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AN OVERVIEW OF ACIAR'S ECONOMIC EVALUATION ACTIVITIES WITH AN ANIMAL SCIENCES PROGRAM FOCUS

Jeff Davis* and Godfrey Lubulwa**

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* Coordinator, Economic Evaluation Unit, Australian Centre for International Agricultural Research, Canberra.

** Senior Economist Economic Evaluation Unit, Australian Centre for International Agricultural Research, Canberra.

ABBREVIATIONS

ACIAR:	Australian Centre for International Agricultural Research
BOM:	Board of Management, ACIAR
EEU:	Economic Evaluation Unit, ACIAR
GRDC:	Grain Research Development Corporation
IARC:	International Agricultural Research Centres
IRR:	Internal Rate of Return
ISNAR:	International Service for National Agricultural Research
PAC:	Policy Advisory Council, ACIAR
PISA:	Project Information System, ACIAR
PMIS:	Project Management Information System—now renamed PISA
UPLB:	University of the Philippines, Los Baños

1. INTRODUCTION

During the past seven to eight years ACIAR has been developing an institutional **Information System** to support decision-making at various levels within the Centre. A significant aspect of this **Information System** has been the importance of the interaction with collaborating project scientists during the establishment and refinement process.

The last meeting of the project scientists from the Animal Sciences program in 1991 was one of the first attended by ACIAR's Economic Evaluation Unit (EEU) group. At that meeting a detailed paper was presented (See Fearn and Davis 1991). The paper focused on aggregate-priority-setting aspects of ACIAR's **Information System** The primary purpose of the meeting in 1991 was to provide the Animal Science program with information and feedback which could be used to develop the program's strategic plan. Much of the output from that meeting, including the information in the EEU paper, was used to develop the Animal Sciences program strategic plan.

Since that meeting of Animal Science scientists other programs have held similar meetings and the EEU group have attended these on a regular basis. Papers similar to this one have been prepared and a brief summary presented. These meetings have been very useful for the EEU group and have improved the effectiveness of the EEU's activities. They have especially been useful for:

- providing groups associated with ACIAR with an overview of the EEU activities;
- strengthening the interaction between the EEU and project scientists and encouraging feedback from these groups;
- providing background information to support project development; and
- providing indications of future plans and when contact might be useful.

This paper has been developed to complement and update the paper prepared for the 1991 meeting. It includes information which it is hoped will be useful to participants after the meeting.

The paper begins with a brief outline of the **Information System** which is used to support decision-making at ACIAR. Some highlights of the aggregate-priority-setting analysis and how this might apply to the animal sciences area are provided. The project-level assessments are also summarised and those applicable to the animal sciences program area highlighted. The results of other attempts to evaluate animal sciences research are also reviewed. This is followed by a discussion of the project evaluation process and how this is being adapted to suit ACIAR's animal sciences program. The paper concludes with an indication of the areas that require further development and the importance of interaction between the EEU and project scientists for this to be achieved.

2. ACIAR'S INFORMATION SYSTEM AND THE PROJECT SELECTION PROCESS

2.1 The importance of institutionally-based information systems to support Research decision-making

The process of allocating research resources in the public sector has increased in complexity during the past few decades. At the same time, the demand for a more systematic, accountable basis for making these allocations has increased. An important source of this demand has been the decision-makers in the public sector research institutions. However, decision-makers in other areas of the public sector have also begun to insist on this greater accountability for public sector expenditure.

In this atmosphere decisions based largely on the intuitive judgement of senior management are becoming less acceptable. There has been an increased demand for this intuitive judgement to be complemented by more systematically-based information. Sometimes there is an inclination to infer that such information can substitute for the final judgement of senior management. While systematically-based information can often strengthen decision-making, especially by providing continuity in the basis for decisions even when senior management changes, it is unrealistic to expect such information to be comprehensive enough to replace the need for the judgement of managers. Better informed judgements, however, are more likely to satisfy the increased accountability being required from public sector institutions. It is important to also recognise that it is often the process of exposing decision-making to the activity of generating the information, rather than the basic summary information itself, that has the main impact on decision-making and improved judgements. The more complex the decision-making environment becomes the more likely this will be the case.

Figure 1 illustrates a typical decision-making process in a research institution. In most institutions decisions are made by an executive group (or groups). This group is usually drawn from a variety of backgrounds. Indeed it is a diversity of experiences that is usually necessary to provide the interchanges that result in effective decisions being made. As indicated in Figure 1 a range of information sources will influence each of the decision-makers. These may include such things as: past experience; professional training; peer group interactions and pressures; and political considerations. The intuitive judgements of each decision-maker, based on these different sources of information, are generally combined to give institutional decisions for research priorities and resource allocations. With increased public demand for accountability by these institutions, it is often important to complement these decision-maker specific inputs with institutionally-generated information. In this way there will be an established set of information which can be well documented and remains with the institution as, inevitably, the decision-makers change.

As indicated in Figure 1 an important feature of any institutional information system should be that it evolves through interaction between the decision-makers, institution members and those interacting with the institution. In this way the important experience and information contributed by these groups can be systematically incorporated in the institutional information. If the information system is effective it should contribute to a strengthening of decisions made by the institution.

