technologies.

2. Participatory Action Research (PAR)

Participatory action research has developed as a social science methodology during the last 30 years. PAR departs from the assumption that involving people in research processes most immediately changes the reality of this people. The mere fact that researchers participate in solving concrete problems, asking questions, and encouraging the reflection of people transforms the living conditions. PAR consciously involves communities in the research process, enabling them to articulate their views, and encouraging them to experiment. Research and social change are considered to be parallel processes.

The basic model for participatory action research is to pass jointly through an action-reflection-cycle:
to see – to reflect – to decide – to act – to evaluate - to see again.

It starts with a participatory, joint analysis of problems, continues reflecting causalities, is followed by decisions and planning, then by implementing actions (trying out new ideas), and ends with evaluating the activities. All is done jointly with the respective target group and supported by the researcher-facilitator. This learning cycle can be repeated several times, thereby, generating firsthand insights into the dynamics of change as well as into recommendations. There exists some intellectual relation to the partner-centred extension approach described above (IV.1).

3. Participatory Technology Development (PTD)

PTD is a term that stands for a range of on-farm and client-oriented research. What they all have in common is that technology development is done in cooperation with farmers, farmer organisations, and extension agents. The objective is to develop readily applicable technologies by using action research principles. Farmers are given an active role in technology design and contribute their knowledge on a local farming system, equipment, and practical skills while researchers bring their scientific knowledge and methodological expertise to bear on the situation.

PTD projects follow a sequence of steps, which typically include:

- Identification of farmer groups and villages interested in agricultural research results;
- Joint problem analysis and site selection;
- Joint research design;
- On-farm trials / farmers' experimentation;
- Joint evaluation / sharing of results with others.

Within the scope of PTD, a balance needs to be found between the contributions of both partners involved. The degree of control exercised by farmers depends on the objective of the PTD exercise and the attitudes of the researchers. In a researcher-dominated mode, farmers would be confined to evaluating proposed technologies. In a farmer-dominated mode, farmers could be supported to generate technological innovations based on their own traditional or indigenous knowledge. PTD is also appropriate for the orientation phase of new extension programmes to identify problems/ technologies and to train extensionists in a participatory approach; in the extension phase, it leads rather naturally to participatory or Farmer Field School approaches (see Kwarteng et al. 2004).

4. On-Farm Research (OFR)

While in PTD, research topics are defined by researchers and by farmers, in on-farm research (OFR) the research topic is defined by the researchers. Then, farmers will be identified who are willing to

offer a plot of land for conducting research. The goal of OFR is to rapidly identify factors limiting production, and test potential solutions on-farm. OFR takes different forms depending on the way experiments will be conducted. The classification distinguishes between trials that are

- designed and managed by the research team on a farmer's field;
- designed by researchers and managed either by the farmer or jointly;
- and jointly-designed and experiments managed by farmer.

OFR uses mainly scientific research techniques for trial design, the choice of treatments, and data analysis. OFR involves mainly farmer fields and less the farmer, his or her knowledge, and experience.

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Deutsche Gesellschaft für
Technische Zusammenarbeit (GTZ) GmbH

Dag-Hammerskjöld-Weg 1-5
65726 Eschborn
T: +49 61 96 79-0
F: +49 61 96 79-11 15
E: info@gtz.de
I: www.gtz.de