Evaluating the impact of capacity building by ACIAR

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Abstract

Research funders like ACIAR typically invest in activities across a spectrum including human capacity building in pursuit of economic, social and environmental benefits. Ideally they allocate their resources such that the returns from these activities at the margin are similar but information about marginal returns is scarce. ACIAR has a strong record in estimating the impact of research leading to new technologies. There is much less experience in valuing research activities that add to human scientific capacity through either discrete training programs or the 'learning by doing' component of every research program. ACIAR commissioned Gordon and Chadwick (2007) to review the literature, devise an evaluation framework and apply their approach in two case studies. They partitioned an estimate of total welfare gains from a new technology between capacity building and research components, only qualitatively recognising 'spillovers' to later technology development. Here we review the literature in a research production framework, we assess the significance of capacity building activities within the total ACIAR program and we propose a tracer study of ACIAR trainees (Allwright Fellows) and partner institutions to develop an evidence based pathway from investment in ACIAR funded capacity building activities to identifiable specific changes in research outcomes.

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Evaluating the impact of capacity building by ACIAR

1. Introduction

Research institutions like ACIAR typically invest in activities across a spectrum including pure and applied research, policy research and development, extension and human capacity building in pursuit of economic, social and environmental benefits. Capacity development is a major component of all the activities of ACIAR and its partners whether through formal training or informally as 'learning by doing' during research projects. It can be thought of as building up a capital stock that potentially yields a flow of economic benefits over many years from the adoption of new technologies developed after the initial investment

ACIAR has a strong record in evaluating the economic impact of its activities, not only as a means of accounting for how it has used its resources but also to guide future investment activities. Until recent years, however, there have been few attempts to separately identify and estimate the returns to investment in formal or informal capacity building. The main reason for this has been the jointness between these different types of investment such that there is no theoretically sound way of decomposing investment into its capacity building and research components. Typically a 'research' project also increases human capacity and scientific knowledge through 'learning by doing' as well as developing a technology to be applied on-farm. Similarly formal training programs are likely to add to scientific knowledge and the stock of farm technologies as well as the more obvious addition to human capacity. Data on research is collected by organisations such as the ABS but no attempt is made to separately identify investment in capacity building, no doubt largely because of these conceptual difficulties.

Gordon and Chadwick (p.15) described capacity building as building human capital in the form of 'the understanding, skills and knowledge base of individuals and institutions'. They point out that 'evaluation of capacity-building generally stops at assessing the capacity built (such as skills gained) and only occasionally goes on to measure capacity utilised'. Because human capital is used jointly in research with other inputs such as machinery, chemicals, labour etc, it is difficult to identify and measure the contribution of capacity building (an attribution problem).

Additionally the 'spillover' benefits of capacity building to later R&D activities have at best been identified qualitatively. Ignoring these 'spillover' benefits means that unless they are reflected in subsequent impact assessments, the economic gains from R&D activities are likely to be understated. Even econometric studies of returns to agricultural R&D at a sector level understate economic gains because the future flows of benefits from capacity building are not captured in historical measures of productivity.

Nevertheless, organisations like ACIAR have a legitimate concern about the balance of their portfolio between formal training and research investments and within research projects the balance between research and 'learning by doing'.

ACIAR has been funding projects with a focus on better understanding the contribution of capacity building. The most important of these has been that by Gordon and Chadwick (2007)) who developed a framework for the evaluation of capacity building and who found that half of total benefits from a small sample of traditional bilateral research projects could

be attributable to capacity building. Several times ACIAR has surveyed the John Allwright Fellows that it has funded during their graduates degrees.

This paper reports a scoping study which had the objective of identifying where further research into assessing the ACIAR's contribution to capacity building and its impact might best be directed. An early finding of the scoping study was that the next stage of the project would best focus on forestry and fisheries projects funded by ACIAR in two research institution in Vietnam: the Research Institute for Aquaculture No 1 (RIA 1) and Forest Science Institute of Vietnam (FSIV)[1].

By focussing on the bilateral programs and the JAF Fellows at these two institutions we expect to be able to:

- Refine our approach to estimating the share of total project resources devoted to capacity building;
- Based on this share, revisit projects in these institutions already subject to impact assessment to estimate the share of total benefits attributable to capacity building following Gordon and Chadwick;
- Develop cost (time) effective processes by which ACIAR and scientists responsible for projects can identify and report on both formal and informal capacity building in a more systematic way than at present;
- Survey JAF Fellows to ascertain what capacity was developed and most particularly, more objectivity identify than in previous tracer studies how this capacity has been utilised. Our objective here is to capture the benefits to capacity building that 'spillover' to subsequent research areas and projects;
- Develop an approach to identifying how ACIAR research and training activities have contributed to the capacity of the two institutions to manage research investments. No attention has previously been paid to even qualitatively identifying institutional capacity building.

In the course of this scoping study some progress towards these objectives has already been made. In particular our initial approach to estimating the share of project resources devoted to capacity building is described and preliminary results presented later in the paper. Our paper starts with a review of ACIAR capacity building activities. Then follows a more theoretical section in which the pathway by which capacity building activities eventually have an impact on farm profitability is developed, building on Gordon and Chadwick. A sample of literature reporting attempts to measure the impact of capacity building is reviewed with particular attention to the ways by which investment in capacity building has been estimated.

2. ACIAR support for Training and Capacity Building

ACIAR's investments in training and capacity building have developed from being an essential but mostly unreported activity in the first few years of the organisation, through various statutory and policy changes in the 80s and 90s, to being an explicit and diverse component of ACIAR strategy today.

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[1] The name of this institution has changed through the period of its support by ACIAR, initially being the Forest Science institute of Vietnam (FSIV), now the Forestry Research Academy of Vietnam (FRAV). For simplicity FSIV is used throughout this report.

Currently ACIAR provides training through:

- Mentoring: personal interaction between scientists during the lifetime of the project
- Workshops: practical training on a specific topic of interest to a project or a group of projects within a program.
- Seminars: Theoretical and practical training on a specific topic of interest.
- Master Classes: theoretical training with practical exercises conducted in partnership with the Crawford Fund
- John Dillon Fellowships: Research Management training and exposure to agricultural R4D institutions and industry partners in Australia
- John Allright: Masters and PhD studies in R4D topics closely related to ACIAR Country Programs

The John Allwright and John Dillon Fellowship schemes are administered under its Capacity Building program. On average, ACIAR awards 30 John Allwright per year and 10 John Dillon. These numbers fluctuate depending on funding availability and university costs. The primary aim of the John Allwright Fellowship is to enhance research capacity in partner country institutions. Postgraduate studies are related to but not part of the collaborative research project in which the students were engaged prior to taking up the award.

The John Dillon Memorial Fellowship provides career development opportunities for outstanding young agricultural scientists or economists from ACIAR partner countries who are involved in a current or recently completed ACIAR project. 8-10 Fellowships are offered annually and run for 5 -6 weeks. The Fellowship aims to develop leadership skills in the areas of agricultural research management, agricultural policy and/or extension technologies.

ACIAR's contribution to formal capacity building is not limited to these Fellowships. In addition it provides financial support to the Crawford and other institutions for specific training courses and fro professional events like the AARES conference.

The informal component of training and capacity building has always been recognised but the difficulty of separating out these activities as a separate component of the bilateral research projects has proved difficult and elusive. In the annual report of 2004/5 it was stated the 'majority of training provided by ACIAR takes place within projects'. Hard evidence to support this bold statement is hard to come by, as will be demonstrated once again in the current study.

