Poverty Alleviation through Agricultural Research – the ACIAR Experience

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Abstract

The evolution of a 'poverty alleviation' focus within ACIAR is briefly described. ACIAR has undertaken intensive efforts with *ex ante* and *ex post* economic evaluation for many years, but explicit measurement of achievement in the area of poverty alleviation has been minimal.

This is because: (a) the concept of poverty alleviation is elusive; (b) calculation of poverty alleviation first requires the calculation of economic benefits (unless poverty alleviation is to be 'self assessed'); (c) calculation of economic benefits from research can be difficult *per se;* and (d) the distribution of economic benefits is difficult/impossible to discern in a partial equilibrium framework.

In light of these issues, the pragmatic approach taken within ACIAR is described. This approach remains fairly strongly focussed upon the assessment of economic benefits, but with a poverty alleviation flavour.

1. Introduction

ACIAR (Australian Centre for International Agricultural Research) is a Commonwealth Government institution. It is part of Australia's development assistance program, with a mandate to:

(a) formulate programs and policies with respect to agricultural research for either or both of the following purposes:

    i.   identifying agricultural problems of developing countries
    ii.   finding solutions to agricultural problems of developing countries

(b) commission agricultural research by persons or institutions

(c) communicate (rsearch results)

(d) establish and fund training schemes related to its research programs

(e) conduct and fund development activities related to its research programs

(f) fund international agricultural research centres

A recent external review of ACIAR (Nairn et al. 1998) recommended that:

> 'ACIAR (should) more effectively communicate the way in which the benefits flow from ACIAR projects to ultimately achieve ***poverty alleviation…***' (p.42)

Yet we find the targeting and evaluation of poverty alleviation aspects of our research to be a difficult, complex and imperfect task. In this paper, the mechanisms that ACIAR uses in attempting to do so are explained, as are some of the problems, and lessons.

2. Poverty alleviation and agricultural research – some reasons why the linkage is difficult

A recent paper by Maxwell (1999) surveys the definitional, conceptual and measurement issues relating to poverty. Maxwell claims that consensus has been achieved in some areas, but many complex areas of disagreement and confusion remain. There has been a tendency to broaden out the definition of poverty alleviation - from 'simple' measures of income or consumption, to basic needs perspectives. Recently, even broader- based definitions have been suggested, evolving into the development of a 'sustainable livelihoods' approach to poverty alleviation (Farrington et al., 1999). For some of the reasons indicated below, the linkage of agricultural research to poverty alleviation is difficult, even when the latter is defined narrowly. Agricultural research cannot be expected to have any direct impact on some of the parameters associated with the broader-based definitions of poverty alleviation, such as access to health and education services.

Considering some of the particular aspects of agricultural research as a tool for alleviating poverty adds to the complexity:

- poor 'farmers' may derive only a proportion of their income from agriculture (eg Parilla, 1995). In those cases, the impact of agricultural research will necessarily be limited.

- if farmers grow a multitude of crops, as many poor farmers do (Parilla, 1995), then any crop-specific, research-generated productivity improvement will not result in far-reaching poverty alleviation for those farmers.

- productivity improvements from agricultural research may have some negative impacts on farm prices and thus on farm incomes. But this is part of the long term dynamic of economic development (Mellor, 1966). So the **timing** of any measure of poverty alleviation from agricultural research, as well as the choice of target group, will influence the result.

- the impact of research may be small per unit, and therefore insignificant for alleviating the poverty of any one person. However, overall economic benefits may still be substantive in comparison to the cost of the research. Such a lack of measurable 'poverty alleviation' in a given region does not imply an inappropriate allocation of research resources. It may simply reflect a broad geographical mandate and focus of the research institution.

- 'good research' which may not 'measurably' impact on poverty alleviation would be 'maintenance research' (Alston et al., 1995). There maybe no measurable reduction in poverty per se, but a prevention of poverty exacerbation. ACIAR funded a biological control project in the late 1980's on a pest of banana in Papua New Guinea. Most bananas in Papua New Guinea are grown by smallholders, and bananas are an important staple for them. The estimate of the economic benefits deriving from the project is over USD150m (Waterhouse et al 1999). This was a sound scientific project with high

economic returns (in the sense of loss avoidance), but not showing any 'measurable' impact on poverty alleviation. ('Loss' from the pest never actually eventuated since the loss was pre-empted by the research). It was poverty alleviation, but difficult to see/measure, since the 'without research' scenario was not very visible.

