Participatory Research for Smallholder Livestock Systems: Applying Common Sense to Complex Problems

P. M. Horne
CIAT, Lao PDR

Werner Stür
Australian Centre for International Agricultural Research, Australia

The XX International Grassland Congress took place in Ireland and the UK in June-July 2005. The main congress took place in Dublin from 26 June to 1 July and was followed by post congress satellite workshops in Aberystwyth, Belfast, Cork, Glasgow and Oxford. The meeting was hosted by the Irish Grassland Association and the British Grassland Society.

Proceedings Editor: D. A. McGilloway

Publisher: Wageningen Academic Publishers, The Netherlands

Participatory research for smallholder livestock systems: applying common sense to complex problems

P.M. Horne[1] and W.W. Stür[2]
[1]*CIAT, P.O. Box 783, Vientiane, Lao PDR*
Email: p.horne@cgiar.org
[2]*CIAT, 22 Seventh Avenue, Windsor, Qld, 4030, Australia*

Key points

1. Participatory approaches to research (PAR) bring researchers closer to farmers, the intended users of research outputs.
2. Active, functional participation of farmers in the evaluation and development of new technologies requires researchers to make an important commitment: respecting the knowledge, skills and opinions of farmers while maintaining confidence in their own scientific knowledge.
3. Farmer experimentation is not usually suitable to provide quantitative biophysical data (this can be achieved more effectively in researcher controlled experiments), but to provide qualitative information and improve understanding. This type of information can be collected systematically to enable rigorous analysis.
4. While participatory approaches are likely to lose some of their current 'favoured status', the principles of farmer participation will remain an essential component of agricultural research.

Keywords: farmer participation, on farm experimentation

Introduction

'Research' – as a distinct activity separate from the everyday life of farming – is a relatively new phenomenon. Only in the last century has agricultural science become sufficiently complicated and large-scale to be separated from the realities of farming. Agricultural research stations were built and became a reliable, predictable comfort zone for researchers. Did agricultural research then became less participatory? Perhaps, but the consequences were not immediately obvious.

In the 1960's, there existed an optimistic mood that modern scientific approaches in agriculture (especially plant breeding and selection) could solve the perceived threat to the food supply of developing countries. The underlying assumption was that modern science had answers and technologies that farmers needed to produce more food. The Green Revolution of the 1950's and 60's, based on new crop varieties and extensive use of fertilisers, irrigation, herbicides, pesticides and machinery, resulted in spectacular yield increases. By the 1990s, almost 75% of the area of paddy rice in Asia and half the area of wheat in Africa was sown using Green Revolution varieties and methods (Rosset *et al*., 2000). Most of the gains were made in relatively uniform production environments where farmers had the means and motivation to aspire to the production levels achieved on research stations. The net increases in food production came at the cost of a greater dependence on fossil fuels and agricultural chemicals, reduced agro-biodiversity and an increased disparity between those that had, and hadn't access to food and food producing resources.

The fact that so many of the world's poorest farmers were either left behind or further marginalised by these new technologies was a stimulus for many to reassess the way research for agriculture was conducted in the developing world. There was a growing demand that research must deliver benefits for the poor. The farming systems which support most of the world's rural poor are complex, risk-prone and often marginal for agriculture. This paper discusses the contribution participatory approaches have made to the needs and opportunities of smallholder farmers. It identifies (i) situations in which it is particularly useful to adopt a participatory approach and (ii) the enabling factors for the successful implementation of participatory approaches to research.

The promise of participatory approaches to research

In the 1970's and early 1980's, Farming Systems Research (FSR) attempted to make technology development more relevant to the realities of smallholder livelihood systems, through a better understanding of the complex interaction of factors that govern the success or failure of new technologies. Farming Systems Research introduced into the discourse an appreciation of (i) the importance of non-biophysical factors on the success of promising new technologies and (ii) the complexity of the farming systems in which they would be tested. However, FSR did not fundamentally change the way that new technologies were generated and 'delivered' (Sumberg & Okali, 1997).

Participatory rural appraisal

In the mid '80's, the concept of 'participation' in agricultural R&D took hold and spread rapidly through research institutions, NGO's and bilateral/multilateral agencies involved in rural development. Many individuals and institutions recognised the need for a broader participation of stakeholders, and contributed to developing practical approaches for implementation (Chambers, 1997). Participatory Rural Appraisal (PRA) emerged as both an approach and a diverse set of relatively simple tools that enabled development-oriented organisations to work with farmers in a more collaborative way, to define and prioritise the key issues in their livelihood systems. Development specialists, adopted PRA widely because:

- Many of the tools were intuitive, providing development workers with a process that was easily followed, and helped them break communication barriers with farmers.
- Increasingly donor agencies, seeking ways to make their projects more effective in delivering impacts, adopted the principles of 'participation' in their projects.
- Experienced development workers found that using these tools, information and insight could be gained relatively quickly.
- The tools were fun – gone were the dull interviews that produced masses of data that rarely got analysed.