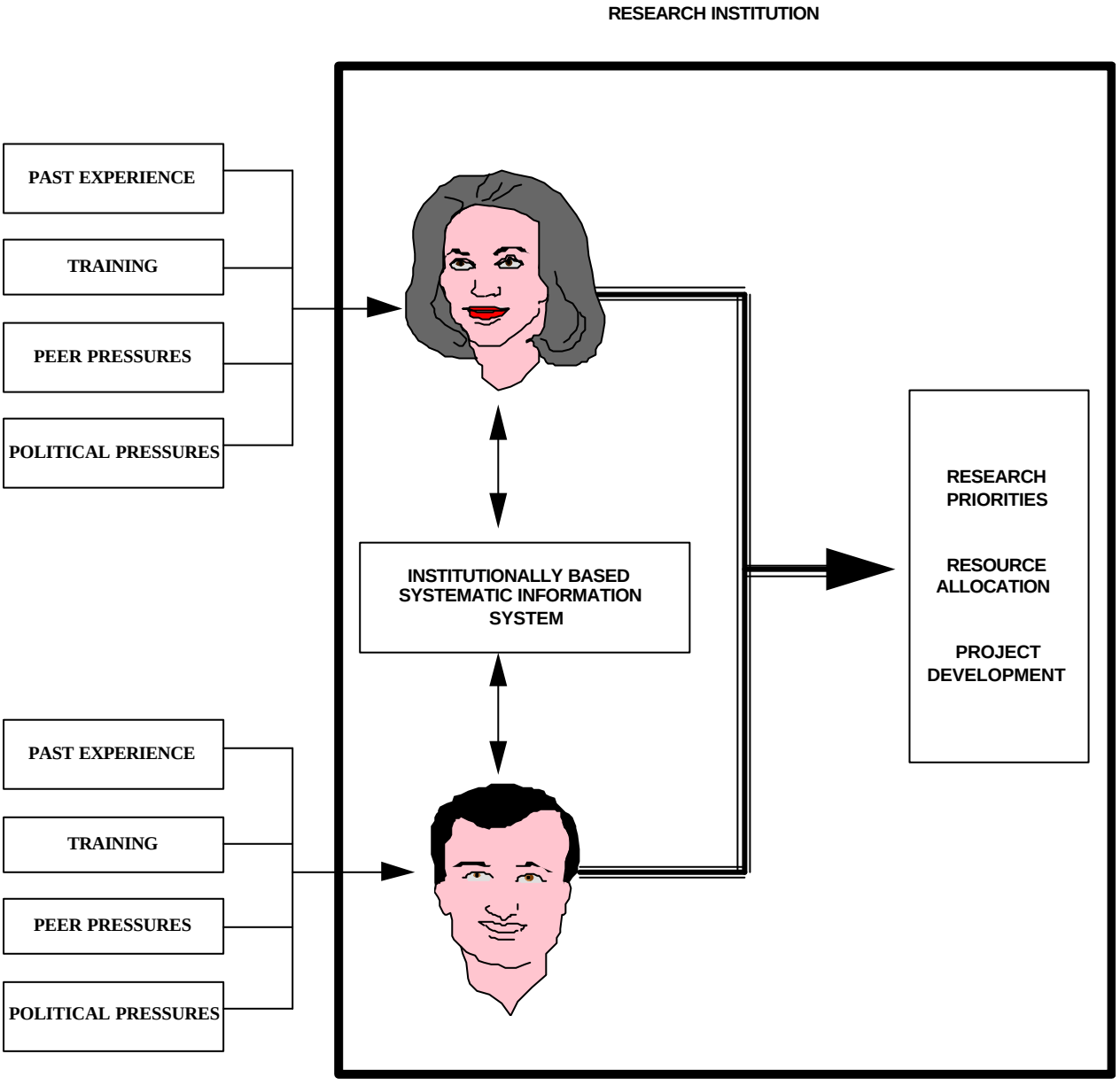


Figure 1. The complementarity between institutionally based information systems and other information sources which support decision-making.

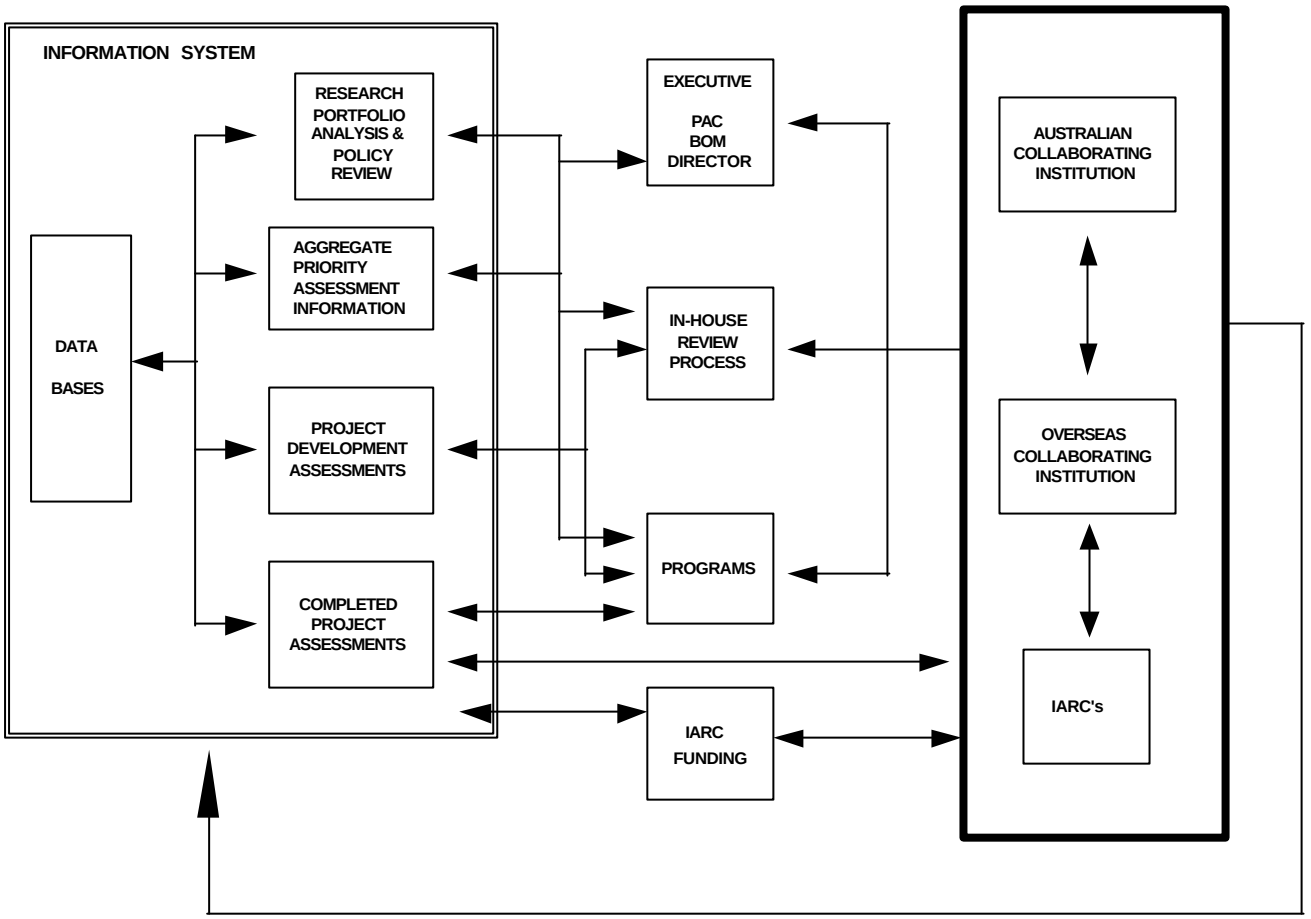
2.2 A brief overview of ACIAR's Information System and project evaluations

During the early days of ACIAR's development it was decided that it was important to develop an institutionally based **Information System** to support decision-making at various levels. There were a range of reasons for this decision. These included: the increased importance being placed on public sector accountability; the diverse nature of ACIAR's mandate research areas and the need to be able to make comparisons between these. It was also expected that the scientific expertise would change with time and, therefore, an institutionally-based **Information System** which drew on this expertise, and evolved with it, was considered important.