- the thread of the research impact may be lost, or obscured, where other scientists are the primary users of the information produced by the research (ie where a piece of research is an 'intermediate product'). Cause and effect relationships are obscured. ACIAR undertook a major piece of 'detective work' to try to unravel the respective contributions of a multi-year, multi-institution pigeon pea research endeavour, funded by ACIAR in the early years, subsequently feeding into ICRISAT's research program (Ryan, 1998). Although the distributional impacts of the projects' impacts were not closely examined, it appears that there was a strong poverty alleviation element. Can that impact be attributed to ACIAR? Only in part! In practice, the impact was treated as a joint (and inseparable) product of the two institutions.

- The timing of any poverty alleviation impact from research was mentioned above, in the broad sense of the dynamic of economic development. However, there is also the narrower, project-specific 'adoption lag' aspect to consider, when timing the measurement of impact. For example, an ACIAR project on 'soybean improvement in Thailand' which commenced in 1991, has resulted in a new variety, Chakkrabhandhu no. 1, certified in July 1998. However, this variety has not yet been sown or harvested commercially. Eight years has elapsed since the project commenced. It may require several more years before any reasonable extrapolation about planting areas and yield impacts can be assessed as a step towards assessing poverty alleviation.

- It may be virtually impossible to trace the impacts of poverty alleviation in any kind of partial analytical framework. For example, Coxhead and Warr (1995) showed that changes in poverty due to technical progress in a developing country (Philippines) accrue mainly through wage changes. Such changes are only captured within a general equilibrium framework.

3. How does ACIAR target its research?

A. *Judgements are made about poverty alleviation aspects of the potential research program. These judgments are via a specification of countries with a high proportion of poor people, commodities grown, or eaten by poor people, or socioeconomic groups thought to be in poverty.* There was a recent interesting example in relation to the control of the Newcastle Disease in village chickens. ACIAR-sponsored research was successful in developing a heat resistant vaccine that could be readily used in the field by coating it on to chicken feed. The vaccine was commercialised by an Australian company, subsequently take over by an American firm. Uptake of that technology has been somewhat limited to date. The capacity of poor villagers to pay for the vaccine was found to be limited and there were some other logistical problems. Having perceived these problems, ACIAR sponsored further research leading to the production of a new, uncommercialised vaccine suitable for poor farmers (Centre for International Economics 1998). Quantities of the seed of this vaccine can be made locally and applied to chickens in drinking water, or by eye drops. The point of telling the short story about this project

was to emphasise that consideration of poverty alleviation aspects drove the evolution of the research along a particular poverty alleviation pathway.

B.   *Given this subjective poverty alleviation framework mentioned in A, ACIAR implements certain procedures to maximise economic benefits within that framework.* These are briefly described.

Prioritising commodities from the perspective of potential economic benefits

In estimating the economic benefits from research, ACIAR utilises a commodity-based, multi-regional, research process model (Davis et al 1987). The technical inputs to the model include estimates of the relative research capability of different countries, the potential spillover of research outputs to other countries, and the expected rate and extent of adoption of technology in each country. The socio-economic impacts are predicted using a multi-region model which takes into account the impact of the research on both the producers and consumers. Large (global) data sets on commodity production and consumption (both commercial and subsistence), prices and elasticities are accessed by the model. This permits an estimation of world price effects that might spill over from research.

ACIAR uses the information generated from the model in several ways. One use of the information is to assist in aggregate priority-setting at ACIAR. Figures 1 and 2 shows a summary of the type of results obtained from the model (for the regions 'Australia' and South East Asia). It shows a summary of results from the model. Commodities are ranked, by region, according to the welfare gains that would result from a 5% reduction in the unit cost of production. At every ACIAR project decision meeting, tabulated information is presented which indicates the priority rating of each commodity for each project being considered. ACIAR looks particularly closely at individual research project proposals that target low priority commodities, and is most likely to conduct ex ante benefit/cost analyses on such proposals.