A further dimension to ACIAR capacity building investments is the formal training that some project participants undertake as part of or associated with an ACIAR project using stipends granted by other donors or their own government. This represents a substantial additional value to projects that is generally only briefly reported in project documentation. In the 3 year period 2006-2009, 227 students were being awarded a Masters or PhD, approximately three times the number of graduates funded directly by ACIAR through the JAF program.

3. Theoretical Framework

Research institutions like ACIAR typically invest in activities across a spectrum including pure and applied research, policy research and development, extension and human capacity building in pursuit of economic, social and environmental benefits. Many of these activities are directed at improving productivity. Productivity growth provides little advantage to a farm business unless it results in increased profitability. So a starting point is to understand the relationship between farm productivity change and productivity.

Profitability, the ratio of growth in income to growth in costs, can be represented as (O'Donnell 2010):

$$1. \quad PROF = \frac{P}{W}\frac{Q}{X} = TT \times TFP$$

Intuitively this equation equates an index of value, *PROF*, with a quantity index, *TFP*, times a price index, *TT*, the terms of trade, the ratio of *P* prices received for outputs to *W* prices paid for inputs[2]. Growth in productivity only translates directly into growth in profitability if the terms of trade are constant. Further, changes in the terms of trade induce changes may lead to changes in farm enterprise mix and scale. All types of economic shocks impact on the terms of trade but more relevant to our purposes, research activities that lead to price changes from say a change in policy or long run improvements in productivity also have an impact on the terms of trade and hence on profitability.

Turning to total factor productivity, research and extension activities add to various stocks of capital which provide annual flows of services which impact on final output alongside conventional inputs such as labour and chemicals. These joint changes in these stocks might be represented heuristically in a production function (adapting Alston et al. 1995) as:

$$2. \quad \left(IK_t, \mathrm{IC}_t, \mathrm{IL}_t, \mathrm{IJ}_t, IZ_t \right) = i\left(R_t, ..., R_{t-L_R}, E_t, ..., E_{t-L_E}; \quad K_t, C_t, \mathrm{L}_t, J_t, Z_t \right)$$

Where R_t and E_t are lagged series of research and extension investments where according to usual accounting procedures, R_t includes many activities including training. K_t is the stock of knowledge or new technologies available to farmers, C_t is the stock of human scientific capacity gained through formal training and learning by doing, L_t is the stock of scientific knowledge not immediately available in the form of technologies available to farmers, J_t is the stock of knowledge available to farm policy makers and Z_t is the stock of knowledge and experience of science managers in allocating research funds. The 'I' notation on the right hand side of this relationship denotes an increment in time t to these five capital stocks. The relationship says that as a result of past investments in research and extension there will be increments to these five capital stocks in time t and the size of these increments will depend not only on the level of investments but on the existing size of the capital stocks. Note that stock of physical capital in the form of laboratories and other research inputs has been omitted in the interests of simplicity.

Equation 2 is a general form of a multi-output, multi-input production relationship where complex product transformation and input substitution possibilities are deliberately left implicit. This heuristic representation reflects the inherent jointness in the relationship where, for example, research activities not only might add to K_t but also add to C_t and L_t and training

[2] *P and W are aggregate prices defined such that PQ is total revenue and WX is total costs.*

activities which add to C_t through skills gained might also add to L_t through the development of new data analysis techniques and might also, through the development of new technology, add to K_t. No accounting system can overcome this inherent jointness.

How these four capital stocks grow can be represented as follows using K_t as an example:

$$3. \quad K_t = K_{t-1} + IK_t - DK_t$$

Where DK_t is the depreciation of the knowledge stock in the present period, perhaps as a technology is replaced or becomes obsolete. Similar relationships hold for the other three capital stocks. This representation is perhaps too simplistic in not explicitly reflecting the jointness between the four stocks.

The extent to which K_t is utilised on-farm depends on P_t, relative factor prices and the human capital held by farmers, H_t and can be represented as:

$$4. \quad F_t = f(K_t, P_t, H_t)$$

The production function for final output can be represented as:

$$5. \quad Q_t = f\left(X_t, \mathrm{F}_t, W_t, \mathrm{A}_t, \mathrm{J}_t\right)$$

where current agricultural output (supply), Q_t, depends on a flow of conventional inputs, X_t, a flow of services from a stock of knowledge (or technologies) that are available to farmers, F_t, uncontrolled factors such as weather and pests, W_t, a flow of services from publicly provided infrastructure in the form of education, transport and communications for example, A_t, and farm policy setting, J_t. This representation abstracts from issues like biased technical change but suits our purposes in this report. Note that Q_t and X_t are vectors of multiple outputs and inputs at time t.

Hence the stream of investments made by the ACIAR has an impact on the research production function in some combination of the following ways:

- sometimes directly through increments to the stock of knowledge and technologies available to farmers, K_t, through advancing the rate of technology development and adoption;
- indirectly through additions to the stock of human scientific capacity, C_t, through training programs and to the stock of scientific knowledge, L_t, through the development of new techniques which later impact on other capital stocks;
- directly through rural policy settings reflected in J_t but perhaps more through changes in the terms of trade;
- indirectly through gains in efficiency in the use of research resources, Z_t through better priority setting for example which are later reflected in K_t.

Gordon and Chadwick (2007) defined human capital, C_t, as 'the understanding, skills and stock of knowledge applicable to the particular environments of the workers and decision-makers (p.15)' and capacity building as 'encompassing training and all other forms of learning that enhance the knowledge, understanding and competencies (skills) of individuals (p.18)'. They distinguished human capital from the stock of knowledge from research activities arguing that the potential impact of human capital is potentially larger because it is better able to influence the institutional environment in which research is undertaken[3]. In terms of the representation of the research production function above, K_t, is the stock of

[3] Further insights may be gained from a formal microeconomic exploration of the substitution between stocks of knowledge and human capacity in the production of new technology.

knowledge already available to farmers whereas the stock of knowledge, skills and experience in scientists, C_t, is not yet available to farmers.

While we might be able to conceptually distinguish capacity building from research activities, the literature does not really examine the practical implications for measuring these activities. Under the Frascati convention used by most statistical agencies, no distinction is made except that capital expenditure, tangible capital, is distinguished from operating expenditure. The capacity building literature does not provide a clear definition of the outcome of research activities as distinct from capacity building activities. Perhaps the outcome of this residual is the accumulation of the knowledge stock.

The practical difficulties of applying this distinction were explicitly recognized by Gordon and Chadwick:
'The complementarity of human capital …..with investments in research, technology, physical capital and institutional infrastructure, make evaluation of just the capacity-building investment difficult (p. 15)'.

This complementarity (jointness) applies at both the input and output levels. At the output level it is hard to imagine a research activity that does not add to both the stock of knowledge and the capacity of scientists. While perhaps we can conceive of training activities that build up human capacity without adding to the knowledge stock, training activities that are part of an overall research programme most likely do add to the stock of knowledge. As we shall see in reviews of empirical applications below, subjective judgement is required to apportion outputs between additions to the stock of knowledge and additions to human capacity. Similarly, at the input level, apportioning a budget between these components requires judgement. Perhaps the Frascati protocol was designed to avoid these difficulties.

The capacity building literature recognises the links between capacity building and research. Brennan and Quade quoting Ryan (1999) and Maredia and Byerlee (2000) noted that investment in capacity is an important component of total research investment because it enhances the productivity of research resources. While research and capacity building activities are substitutable to some extent in their impact on agricultural productivity, a critical mass of capacity is required for research activities to be productive. They recognised that the decisions about R&D and capacity building investments were inter-related and pointed out that little was known about the returns to investment in capacity.

