

## **A Process-Analysis Approach for Improving Multi-Disciplinary Farming Systems Research, Development and Extension**

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### **Abstract**

This paper introduces a process-analysis approach for agricultural research, development and extension that aims to assist in the integration of single discipline perspectives for multi-disciplinary projects focusing on sustainability. It is based on the findings that farmers use processes to draw upon and integrate information from a number of disciplines for their own research and development toward more sustainable farming systems. The concept of indigenous process knowledge (IPK) is introduced as a complementary source of knowledge for existing methods and processes used in scientific research, development and extension (RD&E) organisations. By analysing the decision making processes used by farmers, those working in projects involving agricultural, environmental and social perspectives can learn how to improve project planning, implementation and evaluation in a multi-disciplinary environment. Implications for using a process-analysis approach are discussed and ways of carrying out process-analysis research are examined. These ways include traditional scientific research, contextual research, on-going learning by researchers and extension agents, and co-learning involving researchers, extension agents and farmers. Strengths and weaknesses for each of these ways of operating are examined and their suitability with respect to RD&E organisational goals are presented as a tool for assisting RD&E undertaking a process-analysis approach.

### **Introduction**

The aim to achieve, improve and promote more sustainable farming systems has been at the forefront of agricultural research, development and extension on a global level. There has been an emerging view that to undertake this task more effectively requires the integration of a variety of disciplines relating to farming systems and new ways of thinking about sustainability. Processes used by farmers in multi-disciplinary management have proven successful and may be beneficial to those responsible for (and participants in) multi-disciplinary RD&E. In a co-learning and contextual environment, researchers and scientists can learn from farmers and develop new processes of thinking, whilst contributing to participatory action.

### **Multi-Disciplinary Approaches in Research, Development and Extension**

The idea of a multi-disciplinary approach to RD&E projects is not new and is reflected in the purpose of this symposium. With this focus however, it is now being realised what an enormous task it is to have multi-disciplinary projects that function effectively and efficiently. How to carry out multi-disciplinary projects has been an unforeseen challenge. Problems

with carrying out these types of projects exist because of the different perspectives and approaches within single disciplines. Patton (1990) describes how different disciplines have evolved over time by focusing on different core questions, resulting in theoretical traditions and orientation, which have produced implications for how researchers operate.

In essence, researchers within single disciplines now come together to plan, implement and evaluate activities in many different ways, and these different ways are often conflicting and competitive. In addition, researchers within specific disciplines are likely to view the world revolving around their own discipline. That is, their discipline may be seen as a focal point to which the other disciplines link. Korten (1980) distinguishes between the different methods and roles used by researchers coming from different disciplines. Researchers from one discipline may use informed interpretation, oral communication and narrative presentation, while those from another discipline may use statistical analysis, written communication and numerical presentation.

Not only does a multi-disciplinary approach need to overcome problems of researchers' different roles and ways of research, but it also implies an understanding of the links between the disciplines. For example, a project containing social, economic and biophysical elements requires researchers to investigate and understand the interrelationships and linkages between social, economic and biophysical phenomenon. This is a task rarely done in applied research. The question today is not whether multi-disciplinary RD&E should be carried out, but rather, how to go about operating and making decisions in an effective multi-disciplinary way. This entails drawing on the information, approaches and concepts of the single disciplines, recognising them for strengths and weaknesses to address the task, and then integrating or modifying them in such a way as to improve the effectiveness and efficiency of a project. This involves an understanding of the processes required to do so and this is the challenge.

### **Indeterminate Ways of Thinking about Sustainability Concepts**

One constraint to working in multi-disciplinary teams with projects focusing on sustainability, is the nature in which the sustainability concept is approached. Agricultural researchers have been *seen to act as if sustainability is either a goal-prescribing (meeting certain goals) or system-describing (focusing on fixed properties or levels) concepts* (Cox, MacLeod and Shulman, 1997). These goal-prescribing and system-describing approaches are based on two main assumptions. Firstly, it is assumed that individuals or groups of individuals share a common meaning about sustainability, and secondly, the systems they are working with are static or fixed in nature.