A detailed account of the evolution of ACIAR's **Information System** is provided in Davis and Ryan eds. (forthcoming, chapters 8 to 11). A brief summary is also provided in, for example, Davis and Fearn (1992). Figure 2 provides a simple illustration of the structure of the institutional **Information System** developed by ACIAR and the interface of this **System** with groups within ACIAR and the institutions it collaborates with. The two-way flow of information is highlighted as a crucial component of the **System**. One important component comprises two databases. These are:

(i) A Project Management Database

The project management database is called the **Project Management Information System** (PMIS). It is a complete record of the information set for each Project funded by ACIAR since its inception. The information ranges from the detailed budgets to the publications and the country/commodity focus of the project. The database has been designed to produce a range of reports. Some are used to assist day-to-day project management while others provide summary information for all projects or various groups of projects. The structure of this database and software used to access it is currently undergoing a major review. The system is to be renamed PISA (Project Information System ACIAR).



(ii) A Research Evaluation Database

The **Research Evaluation Database** has been developed to make use of an extensive set of research evaluation literature produced during the past two decades. The methodology that has evolved has been adapted to suit decision-making in ACIAR. This has entailed incorporating more detailed technical parameters in the underlying models and involving technical scientists in the collection of the data used in the subsequent analysis. The models currently used are based on a detailed interpretation of the research process—and the way this process interfaces with the technical and socio-economic aspects of a multi-country world (see Davis, Bantilan and Ryan [forthcoming], Davis and Fearn [1992] or Fearn and Davis [1991] for more details of this research process model).

The technical dimensions of the research process model focus on estimates of the relative strengths of the research systems in different countries, the potential for research output to spillover to other countries and the potential adoption levels of the final technologies. Estimates of the information used to represent these components have been obtained through consultations with research managers and technical experts. While the current estimates still require further verification they do represent a comprehensive set of data.
The socio-economic components have been modelled using a multi-region traded good model with the concept of producer and consumer surplus used to estimate the potential welfare effects of the research. To accommodate this part of the model a range of data sets have been added to the database. These include

production, consumption (both commercial and subsistence), prices and elasticities. As well as the basic data the database includes a full set of the estimates of the potential welfare changes due to research.

To support aggregate-level decision-making an important assumption used for the base-case set of welfare changes is that the research results in a 5% reduction in the cost of producing a unit (usually a tonne) of the commodity.

In its current form the database includes data and estimates of the parameters for all countries. However, these are then aggregated into 75 countries or aggregations of countries. By including all countries, any world price effects, which might flow from the technology spillovers to developed countries, can be incorporated. In addition to the 75 political/geographic regions the technical research spillovers are estimated using between 5 to 75 different production environment classifications, depending upon the commodity. This spillover information is, therefore, available for each of these production environments for each country, although each country will usually only contain a small subset of possible production environments.
The information and analysis is currently available for 45 different commodities. These include 27 from the agricultural sector, 8 from forestry and 10 from the fisheries sector.

In addition to evaluating the aggregate-level information, the database is used to develop project-level evaluations. Further information needed includes details of the costs associated with production of commodities in different production conditions (production environments) and the assessments of the potential impact different types of research are likely to have on these costs and production conditions. This information is combined with project-specific revisions to the aggregate parameter set; thus providing assessments of the potential welfare impact of specific research projects.

Both of the databases described above have been computerised. The **PMIS** follows a more conventional database format while the **Research Evaluation** database uses spreadsheets.

The databases developed as part of the **Information System** are extensive. To be useful for supporting decision-making it is necessary to develop summary reports which condense this information into useful ready-reckoner forms. Considerable effort has been focused on this aspect of the **Information System**. More effort is still required to refine the summary reports to ensure that they achieve maximum effectiveness. Davis and Ryan eds. (forthcoming, chapter 11) provide a detailed outline of these efforts and indicate how this has been an evolutionary process.

Figure 2 summarises, in simple terms, the components of the **Information System** The two databases have been discussed above. These are used to produce summary information to support several decision-making groups. This summary information currently takes four main forms:

(i) Project related information.
(ii) Aggregate priority assessment information.
(iii) Project development assessments.
(iv) Completed project assessments.

In the rest of this paper we will summarise some of the important dimensions of this **Information System** that are specific to the animal sciences research program and in so doing illustrate how the information can be used to highlight some possibly important issues.

2.3 Aggregate priority assessment information with an animal sciences focus

2.3.1 Brief overview of the aggregate priority assessment information

A crucial aspect of developing summary information to support priority-assessment decisions was to clarify ACIAR's objectives. This clarification is continuing, for example, the ACIAR PAC meeting in December 1994 discussed this issue again. Currently, maximisation of the mandate regional benefits is given most prominence. However, Australian benefits are beginning to receive more attention. The large set of welfare-gain information estimated in the **Research Evaluation** database has been employed to support priority assessments. These estimates provide an indication of the likely ordering of the commodities by the regional welfare gains that might result from successful research. Table 1 illustrates the monetary measures of the potential regional welfare gains from research if it is undertaken on problems relevant to the region and generates a 5% unit-cost reduction for each commodity. In this case the regions illustrated are the five mandated for ACIAR and Australia. Information for all countries and regions of the world are available from the analysis.

Table 1. Gross present value of regional welfare benefits for a regional research focus (welfare measured in $US M. over 30 years with 12% discount rate).