Within a project, research activities may add to both the stock of knowledge and the stock of human scientific capacity (through learning by doing). In some case research activities may not add to the stock of available knowledge (their findings are not useful to farmers) but do add to the stock of scientific capacity which may well add to the stock of knowledge in future projects (the efficiency of research resources in later projects is enhanced because they are cooperating with a higher level of human capacity). An attraction of informal training within a program or training related to a program of research (as in the John Allwright fellowships) is that capacity gains are likely to be reflected sooner in gains in the stock of knowledge. Shorter lags in adding to the knowledge stock have an economic value. On the other hand formal training through post graduate study may add more to the stock of human scientific capacity because of its greater breadth.

A key insight from the general model of research impact and related empirical work is that research activities might not have an immediate impact on agricultural productivity but that

their impact may persist for many years. Extension activities in contrast have a more immediate and shorter lasting impact. In a similar vein we might expect that human capacity building might add to a stock of human capital (accepting the views of Gordon and Chadwick that the stock of human capital is different to the stock of knowledge). However this stock of human capital would be similar in impact to the stock of knowledge occurring over decades.

4. A Review of Empirical Studies

Here a sample of previous studies of the impact of capacity building are reviewed both for their methodology and findings but also for the ways in which investment in capacity building was estimated, the focus of the next section. First we briefly review econometric work estimating the return to investment in agricultural research drawing out implications for the human capacity building component. Then we focus on specific capacity building analyses.

Typically total factor productivity (Q/X) is typically regressed against weighted sums of past investments in research (with lags as long as 35 or more years), weighted sums of past investments in extension (with shorter lags of say three years), and variables controlling for seasonal conditions and trends in the farmers' human capital in the form of years of schooling for example (Sheng et al. 2011)[4]. Econometric analyses of this type in Australia (Sheng et al. 2011) and the US (Alston et al. 2000, Alston et al., 2010) for example, have estimated high rates of return to public investment in agricultural research supporting the findings of project level impact assessment studies such as those conducted by ACIAR (Lindner et al., 2013). In none of these analyses was a distinction made between research and capacity building activities.

Given the aggregated nature of the data, the estimated returns to investment reported in these analyses are effectively returns to the range of research and capacity building activities. In the absence of a sensible way of attributing benefits and costs between these alternative activities, one approach is to accept that they earn the common estimated rate of return. Given that stocks of knowledge and of human capacity are likely to have similar long impact profiles this may be a good approximation. Perhaps an argument could be made that the returns to capacity building may be a little higher than the returns to research because it is likely that even research projects that add little to the knowledge stock might add to the stock of human capacity but against this is the likelihood that lags associated with capacity building may be longer.

However since research funders like ACIAR have to make investment across this range of activities, it is important to attempt reassurance that capacity building is a good investment and to devise means of monitoring and evaluation capacity building activities. So now we turn to reviewing analyses of the impact of human capacity building.

There are four broad classes of analysis of the impact of capacity building. First, so called 'tracer studies' survey the participants in training programs, following their careers since 'graduating' to identify capacity built and utilised from their training. Second, following an evaluation framework designed by Gordon and Chadwick (2007), are analyses that attempt to disaggregate total welfare gains estimated using traditional impact assessment processes

[4] This general form can be derived by substituting equations 1.2 and 1.3 into 1.1.

between a capacity building component and a residual research component. Third is the approach developed by Brennan and Quade (2004, 2006) to synthesise a (constrained) research production function relating output to changes in capacity. Fourth are studies typified recently by Bartel et al. (2014) and Obst (2014), which econometrically relate productivity outcomes to capacity building activities.

Tracer Studies

A qualitative approach to assessing the impact of capacity building is through the use of 'tracer studies' to follow the careers of those who have had capacity building opportunities usually in the form of formal training. An attraction of focussing on formal training programs is that their impacts are likely to be predominantly in the form of additions to the stock of human capital, less 'contaminated' by additions to the knowledge stock and the severe attribution issues that brings.

At ACIAR the chief vehicle for formal training has been through the John Allwright Fellowship scheme (and to a lesser extent the John Dillon Fellow scheme). ACIAR has conducted four surveys of John Allwright Fellows (1998, 2004, 2006 and 2008). Typically respondents are asked to comment in a general way about whether their capacity building opportunities have resulted in greater career progression and promotion. Questions about capacity utilised and actual impact are either missing or couched in ways that are not discriminating. The design of these surveys is such that, while supportive, they provide little convincing evidence of the impact of training activities.

A study designed to establish a more evidence-based link between training and productivity outcomes was that by Kumar and Nacht (1990). USAID/Nepal had supported the overseas training of over 4,000 Nepalese in the United States, India, and other countries and Kumar and Nacht were commissioned to assess the impact of this program.

Their study was in three parts. First they surveyed a sample of those who had participated in training programs. One of the questions asked was:
"Could you give examples of any changes you were able to introduce in your work which can be attributed to your training?"
They were aware that some who received training never gained from the experience and so they asked questions about the existence of institutional barriers preventing the utilization of training.

Second they focussed on several institutions in Nepal where a significant percentage of staff had been selected for training. The general areas of contribution included:

- Performing technical activities closely related to their training well;
- Establishing new units in existing organisations or even founding organisations;
- Newly acquired knowledge and skills were applied in their role as educators.

Third, they conducted in-depth interviews with key decision makers across Nepalese society about their impressions of the impact of the training program.

They concluded:

'The net effect of the infusion of thousands of trained personnel into a poor and struggling society is to inject considerable life into the country's institutions, which, in turn, has created important multiplier effects far beyond the aggregate efforts of the individuals involved…..
In short, the dominant conclusion is that Nepalese economic development -- as modest as it has been in national terms-- would have been far less without the massive participant training programs supported by USAID/Nepal over the past three decades (from report summary)'.

In a similar vein to Kumar and Nacht is a study by Effective Development Group (EDG, 2006) of Vietnamese participants in training programs provided by the Crawford Fund. A feature of the EDG approach was that it attempted to establish a pathway from capacity built to capacity utilised. The Gordon and Chadwick case study on water management in Vietnam (2007, described in more detail below) used survey data from the EDG study. The EDG questionnaire was used in the Longmore et al. (2007, IAS 48) and Fisher and Gordon (2008, IAS 52) studies of capacity building discussed more fully below. It will serve as a good starting point for any evaluation of capacity building undertaken later in this project.

The EDG study involved 73 scientists from Vietnam who had undertaken one of the 21 capacity building activities sponsored by the Crawford Fund over the ten years prior to 2006. A two-step process was used. The first step involved a survey questionnaire to 132 people (73 responded) consisting of multiple choice and open ended questions to gather quantitative and qualitative data. The questionnaire led respondents in a structured way through their perceptions of the quality of training, the capacity they developed through to how they personally and their organisation used and benefited from the capacity built. In a second stage some of those who rated their training highly and some of those who rated it poorly were personally interviewed to gain more insight into their different experiences.
In general the respondents were very positive about the relevance of the courses, the adequacy of training material and the skills of the trainers. About 90% proffered that their performance and work improved and about 30% suggested that their organisation had changed as a result of the training programmes.

The EDG questionnaire is an important starting point for our work because of its emphasis on linking capacity building and capacity utilisation. However the views gathered about capacity building and utilization as still general in nature presumably deriving from the nature of the questionnaire. Perhaps we will have an opportunity to gather more specific information about skills developed and specific examples of how these skills were applied both by individuals and organisations and evidence of on-farm adoption. This will require experimenting with different survey instruments.