It has been suggested however, that meanings of sustainability emerge from within the human communication environment and are indeterminate in nature (Penman, 1994) and precise definitions are impossible (Pretty, 1995). That is, the meaning of sustainability is constantly changing in different ways for different people in different contexts, and hence different realities or perceptions about sustainability will inevitably emerge. If this is the case, then single discipline project members trying to operate in a multi-disciplinary way, may have very different views about sustainability. These different realities that team members from single disciplines may have, supports the ideas of the actor-orientated approach (Long and Long, 1992) and the knowledge systems approach (Roling, 1988), where different realities are said to exist among different actors or within different knowledge systems.

Based on this indeterminate perspective of sustainability, an alternative approach has recently been put forward by Cox et al (1997) that aims to re-construct sustainability as a *process improvement tool in research*. The difference with this approach is two fold. Firstly, scientists are not constrained by goals, targets or system levels that suggest that the best practice now is the best practice for the future, and secondly, it allows for the differences in scientists' perceptions about sustainability. This approach *asks scientists to examine what might be possible in bringing about better agricultural practices ... and how we can continually learn to manage in an open indeterminate world*.

## Methodology

To explore some of these issues from a farmer' perspective, a study was conducted to gain an understanding of farmers' perceptions of sustainability and sustainable farming systems in Queensland, Australia. Qualitative data was collected using a focus group methodology (Krueger, 1988). This methodology is a widely used research tool in social science, where individuals *respond in their own words, using their own categorisations and perceived associations* (Stewart and Shamdasani, 1990). Two focus groups (one female participant group and one male participant group) were carried out with farmers located in the Atherton Tablelands, North Queensland, and one focus group (male participant group) with farmers located in the Darling Downs, South Queensland. All participants were involved in cropping systems management.

This paper explores the data that emerged from one of the key open ended questions included in the focus group. This key question was "*What does a sustainable farming system mean to you ?*" Focus group data was analysed using qualitative data analysis software (QSR NUD-IST - Non-numerical unstructured data indexing, searching and theorising). This package is useful for handling textual data and enables a rigorous analysis of qualitative data.

## Results

A number of themes emerged through the analysis of focus group data. These themes are shown below. A synthesis of focus group participants' general perspectives for each of these emergent themes is presented in italics.

### **Farmers see their farming system as an all encompassing system that is dynamic in nature and unique**

Farmers involved in the focus groups see their farming system as a dynamic system, involving a number of components including the family unit, the natural resource base, their finances, the cropping system and capital items such as land and machinery. Each of these components influence each other and are also influenced by the socio-cultural context in which they are immersed. Farmers' needs of their farming systems were seen to be partly based on individual preferences and this determines their uniqueness.

Sustainability is something that farmers don't lose sight of and are always conscious of. It is difficult to provide benchmarks of sustainability, or measure it, either on an individual farm or at any level, because each property and individual is unique and situations are constantly changing. Sustainability involves the maintenance or improvement of things like health,

quality of life, and so on, and these are based on individual preferences. You have to manage your crops, your family, your bank balance, your soil and even your machinery, and they all influence each other. It involves constant monitoring and being aware of what is happening in a dynamic system.

### **Farmers use a multi-disciplinary approach to decision making**

Sustainability and a sustainable farming system, as seen by the focus group participants, involves a holistic approach where the integration of information and concepts from a variety of disciplines is needed. Farmers see themselves as experienced multi-discipline managers. Their continued capacity to endure on the land is partly due to their ability to recognise and prioritise relevant information for immediate and future use and to integrate this information coming in from a variety of sources relating to different disciplines.