South Asia Regional Benefits		South East Asia Regional Benefits		China Regional Benefits		South Pacific Regional Benefits		R
Commodity Ranking	Regional Benefits	Commodity Ranking	Regional Benefits	Commodity Ranking	Regional Benefits	Commodity Ranking	Regional Benefits	Commo Rankin
Rice	421	Rice	200	Rice	1157	Tunas,bonitos etc	6	Fuelwo
Milk	269	Saw&Ven.Logs (NC)	181	Pigmeat	594	Fuelwood (NC)	6	Saw&V
Fuelwood (NC)	204	Fuelwood (NC)	167	Sweet Potato	311	Saw&Ven.Logs (NC)	4	Milk
Wheat	131	Palm Oil/Kernel	96	Maize	277	Sugar	2	Cocoa
Pulses All	115	Rubber	64	Potatoes	237	Banana/Plantain	1	Beef&B
Potatoes	63	Sugar	23	Wheat	233	Palm Oil/Kernel	1	Charcoa
Cotton	52	Coconut	22	Cotton	130	Coffee	1	Palm O
Sugar	50	Banana/Plantain	20	Eggs (poultry)	102	Cocoa	1	Cassava
Saw&Ven.Logs (NC)	38	Cassava	16	Soybean	60	Demersal/other pelagic	0	Sheep &
Sorghum	37	Pigmeat	14	Pulses All	59	Pigmeat	0	Oth.Ind
Groundnut	35	Demersal/other pelagic	13	Fuelwood (NC)	59	Coconut	0	Banana
Millet	24	Prawns/shrimps	13	Saw&Ven.Logs (C)	45	Pulpwood	0	Rice
Sheep & Goat Meat	24	Maize	12	Sugar	44	Saw&Ven.Logs (C)	0	Eggs (p
Banana/Plantain	20	Eggs (poultry)	11	Fuelwood (Con.)	40	Sweet Potato	0	Tilapias
Maize	18	Coffee	11	Poultry Meat	37	Milk	0	Sugar
Beef&Buffalo	16	Poultry Meat	10	Sheep & Goat Meat	30	Prawns/shrimps	0	Millet
Eggs (poultry)	15	Beef&Buffalo	8	Groundnut	29	Rice	0	Maize
Prawns/shrimps	14	Tilapias	7	Saw&Ven.Logs (NC)	28	Tilapias	0	Poultry
Coconut	13	Cocoa	7	Milk	25	Beef&Buffalo	0	Pulpwo
Demersal/other pelagic	8	Oth.Ind.Rdwood	6	Oth.Ind.Rdwood	19	Cassava	0	Fuelwo
Oranges & Tangarines	8	Tunas,bonitos etc	4	Prawns/shrimps	17	Charcoal	0	Ground
Herrings & others	7	Mackerals & others	3	Millet	14	Cotton	0	Herring
Cassava	6	Charcoal	3	Sorghum	13	Eggs (poultry)	0	Cotton
Fuelwood (Con.)	6	Sheep & Goat Meat	3	Wool	12	Fuelwood (Con.)	0	Saw&V
Saw&Ven.Logs (C)	6	Herrings & others	3	Oranges & Tangarines	9	Groundnut	0	Potatoe
Soybean	6	Soybean	2	Beef&Buffalo	8	Herrings & others	0	Pigmea
Charcoal	6	Milk	2	Pitprops	7	Lobsters	0	Demers
Oth.Ind.Rdwood	4	Pulpwood	2	Mackerals & others	5	Mackerals & others	0	Pulses
Wool	3	Sweet Potato	2	Demersal/other pelagic	5	Maize	0	Sorghu
Poultry Meat	3	Pulses All	1	Cassava	4	Millet	0	Wheat

Coffee	3	Saw&Ven.Logs (C)	1	Rubber	4	Oranges & Tangarines	0	Coffee	
Tilapias	3	Groundnut	1	Palm Oil/Kernel	4	Oth.Ind.Rdwood	0	Soybean	
Pigmeat	3	Cotton	1	Pulpwood	3	Pitprops	0	Wool	
Rubber	2	Oranges & Tangarines	1	Tunas,bonitos etc	3	Potatoes	0	Coconu	
Pitprops	1	Lobsters	1	Banana/Plantain	1	Poultry Meat	0	Sweet P	
Pulpwood	1	Potatoes	0	Coffee	0	Pulses All	0	Tunas,b	
Sweet Potato	1	Sorghum	0	Herrings & others	0	Rubber	0	Lobster	
Mackerals & others	1	Wheat	0	Charcoal	0	Sheep & Goat Meat	0	Mackera	
Tunas,bonitos etc	1	Millet	0	Cocoa	0	Sorghum	0	Oranges	
Lobsters	0	Fuelwood (Con.)	0	Coconut	0	Soybean	0	Pitprop	
Cocoa	0	Pitprops	0	Lobsters	0	Wheat	0	Prawns/	
Palm Oil/Kernel	0	Wool	0	Tilapias	0	Wool	0	Rubber	

It has been found that this type of presentational format is not always the most convenient for quick use by decision-makers to assist in setting priorities. Instead an alternative format has been developed. This format uses, what have been called, break-even relativities (Table 2a, b). These relativities are calculated by placing the commodities in order from highest regional benefits to lowest; and then dividing the highest by each of the other commodity's expected gains. For example, in South Asia a 5% cost reduction from prawns/shrimp research is expected to generate a welfare gain in present-value terms of $US14m (a research and adoption lag of 11 years and a 30-year planning period is assumed and a real discount rate of 12% used). On the other hand, the same 5% unit-cost reduction from rice research is expected to provide regional welfare gains to South Asia of $US421m. The break-even relativity for prawns/shrimp is 421/14 = 30. In other words, prawns/shrimp research would need to generate approximately 30 times the percentage cost reduction to provide the same regional welfare gains as rice research.

Notice that as well as the break-even relativities for all commodities within a region, Table 2 also includes the relativities between the geographical regions. This is calculated by dividing the highest regional welfare gains, that is, those for China by each of the highest gains for the other regions. Therefore, it is seen that for tuna, bonitos etc. research in the South Pacific to generate the same welfare gains as rice research in China, about 200 times the percentage unit cost reduction would be required.

In addition to calculating these relativities, it has proven useful to use priority groups instead of an ordered list. We have found six useful and the following relativity ranges appropriate:

Priority Grouping	**Range of Break-Even Relativity**
1	0–10
2	11–20
3	21–40
4	41–80
5	81–160
6	> 160

Care is obviously required in using this type of summary information to support decision-making. In ACIAR it is not used to dictate that research should only be supported for the commodities expected to provide the highest gains. Rather it is used more as a screening device. That is, research focusing on commodities that are in the 4, 5, and 6 priority groups are flagged as requiring closer scrutiny of the likely level of welfare gains that may result. The trend is toward having more detailed economic assessments included with these types of projects to

demonstrate more clearly that, as well as scientifically attractive attributes, there are high potential regional welfare gains.
This aggregate type of information has been used to support decision-making by most of the decision-making groups illustrated in Figure 2. However, it has especially been used as an input to the In-House-Review process.

The possible types of uses that can be made of this aggregate information will be briefly illustrated here with a focus on animal science research. The sets of information covered in the rest of this section include regional priority groupings for the sub-set of commodities relevant to animal science research; an indication of past funding patterns by region and these commodities; and discussion of benefits to Australia versus benefits to partner countries.

2.3.2 Aggregate regional priorities with an animal sciences focus

There are seven direct animal products included in the analysis of 45 commodities. These are milk and milk products, sheep and goat meat, wool, beef and buffalo meat, eggs and poultry meat. The potential gross welfare gains from research on this sub-set of livestock products are seen from Table 1. Again this information refers to the average regional benefit from research focused on problems important to the production environments most prevalent in the region. Recall that these benefits are calculated by assuming the research results in a standard 5% reduction in the unit cost of producing the commodities.