Subsequently however, the concepts and directions of 'participation in development' seemed to become disconnected from the realities of much of the implementation on the ground. While a handful of influential groups, networks and individuals (notably among them, the International Institute for Environment and Development (IIED), the University of East Anglia and the Natural Resources Institute (NRI)) continued to stimulate the debate, encouraging a focus on the quality and action learning aspects of participatory processes, the field application in many cases became bogged down by a fascination with the tools. There are instances of development projects which invested enormous effort into trying to understand farmers' realities using PRA tools (in some cases for up to two years) but when it finally came down to answering the

question "So what can we offer these farmers?", the process reverted to 'transfer of technology'. While PRA had made a major contribution in altering the way development specialists approached rural development, it had not substantially changed the way in which new ideas or technologies were generated to address farmers' problems.

Participatory research approaches

At the same time as the concepts of PRA were spreading, a new set of participatory research approaches, tools and terms emerged (Jiggins, 1989; Sumberg & Okali, 1997, Veldhuizen *et al*., 1997; Stür *et al*., 2002). The arguments driving the development of these more participatory research approaches were:

- Normal modes of agricultural research and extension had failed to make significant contributions to resource-poor farmers in complex and risk prone environments.
- The detailed knowledge which local farmers have of their environment and farming systems was not being utilised in the normal modes of R&D. In the 'transfer of technology' approaches, 'finished' technologies were developed with the expectation that farmers didn't need to adapt the technologies; they needed to change their farming practices to take advantage of the promise the technologies offered.
- Farmers in risk-prone livelihood systems are invariably hungry for ideas and 'raw technologies' to evaluate and adapt to their local opportunities and constraints. They are looking for quick action from researchers.
- Participatory approaches to research advocate farmers' active involvement as decision makers at all stages of the research process, including the early stages of problem identification and setting of research priorities. The promise of participatory approaches to research was that a) inappropriate or poorly-adapted technologies would be rejected early in the process b) researchers would gain a better understanding of the factors that contributed to particular technologies being integrated into smallholder livelihood systems c) technologies would have a greater chance of subsequent adoption because farmers were involved in screening and developing the technologies over a wider range of conditions than would happen on research stations and d) new problems and opportunities would arise that need new strategic research.

The two main approaches that emerged were Farmer Participatory Research (FPR) and Participatory Technology Development (PTD). The most common distinction made between these two approaches is that FPR is somehow more rigorous and technically-focused while PTD places a greater emphasis on community empowerment. In practice, however, there is little to separate them and this paper will refer only to Participatory Approaches to Research (PAR). The main difference between PAR methods is in the emphasis they place on technology development and adaptation. Conroy (2005), refers to "a process in which local people and outside facilitators work together purposefully and creatively to identify, experiment with, and validate technologies that effectively address important problems or opportunities, while simultaneously strengthening the capacity of local communities to address other related problems and opportunities in the future". This definition places emphasis on *development of impacts from technologies*. By contrast, Braun & Hocdé (2000) define "a process whereby a group or a community identifies a problem or question of interest, reviews what is known about it, conducts research on it, analyses the information generated, draws conclusions and implements solutions". This definition places emphasis on *empowerment of communities* to resolve problems through whatever means. The main characteristics of these modes of PAR and comparison with strategic research are summarised in Figure 1. In reality approaches to PAR fall somewhere in between these broad categories.

	Strategic research	Participatory approaches to research	
Main focus	Biophysical Information	Development of Impacts from Technologies	Empowerment of Communities
Objectives	• Define the biophysical adaptation and potential of technologies on research stations; • Deliver the most promising technologies for adoption.	• improve the effectiveness of research in delivering impacts to farmers; • help research focus more on issues of importance to farmers.	• empower communities through building the capacity of farmers' groups to conduct collaborative research; • enhance self reliance and ability to resolve broader community issues.
Where	• Research stations	• Research stations and farms	• Farms and the broader community
Types of participation	**Contractual** Farmers' land and services are hired or borrowed	**Consultative** There is a doctor-patient relationship. Researchers consult farmers, diagnose their problems and try to find solutions	**Collaborative** Researchers and farmers are roughly equal partners in the research process, continuously collaborating in activities	**Collegiate** Researchers actively encourage and support farmers' own research and experiments
Stakeholders	Researchers and 'key' farmers.	Researchers, extension workers and farmers.	Many internal and external stakeholders (including farmers, researchers, NGO's, public and private sector).
Typical activities	Detailed, controlled biophysical research leading to either (i) technology packages being identified for extension or (ii) 'raw technologies' being identified as options for PAR.	Farmers identify, test and evaluate technology options, adapting the most promising to their local conditions, opportunities and constraints.	A community group identifies a problem or question of interest, reviews what is known about it, conducts research on it, analyses the information generated, draws conclusions and implements solutions.
Types of information gathered	Quantitative, biophysical	Quantitative and qualitative	Largely qualitative
Local relevance	Low	Medium – high	High

Figure 1 Comparison of strategic research and participatory approaches to research (modified after Probst & Hagmann, 2003)

Participatory approaches to research in practice

The three modes of research summarised in Figure 1 have strengths at different stages of a research agenda. Government research organisations typically aim to contribute to all three modes of research but are active only in the first. NGO's and development projects are

typically focused on the second and third modes of research, but rely heavily on the first mode as a source of raw technologies. International agricultural research centres are increasingly becoming involved in all three modes of research.