By design, 'tracer' studies do not provide a quantitative estimate of the value of human capacity building nor of investment in capacity building. Nevertheless, given the subjective nature of alternative quantitative approaches, well designed 'tracer' studies of individuals and the institutions where they work, have the potential to identify strong causal pathways between training and efficiency gains for at least a sample of individuals, which lend support to the findings of more quantitative studies. The tracer studies might be useful in identifying case studies for more intensive quantitative analysis.

Qualitative information about within project capacity building can be found in ACIAR's Adoption Studies series and many impact assessment reports make general statements capacity built. Generally these observations do not go as far as providing specific examples

of capacity built and the technologies to which it was applied. The impact pathway process recommended by Gordon and Chadwick (see next) has rarely been followed.

Disaggregating Estimated Total Welfare Gains

Gordon and Chadwick (2007) were commissioned by ACIAR and the Crawford Fund to develop a methodology to evaluate capacity building investments. They proposed a framework for tracing out the impact of capacity building activities. The key steps in applying this framework are:

- 'identifying the links along the pathway from the capacity-building activities to the measured benefits;
- substantiating each significant link using appropriate measures, such as indicators and expert opinions;
- taking into consideration external inputs influencing the outcomes;
- measuring the benefits with the ACIAR capacity building contribution against the most likely scenario without the ACIAR contribution.(p.66)'.

On the basis of an exacting process of qualitatively identifying the impact pathway for capacity building activities, Gordon and Chadwick made an ultimately subjective assessment of the share of project benefits that could be attributed to capacity building. They also made an assessment of the share of project costs that could be attributed to capacity building. This share data was used to quantify benefits and costs of capacity building. Our impression from their case studies is that less attention was devoted to deriving the cost shares. In some cases the cost and benefit shares were assessed to be the same, in which case the returns to capacity building would be very similar to the returns to the total investment. Confidence in estimates of the value of capacity building using the Gordon and Chadwick approach depends on the quality of the initial impact assessment and on the subjective assessment of benefit and cost shares attributable to capacity building.

From their literature review, they also identified three rules of thumb that might be applicable in assessing agricultural capacity building. Quoting from their report:

'While the empirical evidence is very patchy on most of the pathways from capacity building to benefits, some very tentative rules of thumb emerge.

- A worker's lifetime income is higher, on average, by around 10% for each additional year spent in formal education.
- The firm captures around half of the benefits of their investment in specific training for their workers, the workers capturing the other half, and the individuals trained around a third.
- Improvements in human capital explain around 30% of the increase in total factor productivity
- Some 50% of increases in (agricultural) productivity can be attributed to interstate or international R&D spillovers (p.30).'

They applied their framework in two case studies. One way to apply the framework is to work forward from the capacity building activities to efficiency gains attributable to them. A second way, used by them, is to work back from estimated total welfare gains to arrive at an estimate of the contribution made by capacity building to these gains. Their case studies built on two ACIAR impact assessment analyses, one by Ryan (1998, using material from a paper

by Bantilan and Parthasarathy (1997)) of pigeonpea breeding in India and one by Harris (2006) on the management of public irrigation systems in Vietnam.

Dr K.B. Saxena, a pigeonpea breeder at ICRISAT spent a three-year postdoctoral visit to the University of Queensland (UQ), supported by ACIAR, to work with pigeonpea breeders there who had already a strong association with ICRISAT's program. This visit took the form of professional collaboration rather than formal training. According to Gordon and Chadwick (p. 67), 'Dr Saxena described three elements of capacity building, in order of relative significance:

- Learning by doing: Collaboration with experts in the practical application of knowledge, which led to effective on-the-job training;
- Access to knowledge/knowledge transfer concerning: plant breeding techniques developed during earlier UQ projects; the concept of photo-insensitivity and its link with early maturation and the viability of high-density cropping in semiarid environments.
- Working with experts: contact with plant breeding scientists from different organisations and experts in other disciplines promoted the benefits of a multidisciplinary approach and established a network of scientists, working collaboratively on related topics and sharing knowledge.

The gains in scientific capacity by Dr Saxena on this visit allowed him to expedite:

- the release and on-farm adoption in India of SDPP genotypes
- the identification, development, release and adoption in India of ESDPP genotypes
- the identification, development, field-testing and on-farm trials in India of hybrid pigeonpea (HPP) genotypes.

Gordon and Chadwick described an impact pathway from the Australian visits through to specific new varieties released (and other inputs in the form of publications and networks for example) with a clear link to the capacity building program through to on-farm adoption. The impact pathway is set out in Gordon and Chadwick (p.68).

They estimated the welfare gains, following Ryan, as the benefits from advancing the adoption of the new varieties related to ACIAR activities by three years (using used a model developed by Lubulwa and McMeniman (1997)). The NPV from the 3 year advance in development and adoption of new SDPP and ESDPP varieties from 1982 to 2011 in 2005 dollar value discounted back to 1982 was $131.8m giving a BCR of 16.75 and an IRR of 19%.

The contribution of Gordon and Chadwick was to develop and apply a framework for valuing capacity building. In the case of pigeonpea, on the basis of their exacting elucidation of the impact pathway of Saxena's capacity building experiences and expert opinion (largely that of Dr Saxena it would appear) they attributed 50% of benefits to capacity building. There was a short discussion of the basis of this still subjective assumption (p.73). They also estimated on the basis of opinion rather than budgetary evidence, that the share of project costs attributable to capacity building was 30% and therefore the BCR rose to 27.92 and the IRR to 23% (based on an NPV of $70.1m).

In addition Gordon and Chadwick applied the rules of thumb to the pigeon example. Applying the 10% per year of training rule to average income in India for 3 years of training

over a further 30 years of working life gave a benefit of A$5,841(nominal). Then they estimated that the benefits of capacity building to the organisation based on the $5,841 gains to the individual amounted to $8,762, a total of $14,603, much smaller that the benefits attributable to capacity building from the on-farm efficiency gains.

In a second case study Gordon and Chadwick (2007) assessed the benefits from a 3-week training program in an aspect of GIS which was linked to efficient water management projects in several public irrigation schemes in Vietnam funded by ACIAR. These projects were the subject of an impact assessment by Harris (2006). The water management rules developed during the two projects resulted in efficiency gains in the form of higher crop yields and an increase in water available for sale to urban water users. Early in the second project a gap in GIS capability in Vietnam was identified. This GIS capability was essential to the successful outcomes from the second project.

Gordon and Chadwick estimated the benefits of this GIS capacity building as the same share of project benefits as the costs of training were of total project costs. The training only benefited the second project. The benefits from training were assessed as a share of the benefits from the second project. The total investment necessary achieve the benefits from the second project was assessed as the cost of the second project and a 20% share of the cost of project one (recognising the costs of model development in project 1 used in project 2). The costs of the training program were 0.58% of these total costs and this was the share applied to total benefits from the second project to arrive at the benefits of capacity building. Gordon and Chadwick estimated a benefit cost ratio of 13.3 and an IRR of 28%. They were unable to estimate benefits in years after the two projects because the 'trainee' was unable to participate in a tracer study by the Effective Development Group of capacity building activities in Vietnam funded by the Crawford Fund.

The Gordon and Chadwick framework understates the returns from capacity building activities to the extent that no attempt is made to estimate 'spillover' benefits to research projects conducted after the projects under evaluation.

In their Appendix 3 Gordon and Chadwick identified 9 IAS reports (no's 1,3,6,7,18,24,25,26 and 33) where capacity building was a significant component of the projects. They reviewed 18, 25 and 33 in a little more detail in their Chapter 5. No attempt was made to value capacity building in these studies but its importance was often noted. Generally projects are selected for impact assessment because their economic impact is expected to be significant. It is likely that some ACIAR projects with significant capacity building outcomes were not selected for impact assessment because their economic impact was expected to be small.