Notice that, for all regions, the highest benefits for animal products are likely to come from pig research in China with expectations of $US594m in present-value terms over 30 years from the start of the research effort. This is followed by milk research in South Asia with regional gains of $US269m.

The information is presented assuming that the research does not have a direct impact on other livestock products. In some cases this will not be appropriate, for example with poultry meat and eggs. If research is likely to have an impact on both, then the research benefits should be added together and the total compared with the other commodities.

As was discussed above, it has been found more useful to present this information in the form of break-even relativities. Tables 2a and b provides this information with the livestock commodities shaded. As was emphasised earlier, care is required in how this type of information is used. In ACIAR, emphasis is placed on using it to highlight general trends and relativities to focus discussion on important issues. These tables of 'priorities' are not intended to be adopted as dictums but rather to be used in planning discussions to generate debate. There are often likely to be other strong reasons that will override the potential research impacts and place more or less importance on some of the commodities. For example, in ACIAR there may be no Australian expertise for a particular livestock issue; no good researchable problems that can be identified; or the private sector may dominate research in a product.

It is seen from Tables 2a and b that there are some noticeable differences between regions in the number of livestock products in each of the six priority groups. Regions such as the South Pacific and Southeast Asia do not have any commodities in the group 1 set of relative benefits. On the other hand, Africa has two of the seven commodities in this group. Perhaps not surprisingly Australia has five of the livestock commodities in priority group 1. This information can be used as a basis for discussing whether, for example, at a program level

consideration should be given to concentrating on a sub-set of ACIAR's mandate regions. Also whether certain livestock products should receive attention in some regions but not others. Clearly other information is required to finally resolve these types of research-management decisions, however, the potential relative benefits could be relevant to the discussions.

Table 2a. Regional commodity research priority groupings for a regional benefits objective.

South Asia Regional Benefits			Southeast Asia Regional Benefits			China Regional Benefits		
Priority Group	Commodity Ranking	Break-even Relativities	Priority Group	Commodity Ranking	Break-even Relativities	Priority Group	Commodity Ranking	Break-even Relativities
	Rice	1		Rice	1		Rice	1
	Milk	2		Saw&Ven.Logs (NC)	1		Pigmeat	2
	Fuelwood (NC)	2		Fuelwood (NC)	1		Sweet Potato	4
1	Wheat	3	1	Palm Oil/Kernel	2	1	Maize	4
	Pulses All	4		Rubber	3		Potatoes	5
	Potatoes	7		Sugar	9		Wheat	5
	Cotton	8		Coconut	9		Cotton	9
	Sugar	8		Banana/Plantain	10			
							Eggs (poultry)	11
	Saw&Ven.Logs (NC)	11		Cassava	12	2	Soybean	19
	Sorghum	11		Pigmeat	14		Pulses All	20
2	Groundnut	12		Demersal/other pelagic	15		Fuelwood (NC)	20
	Millet	17	2	Prawns/shrimps	16			
	Sheep & Goat Meat	18		Maize	16		Saw&Ven.Logs (C)	26
				Eggs (poultry)	18		Sugar	26
	Banana/Plantain	21		Coffee	18	3	Fuelwood (Con.)	29
	Maize	23		Poultry Meat	19		Poultry Meat	31
3	Beef&Buffalo	27					Sheep & Goat Meat	39
	Eggs (poultry)	27		Beef&Buffalo	25		Groundnut	40
	Prawns/shrimps	30	3	Tilapias	27			
	Coconut	33		Cocoa	28		Saw&Ven.Logs (NC)	41
				Oth.Ind.Rdwood	33	4	Milk	46
	Demersal/other pelagic	53					Oth.Ind.Rdwood	62
	Oranges & Tangerines	55		Tunas,bonitos etc	57		Prawns/shrimps	67
	Herrings & others	64		Mackerels & others	61			
4	Cassava	67	4	Charcoal	63		Millet	81
	Fuelwood (Con.)	67		Sheep & Goat Meat	65		Sorghum	89
	Saw&Ven.Logs (C)	67		Herrings & others	67	5	Wool	97
	Soybean	75					Oranges & Tangerines	129
	Charcoal	77		Soybean	83		Beef&Buffalo	139
				Milk	95			
	Oth.Ind.Rdwood	98	5	Pulpwood	111		Pitprops	163
	Wool	136		Sweet Potato	133		Mackerels & others	214
5	Poultry Meat	140		Pulses All	143		Demersal/other	
pelagic	227		Maize	0				
	Coffee	145		Saw&Ven.Logs (C)	143		Cassava	276
	Tilapias	156					Rubber	276
				Groundnut	167		Palm Oil/Kernel	289
	Pigmeat	162		Cotton	200		Pulpwood	413
	Rubber	183		Oranges & Tangerines	222	6	Tunas,bonitos etc	463
	Pitprops	301		Lobsters	286		Banana/Plantain	1286
	Pulpwood	324		Potatoes	500		Coffee	5786
6	Sweet Potato	351	6	Sorghum	500		Herrings & others	5786
	Mackerels & others	421		Wheat	667		Charcoal	0
	Tunas,bonitos etc	842		Millet	2000		Cocoa	0
	Lobsters	2105		Fuelwood (Con.)	0		Coconut	0
	Cocoa	4210		Pitprops	0		Lobsters	0
	Palm Oil/Kernel	0		Wool	0		Tilapias	0
Regional Relativities	2.7			5.8			1	

Table 2b. Regional commodity research priority groupings for a regional benefits objective (continued).