To date in international agricultural research, there are fewer examples of PAR being implemented to empower communities than to deliver impacts from technologies. Approaches involving empowerment of communities (such as 'learning alliances' that aim to strengthen the ability of communities to conduct sustained participatory learning and action) challenge the mandate and responsibilities of research institutions, and are generally more difficult to implement, are less bounded and require longer-term commitment with intangible outcomes. Despite this, there have been some notable examples of PAR aimed at developing local research capacity in the fields of; natural resource management (Pound *et al*., 2003), management of communal grazing lands (Waters-Bayer & Bayer, 1994; Bayer & Waters-Bayer, 2002), formation or strengthening of community research groups (Ashby *et al*., 2000; Braun & Hocdé, 2000), and the Landcare movement (Garrity *et al*., 2000). There are few examples where attempts have been made to strengthen the capacity of communities of livestock-keepers to conduct their own research.

The emphasis of PAR in international agricultural research has been largely on the 'development of impacts from technologies' (Stür *et al*., 2000; Conroy *et al*., 2002; Stür *et al*., 2002; Franzel *et al*., 2003; Peters & Lascano, 2003; Pengelly *et al*., 2004; Conroy, 2005). Specific methods have ranged from formal experimentation managed by farmers with assistance from researchers, through to completely informal testing of raw technologies and ideas, with researchers encouraging changes and innovation. There are three main types of experimentation focused on development of impacts from technologies:

- Type 1 - conventional research trials designed and managed by researchers (either on-station trials or the same trial but conducted on farms);
- Type 2 - trials using PAR designed by researchers and managed by farmers;
- Type 3 - trials using PAR designed and managed by farmers.

There are many variations within this typology, especially in the extent of collaboration between farmers and researchers in Type 2 trials, and the extent of scientific rigour applied (controls, replication and precision of data collection). Despite this, the typology is useful in highlighting that the most appropriate type of trial to implement depends very much on 1) the objectives of the researcher in conducting PAR and 2) the degree of understanding about the potential of the raw technologies being tested to deliver impacts (see Table 1).

The typology does not imply that one approach is better than another, or that greater levels of participation somehow lead to better outcomes. Strategic research and the two typologies of PAR trials have different strengths that complement each other. The strategic research of plant breeders, for example, is a main source of raw technologies for PAR. It is important, however, that 'researchers select more thoughtfully and consciously between the different options at hand to explore the most appropriate strategy towards impact' (Probst & Hagmann, 2003).

Table 1 Situations in which it is particularly useful to adopt Participatory Approaches to Research (PAR) (after Franzel & Coe, 2002)

Objective	Likelihood of outputs from each trial type[1]		
	Type 1[2]	Type 2	Type 3
Precise and accurate biophysical data	H	M – L	L
Farmers' preferences about:			
• New raw technologies (eg new forage varieties; New anthelmintics)	L	H	M
• New management practices	L	M	H
Information about impacts and adoption:			
• Likelihood of wider adaptation and adoption	L	M	H
• Identifying farmer innovations	0	L	H
• Determining biophysical and socioeconomic boundary conditions for technologies	H	H	H

[1]0 = none, L=low, M=medium, H=high; [2]Type 1 = conventional trials designed and managed by researchers; Type 2 = trials using PAR designed by researchers and managed by farmers; Type 3: trials using PAR designed and managed by farmers.

It is worth noting from Table 1 that:

- Problems commonly arise when researchers expect to get both rigorous biophysical information and sound farmer evaluation from the same trial. In most cases this requires two different kinds of trial. Some PAR approaches have been developed to maximize both biophysical rigour and quality of farmers' participation (Snapp, 2002).
- If the goal of the research is to encourage farmer-innovation, it is important to allow farmers to evaluate the raw technologies to see how they work, discover how they fit into their existing farming system and, most importantly, identify new opportunities that a raw technology or practice may offer (not just focus on the solution to an existing problem). An example of the significance of the unexpected outcomes from farmer innovation comes from recent development of smallholder forage systems in northern Vietnam (Stür *et al*., 2000). Farmers in Tuyen Quang province identified the lack of feed resources for their buffalo and cattle as a high priority problem and requested support from researchers to find a solution. The scarcity of feed meant that the labour input from farmers to finding sufficient feed for their animals was making their livestock systems unviable. In 1997, researchers introduced a range of broadly adapted forage varieties for farmers to evaluate, and encouraged them to find innovative ways to integrate the varieties on their farms. They grew the forages in very small areas near their animal pens to test the feasibility of growing feed for livestock rather than relying fully on communal feed resources. After two years, the 53 farmers who had been testing the varieties concluded there was not enough available land in this region of intensive agriculture to grow sufficient feed for buffalo and cattle. Two farmers, however, found by chance that several of the varieties could be fed to their ponded-fish (grass carp and common carp). This reduced the time needed to feed fish from 2-3 hours per day for collecting soft native grasses to less than 30 minutes per day for cutting planted grasses grown in small plots near the fish ponds. This innovation generated considerable interest within the community and other farmers started to feed planted forages to fish (Yen & Binh, 2000) (Table 2). In this region fish are one of the most productive forms of farm activity with an average farm pond of 600–900 m^2 producing 240–360 kg of fish, worth US$250–300. This is equivalent to the income from two high yielding crops of irrigated rice from 0.25 hectares of land. This development was

totally unexpected to the researchers who only understood the role of forages for ruminants. Through networking, this innovation has been introduced and adopted by farmers in other provinces of Vietnam and other countries in Southeast Asia. In Ea Kar district of central Vietnam, for example, >100 farmers have built substantial fish ponds to take advantage of this production system, and irrigate forages from the ponds during the dry season to maintain production. They have also introduced cattle fattening to the system to utilise the excess feed available when the fish are still just fingerlings. Based on experiences in smallholder forage systems in other parts of the world, the impacts are expected to expand exponentially. These unexpected outcomes from farmer innovation and would not have been possible using conventional research approaches.