Ex ante *project assessment*

ACIAR uses research evaluations to estimate in advance the potential welfare impact of particular research projects. For this purpose, project-specific information is used, and potential impacts are estimated in consultation with the researchers, research managers and other technical experts. In Table 2 (column 3), the distribution of *ex ante* benefit/cost analyses by ACIAR program and geographical region is shown. We have not undertaken any explicit cross-checking of the analysis to see how reliable the results are, but there is a strong *a priori* judgement of overestimation. Nevertheless, we retain the requirement for a benefit/cost analysis, since we feel that, as a miminum, it forces project proponents to articulate clearly the mechanism by economic benefits (a precursor to poverty alleviation).

Table 1: Summary of benefit-cost analyses, by program and by ACIAR mandate region

Program	Number of completed projects	Number of projects analysed *ex ante*	Number of projects evaluated *ex post* *
Animal Sciences			
China	8	1	
Southeast Asia	30	3	2
South Asia	12	2	3
South Pacific & PNG	4	1	
Africa	4		3
Crop Sciences			
China	8	1	4
Southeast Asia	31	5	5
South Asia	7	1	1
South Pacific & PNG	14		7
Africa	5		1
ANRE/Farming Systems			
China	2		
Southeast Asia	24	4	
South Asia	2		
South Pacific & PNG	14	1	
Africa	1		
Fisheries			
China	0		
Southeast Asia	6	2	
South Asia	0		
South Pacific & PNG	13	2	4
Africa	1		
Forestry			
China	7		2
Southeast Asia	15		*
South Asia	2	1	
South Pacific & PNG	1		
Africa	6		5
Land and Water Resources			
China	11	4	1
Southeast Asia	33	2	
South Asia	6	1	1
South Pacific & PNG	2		
Africa	5		2
Post-harvest Technology			
China	1		
Southeast Asia	19	9	10
South Asia	0		
South Pacific & PNG	1		
Africa	0		
TOTAL	295	40	51

* Projects are allocated to the region where most of the research effort occurred.

In summary, the consideration of poverty alleviation in guiding ACIAR research is via a two stage process – first putting a poverty alleviation focus/framework/constraint around the population of possible projects, and then attempting to maximise economic benefits within that focus/framework/constraint, in the manner described above.

4. What has ACIAR achieved in terms of poverty alleviation and other impacts?

What is ACIAR trying to impact upon? A recent article by Mauldon (1998) usefully classified possible research impact into the following categories:

- scientific knowledge

- human research capacity

- community impact (including economic benefits, since these would seem to be a pre requisite to poverty alleviation)

The first two impacts are readily assessed at around, or soon after, the time of project completion. ACIAR undertakes an independent review of all of its projects, and these first two items are explicitly included in the terms of reference for those reviews (see Appendix). All of these independent reviews (more than 100) were read and then summarised in a report by Mauldon (1998). Table 2 is reproduced from that report.

Table 2: The number and percentages out of 111 projects by degree of success and extent of impact

Category of success or impact	Technical success (number)	%	Research Capacity (number)	%	Community impact (number)	%
Outstandingly successful (score of *5*)	16	(14)	14	(13)	5	(5)
Very successful (score of *4*)	41	(37)	36	(33)	20	(17)
Satisfactory (score of *3*)	33	(30)	48	(42)	29	(26)
Less than satisfactory (score of *1* or *2*)	21	(19)	13	(12)	57	(52)
TOTAL	**111**	**100**	**111**	**100**	**111**	**100**

The results in Table 2 provide a count of projects on the basis of one assessment criterion at a time. However, it is useful to categorise projects by composite scores, taking into account all the three categories of assessed performance. On the basis of these scores, two projects (nearly 2 per cent) could unequivocally be judged as having been outstandingly successful (a score of *5* for all parameters), twelve (11 per cent) as having been very successful or better (a score of *4* or more for all parameters) and 48 (43 per cent) as having been satisfactory or better (a score of *3* or more for all parameters). The remaining 63 (53 per cent) projects had a score of two or less on at least one of the assessment parameters. However, only three projects failed to make a score of *3* for at least one of the parameters.