Since Gordon and Chadwick there have been two impact assessments where, judging by the titles of the reports, assessing capacity building has been an important component of the analysis. These are "Assessment of capacity building: overcoming production constraints to sorghum in rainfed environments in India and Australia" by Longmore et al. (2007, IAS 48) and "Breeding and feeding pigs in Vietnam: assessment of capacity building and an update on impacts" by Fisher and Gordon (2008, IAS 52). We have not followed Gordon and Chadwick in reviewing all IAS reports since their study for the significance of the capacity building component.

The objective of the sorghum projects was to develop and use biotechnology techniques to develop strains of sorghum resistant to stem borer and shoot fly in India and Australia. In

Australia the projects were assessed as bringing forward the development and adoption of a new variety by five years and increasing the probability of its adoption. All Australian benefits were treated as economic gains from traditional research processes (additions to the stock of knowledge available to farmers). In India no new strains were immediately available but prospective economic gains were estimated and attributed wholly to capacity building. The rationale for this attribution was not clear but if this approach was widely adopted then a large proportion of benefits from ACIAR research projects would be attributed to capacity building. Longmore et al. conducted a 'tracer' study similar to the EDG study to make as explicit as possible the pathway from capacity built to capacity utilised in India. They found that only for one of the three subprograms could a strong argument be mounted that capacity built had indeed been utilised. Nevertheless the benefit cost ratio in India was 81:1 and the IRR was 19.2%.

The ACIAR funded projects on breeding and feeding pigs in Australia and Vietnam were originally the subject of an impact assessment by Tisdell and Wilson (2001, IAS 17) and assessed again with a focus on capacity building by Fisher and Gordon (2008, IAS 52). It would seem that the project was multi-dimensional in having technology transfer, research adding to knowledge stock and capacity building components. Capacity building in Vietnam allowed further research into 'genetic improvement, nutrient digestibility, AI, chemical analysis and computer-aided diet formulation (p.9)'. Capacity building was assessed as having maintained the improved genetic base after the ACIAR project finished. It also attracted external funding for further research continuing the ACIAR work and Fisher and Gordon extended the stream of benefits (and costs) over a longer period than Tisdell and Wilson to partly capture the 'flow on' benefits of capacity building.

Of total economic benefits from the breeding and feeding components, 40% were attributed to capacity building (the same as its share of the total R&D budget) giving an IRR of 24.5% and a benefit cost ratio of 256:1. Again participants in training programs were surveyed based on the EDG approach to trace out the pathway from capacity built to capacity utilised. The respondents reported high scores for both. Fisher and Gordon estimated the personal benefits to scientists from capacity building but found them to be very small relative to industry benefits.

The Brennan and Quade Studies

Brennan and Quade (2004 and 2006) assessed the impact of two ACIAR funded projects whose objective was to investigate and enhance the sources of rust resistance in wheat in India and Pakistan by providing training for Indian and Pakistani rust scientists at the National Wheat Rust Control Program (NWRCP) at the University of Sydney in the late 1980s and early 1990s. Brennan and Quade (2004) contains a detailed description of the projects that were part funded by ACIAR. No doubt the training component of these projects added substantially to human capacity in India, Pakistan and Australia but there were also additions to tangible capital in these countries in the form of facilities for the safe handling and multiplication of wheat infected with rust and, even if no new varieties were immediately developed, there was a clear addition to the stock of knowledge in the form of a book, *Wheat rusts – an atlas of research genes* (McIntosh et al. 1995) disseminating information about rust resistance genes.

The distinguishing feature of their study was an attempt to synthesise a relationship between human scientific capacity and productivity based on an imposed logistic functional form:

$$y = a \Big/ \left[1 + e^{-(b+cx)}\right]$$

where y is the level of production and x is the level of human capital (of the scientists)[5]. This is a logistic function where production is bounded below by the level of production, d, allowed by 'spill-ins' of technologies from neighbouring regions when 'local' human capacity is zero, such that $y=d$, and above by the maximum level of production when human capacity and other forms of capacity are at a maximum, represented by a. These upper and lower bounds are derived from the expert views of scientists and from trial results. When human capacity is zero their assumption is that the productivity of other research inputs is also zero and gains can only come from spillins. The maximum level of productivity is dependent of the level of other capacities. Their preferred scenario is when these other capacities are not limiting but recognise that if they are limiting then the maximum level of productivity possible is reduced, modelled by varying a. The current levels of capacity and productivity growth provided an observation to 'fix' the location of the logistic function (similar to Scobie et al. 1991).

The narrowing of the gap between a and d is explained wholly by human capacity and the value of the training is estimated as the difference in y with and without the years of training funded by the projects. To make the model empirical Brennan and Quade had to measure human capacity in wheat pathology in India and Pakistan. The alternative measures they used included[6]:

- Total years of experience;
- Total years in study and years in experience;
- Weighted years of experience with MSc less valuable than PhD experience.

Further, they had to apply subjective assumptions about how human capacity changed with the Australian training undertaken by the Indian and Pakistani pathologists. The value of the training was estimated as the difference in the value of output 'with' and 'without' the training.

Brennan and Quade (2004) estimated that the benefit cost ratio for the capacity building delivered through the ACIAR projects was 17.3:1 for their preferred scenario. Some key assumptions underlie this estimate. They charged all project costs of $A1.6m (2003 $s) against their measure of benefits[7] even though some costs were not associated directly with training activities and delivered other outcomes such as changes in tangible capacity and the stock of knowledge. Their estimated benefits are hypothetical rather than observed and are based on the assumption that all other inputs into increasing rust resistance are unchanged. Brennan and Quade called for further research to explore the relationship between human capacity and productivity and into how human capacity is measured. They provided valuable insights into our understanding of capacity building and their empirical work confirmed the findings of other analyses, using different methodologies, that the returns to capacity building are high.

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[5] To simplify the discussion we have expressed this relationship in terms of levels but Brennan and Quade noted that the units of measurement need to be appropriate to the application.

[6] Perhaps Brennan and Quade could have considered a stock of human capital measure based on lagged investment in training were data available.

[7] The derivation of costs is not detailed and hence it is unclear whether the costs of partners in India and Pakistan have been included.

We doubt that there are many easy gains to be had from continuing research in this area as suggested by Brennan and Quade.

Econometric analyses

It is beyond the scope of this study to exhaustively review all attempts to measure the impact of capacity building in sectors outside agricultural research. However two recent studies are briefly reviewed to give a more complete picture of the range of quantitative methods that have been applied to assessing the impact of capacity building. Ost (2014) found that the capacity of teachers and consequent measures of student performance improved not only with general teaching experience but also with grade specific experience. Bartel et al. (2014) found that the training of nurses and the length of their experience in particular hospital units, both dimensions of their human capital, contributed significantly to patient outcomes. The common feature of these studies is that both had access to large data sets with cross section components (linking particular teachers with particular students for example) and over several years. In these studies inputs in terms of measures of capacity built and outcomes in terms of patient or student performance were relatively easy to measure and relate econometrically. It is hard to imagine these happy circumstances arising from the small projects that typify agricultural R&D and capacity building (although the World Bank has attempted to apply such techniques in some of the multi-million dollar development programmes it has funded).

5. Estimating the investment in capacity building

As noted in Section 3 there is no theoretically sound way of separately identifying investment in capacity building from other types of research activity. Note that our focus in on estimating investment in or expenditure on capacity building, not on estimating the returns from these investments. In Section 4 we reviewed how previous studies, particularly those applying the Gordon and Chadwick framework estimated investment in capacity building. Two approaches have been used. In applying their framework to Saxena's pigeonpea research, they made a subjective judgement based largely on expert opinion that the share of benefits attributable to capacity building was 50% and the share of expenditure was 30%. In other studies the share of benefits and the share of costs are assumed to be the same.