Africa Australian Regional Benefits Benefits			W Asia/ N Africa Regional Benefits			Latin America Regional Benefits		
Priority Group	Commodity Ranking	Break-even Relativities	Priority Group	Commodity Ranking	Break-even Relativities	Priority Group	Commodity Ranking	Break-even Relativities
	Fuelwood (NC)	1		Wheat	1		Soybean	1
	Saw&Ven.Logs (NC)	6		Milk	2		Fuelwood (NC)	1
	Milk	8		Beef&Buffalo	3		Coffee	1
1	Cocoa	9		Sheep & Goat Meat	3		Milk	2
	Beef&Buffalo	9		Oranges & Tangerines	3		Beef&Buffalo	2
	Charcoal	9		Cotton	4		Sugar	2
	Palm Oil/Kernel	9		Rice	5		Pigmeat	2
	Cassava	10	1	Saw&Ven.Logs (C)	5		Saw&Ven.Logs (C)	2
				Pulses All	5		Herrings & others	2
2	Sheep & Goat Meat	11		Sugar	6		Oranges & Tangerines	3
	Oth.Ind.Rdwood	17		Fuelwood (Con.)	7		Saw&Ven.Logs (NC)	3
pelagic	3		Rice	Herrings & others 9	7	1	Demersal/other	
	Banana/Plantain	22		Fuelwood (NC)	7		Rice	4
	Rice	22		Eggs (poultry)	9		Maize	4
	Eggs (poultry)	22		Poultry Meat	9		Poultry Meat	5
3	Tilapias	22		Potatoes	10		Eggs (poultry)	5
	Sugar	25					Cocoa	6
	Millet	26	2	Maize	11		Prawns/shrimps	6
	Maize	27		Wool	14		Pulpwood	6
	Poultry Meat	28					Wheat	7
			3	Saw&Ven.Logs (NC)	22		Cassava	9
	Pulpwood	50		Oth.Ind.Rdwood	34		Fuelwood (Con.)	9
	Fuelwood (Con.)	54					Banana/Plantain	9
4	Groundnut	54		Mackerels & others	46			
	Herrings & others	59		Demersal/other pelagic	58		Sheep & Goat Meat	11
	Cotton	65	4	Pitprops	71		Charcoal	11
	Saw&Ven.Logs (C)	65		Charcoal	80	2	Cotton	14
				Pulpwood	80		Pulses All	16
	Potatoes	81		Soybean	80		Wool	17
	Pigmeat	92						
5	Demersal/other pelagic	129	5	Millet	92		Potatoes	22
	Pulses All	129		Banana/Plantain	107	3	Sorghum	25
	Sorghum	129					Oth.Ind.Rdwood	26
				Prawns/shrimps	214		Rubber	36
	Wheat	161		Tunas,bonitos etc	214			
	Coffee	215		Groundnut	641		Palm Oil/Kernel	44
	Soybean	215		Pigmeat	641		Tilapias	53
	Wool	215		Cassava	0	4	Lobsters	56
	Coconut	323		Cocoa	0		Mackerels & others	56
	Sweet Potato	323	6	Coconut	0		Tunas,bonitos etc	72
6	Tunas,bonitos etc	323		Coffee	0			
	Lobsters	645		Lobsters	0			
	Mackerels & others	645		Palm Oil/Kernel	0		Coconut	253
	Oranges & Tangerines	645		Rubber	0		Pitprops	507
	Pitprops	645		Sorghum	0	6	Sweet Potato	507
	Prawns/shrimps	645		Sweet Potato	0		Groundnut	1013
	Rubber	-645		Tilapias	0		Millet	0
Regional Relativities		17.9			18.1			11.4

It is often convenient to separate the priority groups into two further aggregate groups. That is, groups 1–3 and 4–6. Tables 2a and 2b indicate that the South Pacific/PNG region has only one of the seven livestock products in this high priority group, that is, pigs. On the other hand, Africa has six of the seven in the top grouping. This would suggest that perhaps the South Pacific is not an attractive region for Animal Science research whereas Africa could be.

Although Southeast Asia does not have a livestock product in priority group 1 it does have four, out of the seven considered, in the aggregated high-priority group. The three Asian regions all have four of the seven commodities in this high-priority group and therefore, other things being equal, it might be expected that Animal Science research would be prominent in these regions.

Certain commodities provide higher relative research gains than others in different regions. For example, milk seems to provide high potential in both South Asia and Africa but not in Southeast Asia and the South Pacific. The opposite relativities are found for pig research. Wool research is in the low aggregate group for all regions—however, and obviously, not for Australia.

2.3.3 Past animal science expenditure patterns

It is possible to use a combination of the PMIS and Research Evaluation databases to look at some broad trends in the animal sciences research program at ACIAR. As indicated above, the PMIS contains detailed information for each project. One set of information is the commodity emphasis and the project funding. If we combine this information with the aggregate priority groupings from Table 2 for several time periods, it is possible to determine whether there have been any clear trends in the program's emphasis.

Table 3 summarises this aggregate information by regions for every commodity and for all ACIAR's animal sciences research projects. Several points can be highlighted. First it is noticed that, when individual projects are considered, animal science research can have potential impacts on other than direct animal products. For ACIAR's programs, rice and some forest products are good examples of this. This is because draught animal power is used in the production of rice, and possibly other crops, and some projects have focused on this aspect of animal production. Also, some forage related animal research has potential to generate fuelwood and other tree related products. As shown in Table 3 this aspect of the animal science research program was important, especially during the first six to seven years.

Table 3 also indicates that a major share, about 50%, of the animal science program funding has been in Southeast Asia. China has received the next largest share with South Asia and Africa receiving about the same and the South Pacific and PNG the least. If this information is separated into the two halves of ACIAR's existence there are a range of trends evident. One example is a shift away from South Asia and to Africa at a regional level. For animal products there has been a shift towards more research on pigs, especially in Southeast Asia.
Table 4 summarises this funding information by aggregate-priority groups. Some interesting, although probably expected, region/commodity/priority trends are found. In South Asia and Africa all of the expenditure has been focused on the three high priority groups. On the other hand, in the South Pacific all of the expenditure has been on the lowest priority group. Even in the case of China a large share of the research expenditure has been focused on the lower priority commodity groups.

There are bound to be good research based reasons for some of these observed trends. These will often not be captured by the information in the aggregate form of Table 3 and 4. It is hoped that having this summary picture will, however, highlight some issues for constructive discussion.

Table 3. Animal sciences research funding by region, commodity and priority group (1992 to 1995).

Commodity	Priority Group	Southeast Asia ($'000)			Commodity	Priority Group	South Asia ($'000)			Co
		1982–94	1982–88	1989–94			1982–94	1982–88	1989–94	
Rice	1	1814	1421	393	Milk	1	1999	1986	13	
Fuelwood NC	1	111	0	111	Rice	1	422	422	0	
S&V Logs NC	1	111	0	111	Wheat	1	32	32	0	
Total		*2037*	*1421*	*616*	*Total*		*2453*	*2440*	*13*	
Chicken Meat	2	2296	1690	606	Sheep/Goat	2	450	22	428	
Pigs	2	1668	420	1247						
Ducks	2	498	0	498	Beef/Buffalo	3	964	964	0	
Total		*4463*	*2110*	*2352*						
					Chicken Meat	5	483	228	254	
Beef/Buffalo	3	5537	2,011	3,526						
Sheep/Goat	4	2,056	395	1661						
Milk	5	747	394	352						
Pulpwood	5	55	0	55						
Total		*802*	*394*	*408*						
Wool	6	159	0	159						
Sub Total		**15 058**	**6334**	**8724**	**Sub-Total**		**4351**	**3656**	**695**	
Non-Specific	ni	31	0	31						
Honey	ni	278	0	278						
Sub Total		**309**	**0**	**309**	**Sub Total**		**0**	**0**	**0**	
Total		**15 367**	**6334**	**9033**	**Total**		**4351**	**3656**	**695**	

Table 3. Animal sciences research funding by region, commodity and priority group (1992 to 1995) (continued).