Community impact (which includes economic impact, and impact on poverty alleviation) is more problematical. There will rarely be a community impact at the time of project completion, and, as indicated in the soybean example, above, a community impact may take many years to eventuate even after the conclusion of a particular project. Although Mauldon (1998) made a first cut at classifying projects on this 'community impact' criterion, this was attempted at the time of project completion. Therefore the classification was more on the basis of an *expectation* of community impact, within a reasonable period of time, rather than an observed community impact. (In other words, this was really more of a classification of the nature of the research – applied, strategic etc). ACIAR has now commenced a 'rolling' desktop examination of *all* projects completed five years previously (Mauldon 1999). Where there is a positive and quantifiable 'impact story' to document, a more comprehensive 'economic' assessment is undertaken.

ACIAR conducted comprehensive economic assessments of 12 completed projects in 1991 (Menz 1991). Another 12 projects were assessed in 1998 ((Menz and Lawrence 1999). Some were repeat assessments. Three of the latter 12 projects were outstandingly successful in terms of economic return – Australian trees for China, banana skipper control in PNG and Newcastle disease control in village chickens. Each of the three projects has an NPV exceeding $100 million. The benefits are accruing mainly to the developing country partner, but the banana skipper project has also provided significant benefits to Australia in terms of enhancing quarantine. A fourth project (Epizootic Ulcerative Syndrome in Fish) is anticipated to give a similar level of economic returns, but adoption of the results is less advanced than in the other three cases, and therefore the predictions are more speculative. However in all cases, estimates are based upon conservative assumptions.

Several projects had NPV's in the medium level range of between $10m and $100m. These were projects resulting in improved post-harvest handling of tropical fruit (Southeast Asia and Australia), reduced tariffs for Australian wool exported to China, improved fruit fly control (including a contribution to the Pawpaw fruit fly eradication campaign in Queensland), and controlled traffic patterns in reduced tillage (China and Australia). Each one of these projects is providing a significant economic benefit to Australia, as well as to overseas countries. Another project in this group was partially responsible for the widespread adoption of short season pigeon peas in India. It had no impact in Australia, since the mooted pigeon pea industry failed to materialise.

The final set of project benefits (under $10m NPV) resulted from bypass protein feed for Indian dairy cows, forest conservation in Vanuatu and from the first accurate soil test for sulphur applicable to Australian pastures and Canola-producing areas. In the latter two cases, the benefits are quite small, but still comfortably exceed project costs. Both also provide additional (non-quantified) environmental benefits. The Vanuatu project had a strong environmental orientation from the beginning and it was gratifying to see the environmental benefits being achieved simultaneously with modest, but significant, economic benefits.

Part of the exercise summarised in Menz and Lawrence (1999)was to revisit some of the projects that had undergone economic assessment in 1991. Four projects were selected on this basis, with interesting results. In one case, the expected benefits had increase substantially by 1998 (Newcastle disease) while in two cases, the expected benefits had fallen substantially, but remained very positive – bypass protein for dairy cows in India and fruit fly control. The fourth project, on Australian trees in China, gave a similar result in 1998 as in 1991. In the case of Newcastle disease control, the spread of the technology to Africa is responsible for the increase in expected benefits. The promise of extensive use of new fruit fly control techniques in Southeast Asia, apparently imminent in 1991, did not eventuate. The question remains as to why, and whether a further effort by ACIAR, or another agency, is warranted. In the case of the bypass protein technology for Indian dairy cows, the conversion of feed mills to the manufacture of bypass protein predicted in 1991 has continued, but at a somewhat slower rate. A number of components of the benefits predicted in 1991 related to the general development of the Indian dairy industry (improved animal quality etc). These developments did not take place as anticipated, making the bypass protein technology less attractive.

Total benefits (net of research costs) of slightly over $190m million were ascribed to the set of projects assessed. Of that total, about 14% are accruing in Australia, while the remaining 86% are accruing within developing country partners.

So did these projects alleviate poverty? Leaving aside the Australian benefits that are listed, there seems to be reasonable expectation that all of the other projects were targeted to the poorer end of the respective populations.

Costs per assessment ran at around US$10,000 each, including a field visit in most cases. No explicit attempt was made to measure *poverty alleviation.* Such an effort would have cost more and would have almost inevitably involved additional assumptions (eg about *ceteris parabus* outcomes; about extrapolation of adoption trends etc).