Table 2 Expansion of planted forages in Yen Son district, Tuyen Quang, Vietnam (Vu Hai Yen, *pers. comm.)*

	1997	1998	1999	2000	2001	2002	2003
Farmers growing forages (no.)	9	53	138	158	312	529	629
Average size of forage area (m^2)	75	75	200	500	500	500	700

- A criticism of Type 2 trials is that because of a lack of control, they do not provide sufficiently reliable data to be useful for researchers. In the context of PAR, researchers need to question the value of seeking reliable averages. The farming systems in which most of the rural poor live are highly diverse, risk-prone and marginal. Any new technologies emerging from PAR will be further modified through site-specific adaptation. Unless the raw technologies are particularly broadly adapted and robust (as in the case of many forage varieties or treatments for Helminths in cattle and pigs), then developing reliable average results from Type 2 trials will not address farmers' imperative for site-specific adaptation. Ceccarelli *et al*. (1994) argue that for crop varieties in highly variable environments it is more sensible to aim for specific, as opposed to general adaptation. This highlights the importance of understanding the variability of results from PAR trials rather than searching for the average result.

Situations that are particularly suited to these kinds of PAR investigations include:

- *Defining problems*. The nature of a particular problem of importance to farmers may be poorly defined (for example, farmers reporting deaths of buffalo calves but with non-specific symptoms or causes). Researchers can work with farmers to investigate the causes of the problem and with farmers identify options worth testing.
- *Understanding farmers' criteria*. The characteristics of a technology option that are important to farmers may not be well understood. Researchers tend to think of production-oriented characteristics whereas farmers very often have other criteria that are more important in selecting one technology option over another (for example, the green revolution rice varieties were high yielding but not preferred by subsistence farmers because of the poor taste).
- *Encouraging impacts and providing feedback to research*. Often the motivation for conducting PAR has been to better understand which of a range of technology options farmers prefer and why. In this case, researchers need to play less of a role in designing trials and place more effort on monitoring impacts. The lessons for research can be

insightful as the impacts that farmers gain from technologies are sometimes unrelated to the resolution of the initial problem. Sometimes they come from farmers changing their management practices to take advantage of a new opportunity identified during their experimentation. For example, smallholder livestock systems in Laos are mostly extensive (low input and low output systems) where the role of livestock is as a 'livelihood safety net'. Under these circumstances, few farmers are able to test new technologies that would allow them to move from being livestock keepers to producers. Forage researchers needed to find 'entry points' that would provide early and substantial benefits to interest farmers in making a substantial change in their livestock systems. In PAR trials that commenced in 2001, the most common entry point for >1300 farmers was using plots of forages as a source of cut feed to save labour for farmers at particular times of year when they needed to keep animals closer to home. By 2005, around 25% of these farmers had generated significant livelihood impacts by changing their livestock systems to take advantage of the forage resource available, keeping their cattle and buffalo closer to home and fattening them for sale. Thus the impacts came not from resolving the initial problems but from farmers changing their livestock systems to take advantage of new opportunities. These impacts are now expanding rapidly to neighbouring farmers, villages and districts. By 2005, 950 farmers had started feeding the legume, *Stylosanthes guianensis* CIAT 184 to their pigs, both as fresh feed and dried leaf meal (Horne, unpublished data). The impacts that emerged on pig productivity have been significant, novel and surprising to researchers, stimulating a new research effort into the potential role of legumes for improving productivity of village pig systems.

- *Encouraging adoption of complex technologies such as soil conservation practices*. Howeler *et al*. (2005) found that farmers participating in PAR trials of a range of system improvements for *Manihot* spp. (cassava) on sloping agricultural land were more likely to adopt soil conservation practices such as contour hedgerows of *Vetiveria zizionoides* (vetiver grass) and *Paspalum atratum* than non-participating farmers (Table 3). In contrast, 'simple' technologies such as new varieties were adopted more readily by non-participating farmers.

Table 3 Adoption of new technologies by farmers participating in Type 2 trials and non-participating farmers in nearby areas in *Manihot* spp. (cassava) systems in Thailand[1] (after Howeler *et al*., 2005)

	Participating farmers (% adoption)	Non-participating farmers (% adoption)
Varieties	100	86.6
Soil conservation practices	79.5	29.2
Intercropping	28.2	9.6
Fertilization	100	87.6

[1]Data based on a survey of 439 households

Situations where PAR may not be appropriate include:

- Trials requiring good biophysical data to better understand the environmental boundaries of an untried, raw technology (for example, understanding the seed yield potential of a new crop before testing it with farmers as a possible seed cash crop).
- Trials where farmers have limited knowledge about the potential benefits of a technology option and where the technology option requires substantial effort to develop (for example, forage tree legumes can be a long term source of high-quality feed but require up to two

years of careful management to establish successfully). In these cases, conventional demonstrations on rented farmers' fields may be more appropriate.
- Trials that impose significant risk to farmers' livelihoods. In such cases (such as testing new treatments for livestock disease or evaluating seed production of a new crop with farmers), researchers may either choose to conduct more on-station research to better understand the risk, or agree to compensate farmers in case of losses due to problems with the technology option.