Commodity	Priority Group	South Pacific & PNG ($'000)			Commodity	Priority Group	Africa ($'000)		
		1982–94	1982–88	1989–94			1982–94	1982–88	1989–94
Milk	4	18	0	18	Beef/Buffalo	1	4063	298	3765
					Milk	1	170	0	170
Sheep/Goats	6	1487	946	541	*Total*		*4234*	*298*	*3935*
Sub Total		**1505**	**946**	**559**	**Sub-Total**		**4234**	**298**	**3935**
Non-Specific	ni	442		442					
Sub Total		**442**	**0**	**442**	**Sub Total**		**0**	**0**	**0**
Total		**1947**	**946**	**1001**	**Total**		**4234**	**298**	**3935**

Table 4. Animal sciences research funding by research priority groupings and regions—1982 to 1995 (%).

Priority Group	Southeast Asia China			Priority Group	South Asia			Priority Group
	1982–1995	1982–1988	1989–1995		1982–1995	1982–1988	1989–1995	1
1	13.3	22.4	6.8	1	56.4	66.8	1.9	1
2	29.1	33.3	26.0	2	10.4	0.6	61.6	2
3	36.0	31.8	39.0	3	22.2	26.4	0	3
4	13.4	6.2	18.4	4	0	0	0	4
5	5.2	6.2	4.5	5	11.1	6.3	36.6	5
6	1.0	0	1.8	6	0	0	0	6
Not Included	2.0	0	3.4	Not Included	0	0	0	Not Included

Priority Group	South Pacific & PNG			Priority Group	Africa		
	1982–1995	1982–1988	1989–1995		1982–1995	1982–1988	1989–1995
1	0	0	0	1	100	100	100
2	0	0	0	2	0	0	0
3	0	0	0	3	0	0	0
4	1.0	0	1.8	4	0	0	0
5	0	0	0	5	0	0	0
6	76.3	100	54.0	6	0	0	0
Not Included	22.7	0	44.2	Not Included	0	0	0

2.3.4 Australian benefits as an objective for ACIAR

The impact of ACIAR-funded research on Australian agricultural production is likely to be important for at least two reasons. First, the Australian collaborating institution aims primarily to maximise welfare gains to Australia. Any conflicts between this wish to benefit Australia, and ACIAR's aim to provide regional benefits for developing countries, could influence the choice of projects and their research emphasis. Second, farmer-oriented, decision-making groups are showing growing interest in the use of aid funds to support research in developing countries and may be keen to have this research focus on issues of potential importance to Australian conditions. As a result ACIAR is now paying more attention to the Australian benefits from projects than it did in its earlier days. In many cases this does not result in a change to the types and form of projects but rather ensures that Australian benefits are highlighted.

Table 1 (last column) included estimates of the benefits to Australia from research undertaken in Australia and focused on the important production environments for commodities in Australia. If the objective of Australian

research institutions is to maximise the gains to Australia from research, then their priorities are likely to be similar to those listed in Table 2b. It seems from this information that Australian livestock research institutions are likely to place research emphasis on more (all) livestock products than institutions from collaborating countries would—and on more livestock products than would be preferred by ACIAR to satisfy its regional-benefits objective. That is, all livestock products are in the high priority groups for Australia but not for the other mandate regions. This may not pose too many problems as most products are important in at least one of the regions. The exception is wool which is high priority for Australia but not based on a regional benefits objective for any of the other regions. Therefore, it should be possible to match an Australian research institution's interests with those of at least one of the mandate regions.

Perhaps of more crucial concern is when an ACIAR project is developed that focuses primarily on the production environments of most importance to the collaborating partner country. Then the potential gains to Australia will depend on the similarity in production environments and/or the expected spillovers of research impacts between these production environments. Given the diversity in production environments between countries, it is possible that the gains to Australia will be lower if such a research focus is included in the project. Thus a conflict between attaining maximum Australian benefits and maximum partner country gains is likely to arise.

The **Research Evaluation** database, through its modelling of research spillovers, provides some information that may provide some insights on this issue. Although preliminary at this stage, Table 5 provides some estimates of the benefits to Australia from the spillover of research results if the research is focused fully on the production environments of most importance to the countries in the mandate regions. A comparison of Tables 1 and 5 indicates that the gains to Australia are likely to be smaller when this occurs. Although in most cases Australia will still benefit, these gains will probably be limited to between 20 to 30% of those possible from research designed solely to address Australian-specific problems. For many projects, however, their is likely to be a joint focus. Even then though, a compromise in terms of Australian benefits will most likely result.

Table 5. Potential spillover benefits to Australia from research focused on production environments important to partner countries in geographical regions (present value of Australian benefit $USm).

South Asia Asia/ N Africa Regional Benefits		Southeast Asia Latin America Regional Benefits Regional Benefits		China Regional Benefits Regional Benefits		South Pacific Regional Benefits		Africa Regional Benefits		W
Commodity	Australian Commodity Benefits	Commodity	Australian Commodity Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits	
Wool	14.0	Beef&Buffalo	9.1	Wool	14.2	Beef&Buffalo	3.1	Wool	4.4	
	Wheat	20.0	Wool	11.7						
Beef&Buffalo	10.7	Pigmeat	3.2	Beef&Buffalo	11.2	Pigmeat	1.8	Beef&Buffalo	3.7	Milk
Milk	8.1	Milk	2.8	Milk	11.1	Milk	1.0	Pigmeat	1.9	Wool
Sheep & Goat Meat	7.1	Poultry Meat	1.7	Wheat	10.7	Poultry Meat	0.6	Milk	1.7	
	Sheep & Goat Meat	10.8	Milk	5.5						
Wheat	6.5	Eggs (poultry)	1.4	Sheep & Goat Meat	8.5	Eggs (poultry)	0.4	Sheep & Goat Meat	1.2	
	Beef&Buffalo	7.7	Sheep & Goat Meat	5.4						
Pigmeat	4.3	Sheep & Goat Meat	0.9	Pigmeat	4.5	Fuelwood (NC)	0.0	Poultry Meat	1.1	
	Pigmeat	4.0	Pigmeat	4.1						
Poultry Meat	2.2	Wheat	0.8	Poultry Meat	2.3	Rice	0.0	Eggs (poultry)	1.0	
	Poultry Meat	2.1	Poultry Meat	1.8						
Eggs (poultry)	1.8	Rice	0.4	Eggs (poultry)	1.9	Sheep & Goat Meat	0.0	Rice	0.1	Eggs
(poultry)	1.7	Eggs (poultry)	1.5							
Rice	0.9	Soybean	0.1	Rice	1.4	Soybean	0.0	Soybean	0.1	
	Fuelwood (NC)	0.8	Rice	0.4						
Fuelwood (NC)	0.1	Fuelwood (NC)	0.0	Soybean	0.2	Tunas, bonitos etc	0.0	Fuelwood (NC)	0.0	Rice

Table 6. Research break-even relativities for spillover benefits to Australia from research undertaken in various regions.