In their Vietnam water management study instead of expert opinion, they based their attribution rules on the share of the total budget accounted for by training costs. This share was only 0.58%. Note that no attempt was made to estimate the implicit costs of mentoring and on the job learning.

In both cases the estimates of the value of capacity building are primarily dependent on the estimates of total welfare gains and total investment. Both approaches, especially when cost and benefits shares are set equal, result in the returns to capacity building being very similar if not the same as the returns to total investment. Hence it is important that the assessment of the impact of the total project be thorough.

Our objective has been to see whether published ACIAR records can be used to approximate investment in capacity building that places some value on mentoring and which may complement estimates based on expert opinion. Here we apply one method to approximate

investment in capacity and expect to examine alternatives in the follow-up project. The challenge will be to determine whether or not particular approximation method is satisfactory. At present our criterion is whether program managers at ACIAR find our approximation of investment in capacity building accords with their expectations.

In this exploratory exercise we have attempted to estimate investment in the following activities for the two research institutes in Vietnam:

- Specific training activities identified in project budgets;
- Expenditure on formal training through the John Allwright and or John Dillon fellowship schemes;
- Informal training including on-the-job training and mentoring.

Expenditure on the two types of training activities is generally available from ACIAR reports. Estimating investment in informal training is much more subjective. In all three cases collecting data on investment in capacity building will be more feasible and cost effective if official ACIAR documents are used.

The registered project budget is a primary source of data. In this first attempt we have estimated expenditure on informal training or mentoring as the sum of expenses incurred in travel and the salaries of Australian scientists while in Vietnam. Travel expense include fares plus subsistence by Australia scientists visiting to Vietnam and in the travel and subsistence of Vietnamese scientists visiting Australia has also been included (ACIAR's project reciprocal travel budget).

The salary component was estimated as the number of days that the project leader or other Australian scientists travelled to Vietnam. Each day was valued at AUD 800 for a project leader and AUD 600 for a scientist.

We extracted from ACIAR Annual Reports the following data, starting in 2002: Total ACIAR expenditure; Research Program[8] expenditure; and Education and Training[9] expenditure. We used a deflator to convert the reported amounts to 2013 AUD to allow comparison of data in real terms. During the period analysed, the ACIAR budget increased from AUD 47 Million to AUD 104.7 Million. The research program expenditure accounted for 70% (AUD 32.9 Million) of the total ACIAR expenditure in 2002, and for 78% (AUD 81.6 Million) in 2013. The Education and Training budget accounted for 5% (AUD 2.7 Million) of the total ACIAR budget in 2003 and increased to a 10% (AUD 7.1 Million) in 2008 and then decreased to 6% (AUD 6.9 Million) in 2013.

During a presentation in July in ACIAR we discussed the relative reduction of expenditure in Education and Training. The trend can be explained by the fact that since 2005, ACIAR is allocating funds for some postgraduate scholarships directly in project budgets, thus some of the expenditure allocated to the research program is actually for formal capacity building activities. Such in-project formal capacity building amounted to a total of AUD 3.5 Million during the analysed period. As it is currently a difficult exercise to identify all the projects

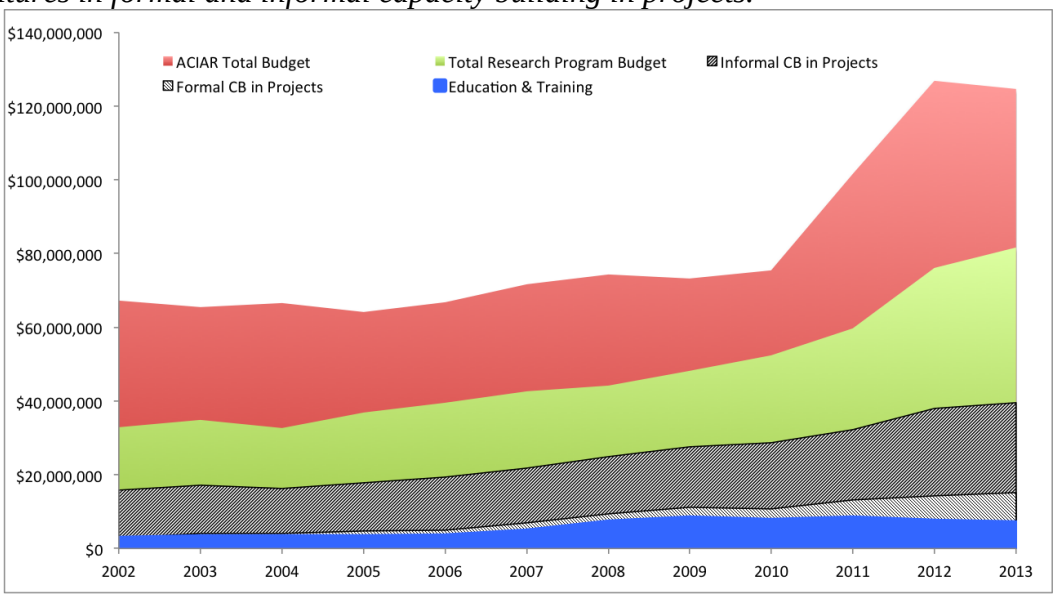
[8] *Representing all bilateral and multilateral research grants.*

[9] *Representing the budget to fund the John Allwright and John Dillon fellows.*

with a formal capacity building component, we estimate that this value actually is below the real value. In the figure 1, we have represented in light grey, an estimation of the likely gradual increment of this type of investment.

However, based on the data collected for Vietnam (Table 1), and on other evidence presented in the annual reports, in Adoption Studies, in Impact assessments and expert opinion, we estimate that the expenditure in informal capacity building in the sample of Vietnamese projects accounted for 10% to 40% of the research program expenditure, the highest percentage of this expenditure is represented in dark grey in Fig. 1. The range of informal capacity building activities recorded in project reports varies from language courses in English, to short technical training courses including mid level management training as well as on going mentoring activities.

Figure 1. ACIAR Expenditure in 2013 Dollars. The area in light and dark grey are estimated expenditures in formal and informal capacity building in projects.



6. The Vietnamese Institutions

The Vietnamese agricultural sector was worth 34.6 Billion USD in 2014 (Source: Website of the General Statistics Office of Vietnam) representing 18.12% of GDP. Agriculture, forestry and fisheries together employ 46.6% of the Vietnamese population, with the majority of agricultural production taking place on family farms of less than 0.5 ha.

There is unfortunately no recent assessment of Vietnam R&D. However in 2003 there were 43 agencies involved in agricultural R&D (ASTI, 2006) employing 2,964 full time equivalent researchers with a total budget of 73 Million USD (2000 prices). Most of the public research agencies are under the supervision of the Ministry for Agriculture and Rural development (MARD).

Of interest to this paper is the Vietnamese Academy of Forest Sciences (prior to 2012, VAFS was know as the Forest Science Institute of Vietnam (FSIV)). In 2003 FSIV employed 169 researchers (FTE's). Today the Academy employs 477 staff, including 6 Associate

Professors, 1 Doctor of Science, 31 PhDs, 40 PhD. candidates, 100 Masters of Science and Master of Science candidates, and 230 engineers and university graduates. Its objectives are:

"*Implementing scientific research, technology transfer, post-graduate training, international cooperation, advisory services and business regarding forest research, development and extension in Vietnam".*

Fisheries and aquaculture research is not placed under MARD but under the Ministry of Fisheries (MF). Vietnam has 3 Research Institutes of Aquaculture (RIA No. 1, No. 2, and No. 3). In 2003, those employed 172 researchers (FTEs). The objectives of the three institutes are similar and include *'breeding, farming practices, diseases of freshwater and saltwater fish species, processing and storage of fisheries products, and feed and nutrition for fish'.* They differ by their geographical focus: RIA No. 1 concentrates on the northern part of Vietnam, RIA No. 2 on the South, and RIA No. 3 on central Vietnam.