There are many documented examples of PAR with a focus on delivering impacts from technologies. Despite the specific differences in methodological detail between them, they generally share a common sequence of activities, facilitated by outside organisations and conducted either by individuals or groups (Veldhuizen *et al*., 1997; Horne & Stür, 2003; Conroy, 2005);
- identify key problems and opportunities using tools such as mapping, ranking, calendars and problem trees.
- identify, test and evaluate new ideas or raw technologies to address these problems and opportunities.
- evaluate the outcomes of the trials using tools such as ranking and scoring as well as collecting relevant conventional research data.
- decide what steps to take next (including the need for further experimentation or new options).

While these activities and tools are conducive to a participatory mode of research, they are not inherently participatory (Conroy 2005). Active, functional participation of farmers in the evaluation and development of new technologies requires researchers to make an important commitment: respecting the knowledge, skills and opinions of farmers while maintaining confidence in their own scientific knowledge. It is a key factor for successful PAR that researchers demonstrate to farmers, through words and actions, that they are respected as equal stakeholders in the PAR process.

When PAR is carried out with this kind of commitment and using genuinely promising raw technologies or ideas, impacts (both direct impacts and impacts on livelihoods) are likely to materialise. The process can rapidly move from 'identifying, experimenting with, and validating new technologies' to 'expanding the benefits to more people, more quickly and equitably'. That is, the process can quickly move from research to extension. A broad coalition of stakeholders is needed to take the outcomes of participatory research into extension, and the formation of such coalitions has to happen earlier rather than later in the process to foster ownership and commitment by development partners (e.g. government extension service). There is no abrupt end to participatory research or 'handing over' of results to development partners; research and development overlap for considerable periods with a continuing need for researchers to support the innovation process, and for development partners to find ways of short-cutting the time needed for other farmers to learn about the results and adapt the outcomes to their situations. Researchers alone usually do not have the skills and mandate to follow-through with extension opportunities.

Participatory approaches to research in livestock systems

Smallholder livestock keepers in the tropics have generally been poorly served by research. The tendency has been for research to focus on technical aspects to improving productivity without fully understanding the constraints facing the livestock keepers. Despite this, there

are a handful of well-known examples where smallholder livestock keepers have benefited from changes brought about by;

- *Regulation* - some large-scale beneficial impacts in farming systems have came about through enforcement rather than participation. For example in Amarasi district of West Timor, traditional regulations ('adat') were imposed in the 1930's and 1940's compelling shifting cultivators to plant the tree legume *Leucaena leucocephala* in hedgerows. This provided sufficient feed for livestock and soil improvement for cropping to eliminate seasonal famine by the 1960's. By the 1980's, 500km^2 of Amarasi was covered with *Leucaena* based crop-livestock systems (Shelton *et al*., 2000).
- *Strong government support programs* - these can support development of widespread impacts that would not have emerged on their own. Examples include the development of a network of >4000 smallholder forage seed producers in Thailand with government support over 25 years (Hare & Horne, 2004) and the spread of the green manure legume *Astragalus sinicus*, over more than 8 million hectares of paddy rice in southern China (Wen *et al*., 2000).

There are however, many more examples of large failures of these two approaches than successes. In Southeast Asia, there have been numerous unsuccessful attempts to 'photocopy' locally successful systems (e.g. forage hedgerows for erosion control and simple agro-livestock technologies) from one location to another. These failures came about from not recognising that often the technology (e.g. the hedgerows) is just the manifestation of 'a complex conjunction of people, technologies, events and luck…often with unanticipated outcomes' (Rob Cramb, *pers. comm*.). Some technologies have been actively promoted despite well-understood reasons for their repeated failure to deliver impacts. The benefit of treating rice straw with urea, for example, comes from higher digestibility of the straw increasing feed intake. This is only potentially useful in areas where there is a surplus of straw, yet the technology is often promoted in areas where all the rice straw is already utilised by animals in the dry season. Similar stories exist for promotion of molasses-urea-blocks, cross breeding with exotics to produce 'better' (i.e. larger) animals and delivery of vaccines to eradicate infectious diseases that are of greater global than local importance. Little research has focussed on the priority issues of the poor in relation to livestock (LDG, 2004). Most of these issues (see Table 4) are researchable and potential options already exist that may be able to overcome the problems.