A sustainable farming system is a whole complex of things. It is about managing everything in the package and everything seems to be influenced by or dependent upon what's happening out there, the environment, society, local and global markets, government policy and technology. In so many cases, the information you get seems to be inconsistent or unrelated. You get something from one person and something different from someone else, and you've got to look at it all and decide for yourself what is the best way to do things. We are better off now than what we were before though. Now we can think more critically about information, where as before we use to just do what we were advised.

### **Farmers perceive sustainability as a process-orientated concept**

Throughout the focus groups, participants used descriptions such as *constantly changing*, *dynamic*, *continuous improvement*, *long term outlook* and *constant observation* in the context of sustainability. A sustainable farming system was not seen as a persistent or fixed system that is implied by the goal-prescribing and systems describing sustainability concepts.

Sustainability is something you can't really achieve. You look at what you're doing and you can get some idea if you are going in the right direction. You can get an idea of whether you are being more sustainable or not. You are not just looking at what is happening on your property either, but you are looking at the things that influence whether you can carry out some of the things you want to do, and the markets and other things you are tied up with. It's how you go about things and what is happening in your system over time.

### **Farmers use a continuous learning approach in their management**

There was a strong view by participants that continual observation and learning was needed to maintain and improve the farming system. There was also an importance placed on the family farm, where management skills and learnings are passed down from generation to generation.

A sustainable farming system is a system that continuously strives to improve resource quality, while maintaining economic viability and quality of life, so that it will be there for future generations. It is based on a long term outlook on management and incorporates the use of improved practice and also new technology and information. You are always learning. The family unit is required for a sustainable system because continuous improvement in

practice and decision making is based on dedication, built experience and constant observation. Dedication comes from the personal motivations that keep you on the land, built experience comes from constant learning and the generation to generation handing down of information, and constant observation means working closely with the land, one on one.

## **Discussion**

The notion that RD&E agents can enhance multi-disciplinary projects focusing on sustainability, by learning from and with farmers, the processes needed to operate within a multi-disciplinary learning environment, has been based on the findings from this focus group study. This is not to say that some RD&E agents are not working in effective multi-disciplinary ways already, or that the way a farmer operates in a farming system directly correlates to the way team members operate in a project team. Using a process-analysis approach to understand farmer decision making processes is suggested as a way of improving RD&E. A process-analysis approach can aid in learning about processes that may be applicable, whilst discovering and recognising where processes differ between farm management and project management.

## **Farmer knowledge as process knowledge**

The idea that farmer knowledge and scientific knowledge can be complementary sources of knowledge in decision making is gaining acceptance. Parallels between farmer knowledge or indigenous knowledge (as it is often referred to) and sustainable development within particular situations and contexts is also well documented (Agrawal, 1994; Scoones and Thompson, 1994; Clarke, 1990). In recent years, the emphasis for the contribution and incorporation of farmer knowledge in scientific research has been on indigenous technical knowledge (ITK). That is, the knowledge that farmers have about the technical aspects within their farming system. Scoones and Thompson (1994) however, suggest that this is a *rather narrow interpretation of local people's knowledge and abilities that has concentrated attention on their role in agricultural production*. It has been through this realisation that the concept of Rural People's knowledge has now come about, viewing ITK as only one of the components of this knowledge system. Taking on a process-analysis approach by RD&E implies a recognition of the value of indigenous process knowledge (IPK) in the management of complex soft systems.

## **Ways of process-analysis research**

Process-analysis can be carried out by RD&E organisations in a number of ways, each way reflecting a different type of farmer interaction or participation.

*Process-analysis by researcher using traditional methods of data collection* - Traditional research methods of collecting data, such as surveys, may give some insight into farmer management processes, however data will be general and broad. In this process of collecting data, participants in the process gain very little, if anything, and a change to the system is not expected by the researcher. Data is analysed and the results are placed into the researcher's way of thinking. Outcomes by the organisation are predetermined. An assumption is that the researcher knows the right questions. This type of research may have benefits for issue identification in a broad sense.