Since 2003, a total of 127 ACIAR projects were and are still being implemented in Vietnam. The research programs with most projects were Fisheries with 27 projects, Forestry with 18 and Agribusiness with 16.

The fisheries and forestry research programs were finally selected for further analysis in this scoping study and within these programs, we then decided to analyse the investment in capacity building in specific institutes rather than by research topics, largely because institutional strengthening *per se* is of interest to ACIAR and an important objective of this project.

Research Institutes for Aquaculture

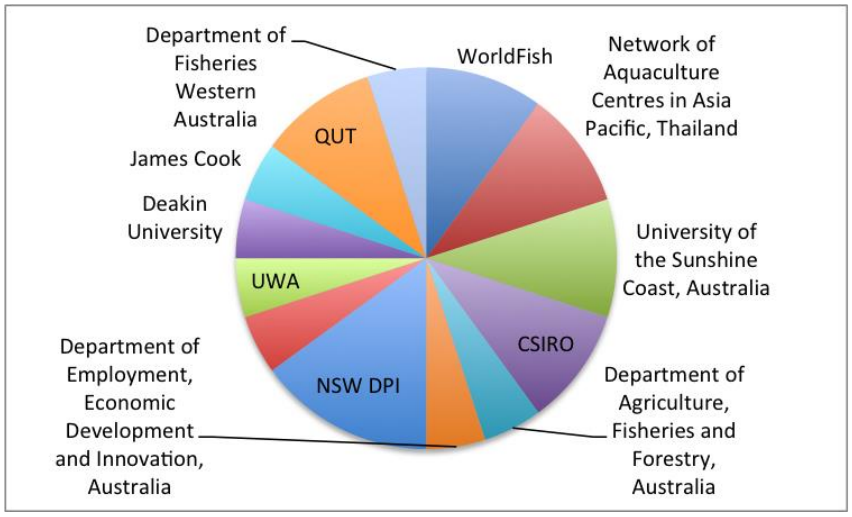
In 2011, ACIAR organized a meeting with Vietnamese officials from Research Institutes, Universities and fisheries agencies to help identify priorities for the ACIAR fisheries program in Vietnam. At that time, the total seafood production in Vietnam was 5.1 Mt (7th in world). The main species for aquaculture production were shrimp (400,000 t, (3rd in world) and Pangasius catfish (1.35 Mt (1st in world). The consultation defined that the key species groups for future development in Vietnam are marine shrimp (black tiger and white-leg shrimp), pangasius catfish, tilapia, molluscs (clams, oysters, abalone and babylon), marine species (barramundi, cobia, grouper, pompano).

At the end of the Meeting, it was agreed that the ACIAR fisheries program in Vietnam would aim at improving the competitiveness and sustainability of sustainable aquaculture and its priorities would include: (Source ACIAR Website and Pers. Com. Chris Barlow)

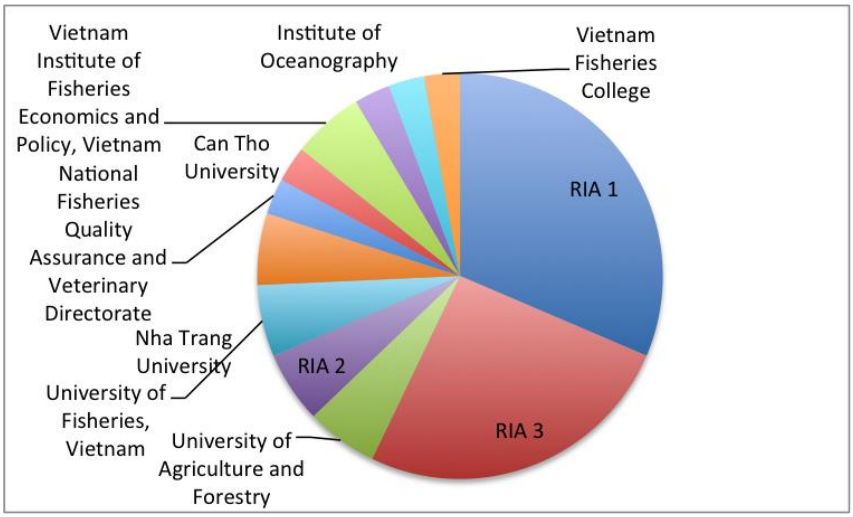
- Improved hatchery practices and breeding programs
- Cost-effective feeds and feeding strategies
- Improved understanding of aquatic animal health
- Profitable and environmentally responsible grow-out technologies.

Figure 2: Percentage of Fisheries project implemented by partners in a) Australia and in b) Vietnam

a)



b)



As these research priorities fit well with RIA 1, 2 and 3 objectives, ACIAR has continued to engage with these institutes. For the Fisheries program, ACIAR projects seemed to be evenly spread between various research institutes in Australia, regional bodies such as the Network of Aquaculture Centres in Asia, NACA, and international research centres such as the World Agroforestry Centre (ICRAF), and WorldFish (Figure 2a). However, in Vietnam, the situation is different: some institutes (such as RIA1 and RIA3) are participating in many more projects relative to other Vietnamese institutes (Figure 2b).

We have chosen to work closely with RIA1 initially because of its larger group of scientists and ACIAR projects. Since 2003 there have been 27 Fisheries projects in Vietnam with a total budget of AUD 15 Million and 9 JAFs. Twelve institutions in Vietnam and 8 in Australia were involved as project partners. The RIA 1 was a partner in 10 of those projects. Three of those 10 projects were small research activities (SRA) and as such had little capacity building activities. Thus we focused our analysis on the 7 remaining projects (see Table 1 below).

Table 1. Analysis of 7 ACIAR Fisheries projects in Vietnam implemented with RIA 1

Project Id	ACIAR Contribution in AUD	PhD	MSc	Total Reciprocal Travel Budget in AUD	Days in Vietnam Project Leader	Days in Vietnam Scientists	Budget in AUD for Workshops Seminars etc... or Part I	Total Value Informal Training	% of Vietnamese allocation in total Budget
FIS/2005/114	395,850	2		71,580	7	27	-	93,380	3%
FIS/2002/068	711,460			43,289	72	36	-	122,489	15%
FIS/2006/141	1,504,713		1	189,600	97	163	16,000	381,000	16%
FIS/2012/101	1,673,000			111,550	224	0	-	268,350	23%
FIS/2000/018	341,126	1		41,150	56	12	14,400	107,550	32%
FIS/2002/077	989,214			43,760	10	25	-	66,760	36%
FIS/2001/013	382,060			48,000	55	56	24,400	150,000	39%
7 Projects	$5,997,423	3	1		74	46		$1,189,529	15%

The total value of the suite of projects where RIA1 was partner since 2003 is approximately AUD 6 Million. Three projects had a budget for capacity building to fund workshop and seminars.

Using the same procedures as described above, we obtained a total value of informal capacity building implemented in these projects ranging between AUD 66,000 to AUD 381,000 accounting for between 3% and 39% of the budget allocated to Vietnam (Table 1). Adding the value of the 3 PhD and 1 MSc training awarded to RIA 1 scientists, the total value of the capacity building since 2003 was estimated to be AUD 2.2 Million.