As PAR were largely developed and implemented with crop technologies; some argue that it is more difficult to use PAR in livestock systems research because of:

- The greater time scales involved in livestock research, especially breeding and production research.
- Problems in sampling procedures and replication because of small numbers of animals available on farms. This makes it difficult to deal with between-farm and between-animal variability.
- The difficulties for farmers of managing individuals or groups of animals differently on the same farm, especially in feeding trials.
- Large variation in basal diets against which treatments are compared between and within farms (Morton *et al*., 2002).
- Potentially greater risk to farmers from research on farm animals (e.g., testing new vaccination procedures with pigs). The loss of one animal (whether it was a direct result of the experimentation or not) can be significant to the farmer and hamper the relationship with researchers.
- The mobility of livestock, especially in extensive systems.

Table 4 Typical constraints in smallholder livestock systems and potential options for Participatory Approaches to Research (PAR) (after Conroy, 2005)

Constraint	Impacts on		Example Options for PAR
	Numbers	Production	
Seasonal feed shortages		✓	Forages and other feed resources (e.g. sweet potato, cassava and maize for pigs)
Insufficient feed all year	✓		
Not enough labour to tend animals or cut feed	✓	✓	Having a managed feed resource allowing animals to be housed closer to home, enabling better management
Wandering animals damage crops, get injured or stolen		✓	
Fatal diseases	✓		Strategic use of veterinary medicines combined with better housing, herd management and feeding
Productivity-limiting diseases		✓	
Poor management	✓	✓	
Scarce water	✓	✓	Options will be site specific
Poor access to markets	✓	✓	Livestock producers groups

In reality many of these problems either do not arise, or there are ways to overcome them, moreover these issues are part of the nature of smallholder livestock systems, and represent the context in which any new technology option must be tested. So, while it may be true that PAR in livestock research is more difficult to implement than in cropping systems, the justification for, and potential benefits from PAR in livestock research are as great as they are in crop research. Given this potential, what are the main factors needed for successful implementation of participatory approaches to livestock research?

Individual commitment

The attitudes, facilitation skills and empathy of the researchers for PAR are key factors that will determine the outcomes of the PAR. Central to this is respect for farmers' views and their role as equal partners in the process.

Institutional commitment

Research institutions need to have a long-term commitment to PAR, especially if the work is targeted at developing impacts and encouraging innovation. Inherent in this commitment is the need for a broad skills base. It is desirable to have at least one 'process specialist' (not just biophysical researchers in the team), but PAR should not be implemented just by process specialists – the interaction between farmers and researchers is both insightful and necessary if there are technical issues or opportunities to overcome. It is also vital to have access to good technical advice and the raw materials (e.g. seed) for any technical options that are being tested. Finally, the organisation will need adequate funding. The financial resources required for PAR are often underestimated. Monitoring and analysis may be more time-consuming than they are in more conventional research modes (Conroy, 2005).

A researchable issue

It is necessary to have an issue that farmers consider important enough for them to commit time and resources to finding a solution. It should be an issue that faces many farmers in the

area and for which researchers have something to offer. Researchers have to bring technical options and ideas that will be adapted by farmers in a participatory approach. If farmers could have developed innovations to solve their problems with what they already have in hand, they would have done it long ago! There are many instances of organisations that are strong on participatory processes but lack access to the best available technical options. The result is a strong community process without any options to offer farmers or worse, inappropriate options, such as fruit tree varieties that are poorly adapted to a region or have a limited market. Key technical information associated with the options can be just as important but does not flow as easily as 'hard' technologies.

A clear research process

All of the stakeholders need to have a clear idea of the different stages in the process – diagnosis of issues, identification of options, testing, evaluation and planning – and the specific activities that will be conducted. This process needs to be flexible and alert, partly because the inherent nature of on-farm work, but also because PAR creates a moving research target. Technical developments that lead to impacts often do not come from solving the immediate problems (which are usually the entry points), but from farmers changing their production systems to take advantage of a new opportunity. This was clearly demonstrated in the example of feeding forages to fish in Tuyen Quang, described earlier in this paper.

Challenges for wider acceptance of participatory approaches to research

One of the main benefits of the spread of PAR concepts has been that more researchers are listening to, and working with farmers. This increased interaction with the 'end-user' has been an important shift in the research process and, in a sense, is a return to a common sense approach to complex problems. Few would now disagree that farmers need to be involved in agricultural research, and few would agree that researchers can continue to develop agricultural technologies assuming they will be disseminated by extension processes. The concepts and practice of farmer participation in research have become part of the comfortable norm of many researchers involved in adaptive research. However, even among researchers who have empathy for the principles of PAR, there are criticisms about its practice that present challenges to the wider acceptance of PAR.

Breaking down differences between rhetoric and reality

The discourse about participatory approaches in agricultural research and natural resource management is way ahead of the realities of implementation on the ground. The issues facing field implementation are very practical; (i) developing the basic skills, technical abilities and experience of field staff to do collaborative research with farmers; (ii) creating a common understanding of the PAR process among field staff so that they can continue to implement activities as a sequence of events; building on the last and preparing for the next, and (iii) engendering a problem solving and systems-oriented (as opposed to discipline-oriented) approach to PAR. A challenge for wider acceptance of PAR approaches is to demonstrate that these basic issues of implementation can be achieved, replicated and institutionalised in a cost-effective way.

Overcoming institutional inertia

International and national organisations engaged in agricultural research need to redefine their roles and mandates to accept PAR and multi-stakeholder approaches to research as a normative mode of action. This includes accepting a mandate and responsibility for research to engage in a wider spectrum of activities - from strategic research to achieving impacts on farmers livelihoods.