*Process-analysis in a farming system context* - This implies interpretive understanding, whereby RD&E collect data in the socio-cultural context of a farming and rural system environment and analyse this data in relation to this context. That is, the learning that takes place will not just be on process, but on process in a rural peoples' context. This requires hermeneutics. Hermeneutics, as described by Patton (1990) is a theoretical approach that asks *what are the conditions under which a human act took place or a product was produced that makes it possible to interpret its meaning* ? This may involve using traditional methods or participatory methods of data collection.

*Process-analysis using on-going learning by researchers and extension agents* - The move toward multi-disciplinary approaches has unveiled the problems that arise when actors with different perceptions come together for project planning, implementation and evaluation purposes. A learning paradigm has been suggested by some development theorists and practitioners as a way of improving this emerging dilemma (Roling and Jiggins, 1994; Kloppenburg, 1991) and participatory methods for alternative systems of learning and action have been documented (Pretty, 1995). This type of approach has been seen as an alternative approach because it takes into account the post-modernist view of *multiple fragmented realities* (Davies, 1994). Organisations taking on an on-going learning approach will need to know ways of facilitating learning within the project environment. This approach involves participatory learning by the project members in learning about farmer processes, but neglects learning by participants in the research.

*Process-analysis using a co-learning approach* - Some scientists in research and development have already looked toward organisational learning to adopt a *quality continual learning process* approach to allow for differences in meanings between researchers, such as the meaning of sustainability (Cox et al, 1997). This supports a learning environment for researchers, but the question of participation by the end user remains. A co-learning approach attempts to address this issue by involving the end user in a continual learning process. Taking on this approach, RD&E agents look toward, learn from and learn with farmers who are already operating in a multi-disciplinary way within a systems construct. A co-learning approach also takes into consideration the differences in meaning of concepts such as sustainability, not only between scientists, but also extension agents and farmers. A learning forum is provided where similar experiences can be reflected upon enabling collective discussion and decision making by researchers, extension agents and farmers.

An interesting point to ponder at this stage is that maybe in a co-learning environment, the need to understand the processes used by farmers (to integrate, analyse, synthesise and apply multi-discipline based information) may become less important, as researchers will be contributing to and working within these already existing farmer processes. That is, the researcher becomes an integral part of the process, rather than being detached. The need to understand decision making processes may then be *superseded* by the need to understand processes to facilitate participation and co-learning. Although decision making and management processes can be better understood, using a co-learning approach is likely to provide an environment where participatory and public action takes place.

### **Introducing a Process-Analysis Approach in RD&E**

This paper promotes a co-learning approach within a farming systems context as the most beneficial way to carry out process-analysis. The change to a co-learning approach within

some RD&E organisations, however, may need to be progressive. It is also acknowledged, that to meet the needs of some projects that are operating within short time frames, limited resources and pre-determined objectives, a co-learning approach may appear to be unrealistic. For these reasons, these different ways of going about process-analysis have been introduced. Some of the strengths and weaknesses of each of these ways of going about process-analysis are seen in figure 1, including their suitability for organisational goals.

Figure 1. A tool for progressive methods of process-analysis in organisations

Research Method	Strengths	Weaknesses	Suitability
Traditional methods of data collection used by researcher	quick and easy data collection; limited resources required; limited interaction; projects can have pre-determined outcomes	assumes the researcher knows the questions to be answered; feedback loop is weak; can be threatening to the research 'subjects'	organisations with limited resources operating on short time frames; results needed on a broad scale based on issue identification
Data collection within a farming systems context	allows for the data gathered to be related to context; allows for learning about the context; provides self development	question of who owns the data gathered is raised; may be threatening to and time consuming for farmers	organisations working particularly for rural and farming system projects; results needed in a contextual scale to improve understanding of system itself
On-going learning by researchers and extension agents	provides organisational development; emergent outcomes for the researcher that continually improve with respect to changing situations	may be threatening to researchers and extension agents; knowledge gained in the process is restricted to researchers and extension agents	organisations that need to feel in control of the data gathered; not applicable to projects that need to reach project benchmarks
Co-learning by researchers, extension agents and farmers	improves community development; emergent outcomes for researchers, extension agents and farmers; equality of knowledge and the direction of development	may be threatening to researchers, extension staff and farmers; requires time and commitment; difficult to acquire funding due to indeterminate outcomes	organisations wishing to take on a community development approach; learning is more important than outcomes themselves; funding is long term and outcomes are learning outcomes