Vietnam Forestry Program

Since 2003 there have been 18 Forestry projects part funded by ACIAR from a budget of AUD 14 Million and there have been 13 JAFs. Ten institutions in Vietnam and ten institutions in Australia were involved as partners. The Forestry Science Institute of Vietnam (FSIV) was a partner in 10 projects and this is the Institute that was have chosen to examine in more detail in this and a following project.

The total value of the suite of projects in which FSIV was a partner was AUD 8.5 Million (Table 2). During the analysis of the project budgets, we were surprised to notice that in a majority of cases, no money was specifically allocated to capacity building activities. In two cases only, a budget line was allocated to fund workshops and/or seminars.

Using the procedures described above, we estimated that value of informal capacity building implemented in the FSIV projects ranged from AUD 27,000 to AUD 65,000, accounting for between 7% and 30% of the budget allocated to Vietnam (see Table 2).

We also observed that when projects were commissioned to a multilateral or a regional institution with offices based in Vietnam or in a neighbouring country the travel budgets were

small, and there were only relatively few days allocated for in-country travel by the project leader and or scientists. This was due to these mentors and on the job trainers living in or relatively close to Vietnam. Two projects were omitted for the analysis on this basis. This will be further analysed during the second phase of this study. This illustrates the difficulties of devising 'rules' to estimate investment in capacity building. Perhaps greater reliance on the judgment of scientists is required if these types of projects are to be part of any analysis.

If we take in consideration the 9 PhD and 2 MSc grants that were awarded to scientists from FSIV since 2003 and attributing a value of AUD 300,000 to a PhD and 150,000 to an MSc, the total value of capacity building effort since 2003 in FSIV is worth AUD 4.5 Million.

Table 2: Analysis of 10 ACIAR projects in Vietnam implemented with FSIV

Project Id	ACIAR Contribution in AUD	PhD	MSc	Total Reciprocal Travel Budget in AUD	Days in Vietnam Project Leader	Days in Vietnam Scientists	Budget in AUD for Workshops, Seminar, Part I, etc...	Total Value in AUD of Informal Training	% of Vietnamese allocation in the Budget
FST/2002/112	386,083	1		12,300	5	6	7,633	27,533	7%
FST/1999/095	682,611	2		15,260	11	28	-	40,860	9%
FST/2010/034	1,643,437			33,010	24	24	-	66,610	11%
FST/2008/007	1,102,344	1		171,280	39	249	-	351,880	12%
FST/2001/021	519,932			37,670	34	17	-	75,070	13%
FST/2008/039	1,101,028	1		87,240	120	145	-	270,240	16%
FST/1996/005	572,857			41,340	7	7	-	51,140	20%
FST/2003/002	506,054		1	38,840	20	102	-	116,040	26%
FST/1997/024	1,145,013		1	12,093		31	73,726	104,419	29%
FST/2006/087	927,862	4		99,850	154	238	-	365,850	30%
Grand Total	$8,587,221	9	2		46	85		$1,469,642	17%

7. Conclusions

A key objective of this scoping study has been to identify where further research into assessing the ACIAR's contribution to capacity building and its impact might best be directed. An early finding of the scoping study was that the next stage of the project would best focus on forestry and fisheries projects funded by ACIAR in two research institutions in Vietnam: the Research Institute for Aquaculture No 1 (RIA 1) and Forest Science Institute of Vietnam (FSIV).

From a review of the literature, especially research funded by ACIAR, a heuristic path by which investments in capacity building and other components of 'research' eventually flow through to changes in agricultural output and farm profitability was developed. This model emphasised again the jointness in research activities which means that there is no theoretically sound way to separately identify investment in capacity building and its subsequent economic impact. This is the case both for formal training programs and for informal mentoring and learning by doing within bilateral research projects. One implication

of this intractable jointness problem is further research into developing methodologies to assess the impact of capacity building is not a high priority in our view.

The insight that critical masses of various capacity components such as human capital are essential to the productivity of research activities is an important one, as is the insight that some projects might not add to the knowledge stock but do add to the capacity stock which likely adds to the knowledge stock some years hence. Before investing in a country ACIAR needs to be confident that the social and institutional capital exists to support agricultural research. At a project or programme level ACIAR needs to be confident that the human capital in the form of knowledge and skills exist to work with Australian scientists or that the projects contains capacity building components to build up these skills and experience.

Valuable experience (and more robust results) can be gained by further applications of the Gordon and Chadwick framework which requires a subjective assessment to be made of the share of total economic gains from a research project (or technology) that can be attributed to capacity building. They recognised that the benefits of capacity building 'spillover' to the scientists' ongoing research careers but did not attempt to value this. Their assessment of the shares of returns and costs attributable to capacity building were derived either from expert opinion of from the actual cost of training activities (which does not attempt to value the investment in mentoring). It necessarily follows from this approach that the returns to capacity building are similar, if not the same, as those to the project as a whole. This is a sensible outcome given the high level of uncertainty.

In this paper we have explored another approximation to the investment in capacity building which is based on publicly available financial records of ACIAR's bilateral research projects. We have estimated investment in capacity building as the sum of travel costs for Australian and partner country scientists and a salary allowance for Australian scientists based on the number of days they spend in partner countries which we suggest as a proxy for time spent mentoring. We applied this approach in the two research institutions in Vietnam. For some projects the share of costs attributable to capacity building was less than 10% but for others it approached 40%. Obviously the importance of capacity building will vary between projects. Gordon and Chadwick estimated that for a pigeonpea breeding program the share of projects costs attributable to capacity building was 30% and Fisher and Gordon estimated it to be 40% for a pig breeding project in Vietnam. We expect to try alternative methods in an extension of this project in conjunction with tracer study approaches to the subjective expert opinion approach of Gordon and Chadwick.

It is important to maintain the focus on robust measures of total welfare gains in traditional impact assessment studies because the Gordon and Chadwick framework involves subjectively attributing these total welfare gains between research and capacity building activities. Those using their framework have often employed the EDG tracer study processes as a basis for these subjective judgements. The objective in these tracer studies is to develop evidence based links between capacity building activities, capacity utilised and efficiency gains. In our view future analyses using tracer study processes could experiment with questions seeking specific examples of capacity built and specific examples of the technologies to which it was applied. Some tracer studies seem to have encouraged uncritical responses to these issues

An important reason for focussing on a small number of institutions rather than projects or scientists, is that past ACIAR research has not attempted to identify or measure capacity

building within research institutions, an important objective of its Capacity Building Program. These two Vietnamese institutions have had a large number of ACIAR funded projects where mentoring has likely been an important component. In addition a significant number of staff at these institutions has taken advantage of training opportunities provided by ACIAR in the form of John Allwright and John Dillon Fellowships. Several of the projects there have been subject to ACIAR impact assessments. Hence these institutions provide an ideal situation in which to test various ways of estimating both the investment in and the returns from capacity building. Tracer study surveys, of scientists who have had either formal or informal capacity building, which emphasise the identification not only of capacity built but how this capacity has been utilised are likely to provide insights into the influence of capacity building beyond the life of the projects and also into the capacity of the institutions themselves to better manage the science they are responsible for.

We agree with the view of Gordon and Chadwick (2007) who concluded their report saying:

'Applying quantitative techniques to capacity-building investments presents many empirical challenges. But it is important to persevere in trying to quantify the impacts in order to understand the relative benefits of the capacity-building investments ……. The simple process of thinking through capacity built, how capacity is utilised and what the impact of this has been or will be will raise the quality of these investments in the future and allow better recognition of the value added by capacity building in the future.(p.97)'

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