Applying PAR systematically

LDG (2004) give one example where the priorities of livestock experts influenced farmers to identify Foot and Mouth disease as a major issue for research, even though 41% of households did not own animals that could be affected by FMD. The danger is that poor implementation of PAR and false perceptions drive agendas, and these contribute to the perception of PAR as lacking rigour. While the data collected from PAR trials may not be as rigorous as on-station research, it can be collected in systematic ways to improve its reliability. This can include triangulation of methods to avoid researcher bias and check on the repeatability of farmers' preferences (Conroy, 2005). A challenge for the wider acceptance of PAR, is the development and application of more-rigorous approaches to analysing data from trials that are not specifically aiming at encouraging farmer innovation (Bellon & Reeves, 2000).

Moving beyond appraisal

For many, the perception of 'participation in research' is Participatory Rural Appraisal. Organisations involved in PAR need to move beyond this, providing farmers with action and access to ideas and technologies that are addressing their problems.

Sustaining PAR beyond projects

What happens when the donor funds run out and the 'experts' go home? How much of the success can be attributed to their time and effort? Is it possible to reach a stage towards the end where not only can the immediate groups with whom they have worked continue to develop, but where the messages can spread beyond the point of contact? Sustainability of a farming system is not a static endpoint with a checkbox to be ticked, but an ongoing and dynamic response to changing markets, environments and policies. New problems and opportunities are continually arising. Sustainability will be better achieved by local people having access to a broad range of technical information and raw materials of technologies along with the ethos of problem solving, so that they can respond to those changing markets, environments and policies. Given the practical realities of PAR described above, it is easier to identify these needs than to implement them. Learning alliances, to assist communities to conduct sustained learning and action through research, are a promising way to address the issue of sustainability of PAR.

Avoiding tokenism

Many of the criticisms of PAR refer to the perception that 'participation' has become just another necessary component of funding proposals. This 'tokenism' results in cynicism about 'participation'. The challenge for advocates of PAR is to demonstrate clearly that these approaches provide substantial benefits to research that cannot be gained in other ways.

Similarly, a common criticism of PAR by biophysical researchers is that 'participation' has become an end rather than a means!

It is not necessary to fundamentally change the way agricultural research is done to make it somehow more participatory. Rather, there is a need to conduct agricultural research that includes farmer participation (of varying types and levels), rather than conducting farmer participatory research as a distinct and separate activity (Okali & Sumberg, 1997). Participatory approaches to research will probably lose some of their current favoured status, but the principles will remain and should be institutionalised. The trend to increased interaction with and involvement of 'end-users' in agricultural research is here to stay.

Acknowledgements

In preparing this paper, we recognized that we have been enthusiastic advocates of PAR to the point where it might have become a 'blind spot'. We are grateful to colleague's and development practitioners for their opinions about PAR. Special thanks are due to Douglas Gray (ILRI) and John Connell (CIAT) for their ongoing inputs to the discussion.

References

Ashby, J., A. Braun, T. Gracia, M. Guererro, C.A. Quirós & J.I. Roa (2000). Investing in farmer researchers: experience with local agricultural research committees in Latin America. CIAT Publication 318, Centro International de Agricultura Tropical, Cali, Colombia, 199p.

Bayer, W. & A. Waters-Bayer (2002). M&E with pastoralists: a review of experiences and annotated bibliography. ETC Press, Eschborn, 56p.

Bellon, M.R. & J. Reeves (2000). Quantitative analysis of data from participatory methods in plant breeding. The International Maize and Wheat Improvement Centre (CIMMYT), Mexico, 143p.

Braun, A.R. & H. Hocdé (2000). Farmer participatory research in Latin America: four cases. In: W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Working with farmers: the key to adoption of forage technologies. Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, 1999. The Australian Centre for International Agricultural Research (ACIAR) Proceedings 95, Canberra, 32-53.

Ceccarelli, S., M. Erskine, S. Grando & J. Hamblin (1994). Genotype by environment interaction and international breeding programmes. *Experimental Agriculture,* 30, 177-187.

Chambers, R. (1997). Whose reality counts? Intermediate Technology Publications, London, 297p.

Conroy, C. (2005). Participatory livestock research: a guide. Natural Resources Institute, London, 295p.

Conroy, C., Y Thakur & M. Vadher (2002). The efficacy of participatory development of technologies: experiences with resource-poor goat-keepers in India. *Livestock Research for Rural Development,* 14 (3).

Diamond, J. (1998). Guns, germs and steel. Random House, NY, 480p. (ISBN: 0-393-31755-2).

Franzel, S. & R. Coe (2002). Participatory on-farm technology testing: the suitability of different types of trials for different objectives. In: M.R. Bellon & J. Reeves (eds.) Quantitative analysis of data from participatory methods in plant breeding. The International Maize and Wheat Improvement Centre (CIMMYT), Mexico, 1-8.

Franzel, S., C. Wambagu & P. Tuwei (2003). The adoption and dissemination of fodder shrubs in Central Kenya. *Agriculture Research and Extension Network (AgREN) Paper 131*, Overseas Development Institute, London, 10p.