5. Concluding comment

There was no explicit mention of poverty alleviation in the original act of the Australian parliament which 'set up' ACIAR in 1982. There are some differences between the original 1982 Act and the Act that currently governs ACIAR, but neither explicitly mentions poverty alleviation (see the Introduction to this paper). A review in 1997 of Australia's overseas aid program (of which ACIAR is a small part) made a strong recommendation (Committee of Review 1997) that:

'The objective of the Australian aid program should be to assist developing countries to reduce poverty through sustainable economic and social development'

ACIAR's first Corporate Plan (January 1994-December 1996) stated that ACIAR's Corporate mission was to 'improve the well being of people…'. The subsequent corporate Plan explicitly included the words 'to reduce poverty…', but there is also reference to 'food security' and 'sustainable resource management'.

The 1998 review (Nairn et al 1998) of ACIAR recommended, in relation to poverty alleviation, that ACIAR:

- reorient its focus more towards development impact;

- demonstrate explicitly its achievements in poverty alleviation at the rural level; and

- monitor the CGIAR study on the impact of agricultural research on poverty alleviation.

In making these recommendations, the review team contemplated whether ACIAR's mission should be taken one step back from poverty alleviation to become something more like: 'to improve the capacity …to identify and solve agricultural problems and constraints to development' (p.19). However, this was not their final recommendation.

The evolution of ACIAR's research focus since its inception in 1982 could best be described as 'towards having a demonstrable economic impact'. Simultaneous with the evolution towards economic impact, there has been an evolution towards poverty alleviation. This trend began well before the recent review of ACIAR. Perhaps the outstanding issue is whether an international research organisation should satisfy itself with 'capacity building/knowledge generation', or should be involved with technology transfer and other more applied issues, where comparative advantage may be less. The decision within ACIAR has been to move further towards the development end of the spectrum, sometimes in conjunction with agencies of that bent (vis a vis research agencies).

ACIAR uses a two stage ex ante research targeting process 1. choose research targets taking subjective account of poverty alleviation concerns; 2. then maximise economic benefits (and there are two strategies used for achieving the latter – prioritising commodities and regions and undertaking an explicit B/C analysis of the expected project impact).

ACIAR is gravitating towards a three-stage impact ex post assessment process – one via a desk study at a preliminary stage (around the time of project conclusion), a desk study (5 years after project completion) and a 'full scale' assessment of those projects which appear to have had a substantive impact. Premature undertaking of *ex post* impact assessments can detract from credibility but often there is some imperative to make a premature assessment - otherwise 'lose the thread' and the experience with the ACIAR projects indicates that they do take a long time to have a community impact.

The recent external review of ACIAR expressed the opinion that ACIAR's *ex post* impact assessments still had a strong *ex ante* element (ie they were undertaken after the project was completed but before the full impact had been realised). This resulted in what the review team considered an excessive number of assumptions. But the Thai soybean example, which is by no means atypical, does highlight the problem. One maybe needs

to wait for 10-12 years prior to being in a position to make a strong statement about poverty alleviation. But how many other things would have been changing during that time? (Would a *ceteris parabus* assumption be preferable to 'real world', but confounded data?) And is the cause and effect link between the project and the outcome being lost/obscured along the way?

For the series of reasons mentioned in the paper, ACIAR has not specifically targeted the ex post impact assessments on poverty alleviation. However, since we target poverty and income generation (albeit somewhat subjectively) in our choice of research projects, it is a reasonable assumption that the economic benefits emanating from our projects are strongly biased towards poverty alleviation.

General equilibrium models lend themselves to tracing poverty alleviation impacts of research. Indeed it may be virtually impossible to trace these in any kind of partial framework. ACIAR has heavily promoted General equilibrium models as tools for broader agricultural policy research, with a strong poverty alleviation focus. Comprehensive, and agriculturally-oriented models have been produced for the Philippines (Coxhead and Warr 1995), Thailand (Warr 1998), Indonesia (Trewin 1999) Sri Lanka (Bandara and Coxhead 1999) and China (forthcoming project). General equilibrium models have not been explicitly used in ACIAR for the purpose of targeting biophysical research. Usually the models would lack adequate technological definition for this purpose at the project level. However, they could be used for guiding/assessing biophysical research with a poverty alleviation focus, where the 'research scope' is fairly broadly defined, such as at a programmatic level (Lin 1999).

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