An important aspect of this research is that farmers have been working in a multi-disciplinary environment through necessity for generations. Multi-disciplinary environments include physical, environmental, technical, economic and social aspects. RD&E agents can explore farmers' processes of integrating single disciplinary information, approaches and concepts to address issues and make decisions pertaining to complex soft systems.

### Implications of Taking on a Process-Analysis Approach

Research, development and extension agents taking on a process-analysis approach has a number of implications. This is primarily to do with the different assumptions and contexts from which farmer knowledge and scientific knowledge has emerged. For this reason there has been some debate to whether farmer knowledge and scientific knowledge can be integrated. Scoones and Thompson (1994) state that *to remove local knowledge from the web*

*of meaning and influence from which it arose and attempt to fit it into the constrictive framework of western scientific rationality is likely to lead to significant errors in interpretation, assimilation and application.* This means that if RD&E agents try to learn about the processes used by farmers in making decisions, even if learning takes place within a farming system context, the application of these processes in another context should be done with caution.

Another implication is the way in which data is gathered, analysed and interpreted. How this research is undertaken determines the validity and appropriateness of such processes in their application. Some organisations may feel they need to work in a less participatory manner and in different contexts in the data collection, analysis or interpretation phases. It needs to be made clear, that within each of these approaches, traditional methods of data collection, analysis and interpretation can be used to serve some purposes. It is the approach that the researcher takes toward their own and their organisations research journey, however, that determines the relevance and applicability of research findings in the future. In addition to these implications, if the idea of 'different realities' is to be considered, it must also be put forward that those involved in any of these approaches may have different views about their own and others involvement. In light of these issues mentioned, a process-analysis approach may require an overall gradual learning approach by the organisation. That is, gradual learning as part of organisational maturity, may be necessary for the organisation to function in a co-learning and contextual environment described in this paper.

## Conclusions

In the context of this conference, a number of suggestions and ideas have been presented that will hopefully provide some benefits for both RD&E in Queensland and RD&E at a global level. To achieve a common understanding of the complexity and the needs required for environmentally sound farming and rural development, let us look toward those who operate within this environment and learn from (and with) them the skills required to manage complex systems. To develop strategies which allow a satisfactory integration of economic, social and environmental issues, let us learn from those that have trialed various strategies through experience in a farming systems context. If this can be carried out in a learning forum involving agents from RD&E and farmers, this will be a step forward for research and development in any area focusing toward farming systems, sustainability and multi-disciplinary thinking. For generations, farmers have had to define realistic, practical and systematic approaches to complex problem solving and continuous improvement. For this reason, a co-learning process-analysis approach looks not only at problem solving, but also considers ideas in relation to 'solution enhancement'.

The approach put forward in this paper requires the provision or enabling of a learning forum for maximum benefits to be achieved by RD&E agents and farmers. It also requires a recognition of the processes used by farmers, not just content. It is about exploring the ways that farmers make decisions and cope with everyday paradoxes and conflicts, to aid us in the quest for an alternative way of looking at RD&E in resource management. This means taking on board a co-learning process-analysis approach in an appropriate situational context. Understanding decision making in complex systems can occur experientially on behalf of researchers and scientists, when they make decisions with farmers in a learning environment. It is not about researchers and extension agents learning from farmers so that they can become better at instigating pre-determined change. Learning to learn with farmers and learning to

learn from farmers will depend on farmers being genuinely recognised for their experience in and knowledge about systems analysis and management.

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