Garrity, D., A. Mercado, R. Howeler & S. Fujisaka (2000). Participatory methods in research and extension for using forages in conservation farming systems: managing the trade-offs between productivity and resource conservation. In: W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Working with farmers: the key to adoption of forage technologies. Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, 1999. The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 95, Canberra, 254-272.

Hare, M.D. & P.M. Horne (2004). Forage seeds for promoting animal production in Asia. *Proceedings of the 10th Asian Seed Congress, Seoul, Korea*, September 13-17, Asia Pacific Seed Association, Bangkok, (in press).

Horne, P.M. & W.W. Stür (2003). Developing agricultural solutions with smallholder farmers - how to get started with participatory approaches. The Australian Centre for International Agricultural Research (ACIAR) Monograph No. 99, CIAT and ACIAR, 119p.

Howeler, R.H., W. Watananonta & T. Ngoc Ngoan (2005). Working with farmers: the key to achieving adoption of more sustainable cassava production practices on sloping land in Asia. Paper presented at the International Potato Centre, UPWARD Network Meeting, held in Hanoi, Vietnam, January 19-21, International Potato Centre, (in press).

Jiggins, J. (1989). Farmer participatory research and technology development. *Occasional Papers in Rural Extension 5. Department of Rural Extension Studies,* University of Guelph, Canada, 12p.

LDG (2004). Receptors, end users and providers: the deconstruction of demand-led processes and knowledge transfer in animal health research. Livestock Development Group, School of Agriculture Policy and Development, University of Reading, 101p.

Morton, J., B. Adolph, S. Ashley & D. Romney (2002). Conceptual, methodological and institutional issues in participatory livestock production research. *Livestock Research for Rural Development,* 14 (4).

Okali, C., J. Sumberg & J. Farrington (1994). Farmer participatory research: rhetoric and reality. IT Publications, London, 156p.

Pengelly, B.C., A. Whitbread, P.R. Mazaiwana & N. Mukombe (2004). Tropical forage research for the future – better use of research resources to deliver adoption benefits to farmers. In: A.M. Whitbread & B.C. Pengelly (eds.) Tropical legumes for sustainable farming systems in southern Africa and Australia. The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 115, ACIAR, Canberra, 28-37.

Peters, M. & C.E. Lascano (2003). Forage technology adoption: linking on-station research with participatory methods. *Tropical Grasslands,* 37, 197-203.

Pound, B., S. Snapp, C. McDougall & A. Braun (2003). (eds.) Managing natural resources for sustainable livelihoods. Uniting science and participation. Earthscan Publications, London, 252p.

Probst, K & J. Hagmann (2003). Understanding participatory research in the context of natural resource management – paradigms, approaches and typologies. *Agriculture Research and Extension Network (AgREN) Paper 130*, ODI, London, 16p.

Rosset, P, J Collins & F. Moore Lappé (2000). Lessons from the Green Revolution. Report of the Institute for Food and Development Policy, Oakland, CA, USA, *Tikkun*, 15 (2), 52-56.

Shelton, H.M., C.M. Piggin, R. Acasio, A. Castillo, B.F. Mullen, I.K. Rika, J. Nulik & R.C. Gutteridge (2000). Case studies of locally-successful forage tree systems. In: W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Working with farmers: the key to adoption of forage technologies. Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, 1999. The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 95, Canberra, 120-131.

Snapp, S. (2002). Quantifying farmer evaluation of technologies: the mother and baby trial design. In: M.R. Bellon, & J. Reeves (eds.) Quantitative analysis of data from participatory methods in plant breeding. The International Maize and Wheat Improvement Centre (CIMMYT), Mexico, 9-17.

Stür, W.W., P.M. Horne, F. Gabunada Jr., P. Phengsavanh & P.C. Kerridge (2002). Forage options for smallholder crop-animal systems in Southeast Asia – working with farmers to find solutions. *Agricultural Systems*, 71, 75-98.

Stür, W.W., P.M. Horne, J.B. Hacker & P.C. Kerridge (2000). Working with farmers: the key to adoption of forage technologies. In: W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, (1999). The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 95, Canberra, 325p.

Sumberg, J. & C. Okali (1997). Farmers' experiments. Creating local knowledge. Lynne Riener Publishers, London, 186p.

Veldhuizen, L. van, A. Waters-Bayer & H. de Zeeuw (1997). Developing technology with farmers: a trainer's guide. Zed Books, London, 230p.

Waters-Bayer, A. & W. Bayer (1994) Planning with pastoralists - a review of methods focused on Africa. Working Paper. GTZ, Eschborn, Germany, 90pp.

Wen, Shi Lin, Xu Minggang & Qin Daozhu (2000). *Astragalus sinicus* L. in rice farming systems in southern China. In W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Working with farmers: the key to adoption of forage technologies. Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, (1999). The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 95, Canberra, 181-183.

Yen, Vu Hai & Le Hoa Binh (2000). Forage options for fish and pigs in Vietnam. In: W.W. Stür, P.M. Horne, J.B. Hacker & P.C. Kerridge (eds.) Working with farmers: the key to adoption of forage technologies. Proceedings of an International Workshop held in Cagayan de Oro, Mindanao, Philippines, October 12-15, (1999). The Australian Centre for International Agricultural Research (ACIAR) Proceedings No. 95, Canberra, 281-283.