South Asia Asia/ N Africa Regional Benefits		Southeast Asia Latin America Regional Benefits Regional Benefits		China Regional Benefits Regional Benefits		South Pacific Regional Benefits		Africa Regional Benefits		W
Commodity Ranking	Relative Commodity Benefits Ranking	Commodity Ranking	Relative Commodity Benefits Ranking	Commodity Ranking	Relative Benefits	Commodity Ranking	Relative Benefits	Commodity Ranking	Relative Benefits	
Wool	1.0	Beef&Buffalo	1.0	Wool	1.0	Beef&Buffalo	1.0	Wool	1.0	
Wheat	1.0	Wool	1.0	Beef&Buffalo	1.3	Pigmeat	1.7	Beef&Buffalo	1.2	Milk
Beef&Buffalo	1.3	Pigmeat	2.8	Milk	1.3	Milk	3.1	Pigmeat	2.3	Wool
Milk	1.7	Milk	3.3	Wheat	1.3	Poultry Meat	5.2	Milk	2.6	
Sheep & Goat Meat	2.0	Poultry Meat	5.4	Sheep & Goat Meat	1.7	Eggs (poultry)	7.8	Sheep & Goat Meat	3.7	
Wheat	2.2	Sheep & Goat Meat	1.9	Pigmeat	3.2	Fuelwood (NC)	na	Poultry Meat	4.0	
Pigmeat	3.3	Eggs (poultry)	6.5	Poultry Meat	6.2	Rice	na	Eggs (poultry)	4.4	
Poultry Meat	6.4	Beef&Buffalo	2.6	Eggs (poultry)	7.5	Sheep & Goat Meat	na	Rice	44.0	Eggs
Eggs (poultry)	7.8	Sheep & Goat Meat	10.1	Rice	10.1	Soybean	na	Soybean	44.0	
(poultry)	11.8	Pigmeat	5.0	Soybean	71.0	Tunas,bonitos etc	na	Fuelwood (NC)	na	Rice
Rice	15.6	Wheat	11.4	Fuelwood (NC)	142.0	Wheat	na	Tunas,bonitos etc	na	
Fuelwood (NC)	140.0	Poultry Meat	9.5	Tunas,bonitos etc	na	Wool	na	Tunas,bonitos etc	na	
Soybean	140.0	Rice	22.8							
Tunas,bonitos etc	na	Eggs (poultry)	7.8							
		Soybean	91.0							
		Fuelwood (NC)	25.0							
		Tunas,bonitos etc	na							
		Fuelwood (NC)	200.0							
		Wool	na							
		Tunas,bonitos etc	na							

na: Not applicable since expected research impact is negligible

It might also be important to consider whether the priorities, using spillover gains to Australia, are the same or similar to those given by research meant primarily to benefit Australia. Table 6 provides the relativities for the information in Table 5. It can be seen that for all regions, even though the absolute levels of benefits are different, the relativities are similar. This suggests that the commodity emphasis is likely to be similar, regardless of the type of research emphasis adopted. Clearly though, the production-environment emphasis for the research is likely to be of considerable importance. This conclusion applies for the livestock products but not necessarily for crops, fisheries and forestry.

The issue of Australian benefits–objectives has only recently began to be investigated using the **Information System**. More consideration is still required which may lead to the need for additional analysis within the **Information System**

2.3.5 Overview

The above information has been extracted from the ACIAR Information System to indicate the type of summary information that can be generated. There is still considerable scope to expand the range of information and also verify and validate much of the existing information. With some of the other program areas in ACIAR the technical information has been incorporated with the assistance of the ACIAR coordinators and project research leaders. This has especially been the case for the forestry and fisheries programs. The animal science products have not yet benefited from this interaction.

At a program level, the information would be enhanced if estimates of parameters, such as the production environment spillovers, were disaggregated into disciplines within a commodity. This information would facilitate more detailed program level information.

The aggregate-priority-assessment information is based on the assumption of a standard average research project with a 5% cost reduction as the impact. It is important to ask whether research in some areas and on some commodities is likely to consistently generate higher cost reductions (or equivalents) than others. This type of issue can only be addressed by considering specific projects and the technologies generated by these. As was indicated in Figure 2, the project-development and completed-project assessments have been included in the **Information System** to add this detail. These are briefly discussed in the rest of the paper.

2.4 The current status of ACIAR's project assessment activities

The initial emphasis of ACIAR's **Information System** was to provide information to support the determination of aggregate-priority-assessment directions. After the initial impact of this information it became clear that its effectiveness could be enhanced if it was complemented by project-level assessments of potential and actual research impacts. This section briefly summarises these assessments and highlights the animal science research program component. Assessments have been separated into the following two groups:

(i) Completed-Project Assessments

In preparation for ACIAR's Sunset Review it was decided to have commissioned a set of completed-project economic assessments. Initially a set of 20 projects or 12 research areas were selected. The main criterion was that the benefits from the projects had started to flow and that they were identifiable. Since this time, several further projects have been evaluated. These included a Tuna Bait Fish Biology project which had also been the subject of an earlier project development assessment. However, the major addition to these completed project evaluations has been the evaluation of four postharvest tropical fruit projects. These were undertaken during the past year. The longer term aim of evaluation work in ACIAR is to develop more of the integrated assessment efforts, that is, from the initial project idea stage through to well after the research has been completed and had an impact on the production process. Table 7 summarises the results of the seventeen assessments completed to-date. A detailed description of these studies is given in Menz (1991), Fearn (1991) and Davis and Lubulwa (1993) and will not be repeated here. Some trends do appear in these studies. The large majority of the projects were on issues relevant to commodities that are in the first two aggregate-level-priority commodity groups for the region where the research was undertaken. Some of the high-benefit projects are also in this category. The animal science projects have been shown to have had good impacts and high rates of return to the funds invested.

Table 7. Summary of economic assessments for selected completed ACIAR research project areas.

Economic Assessment Number	Project Number	Short Project Title	Program Area	NPV Estimate[1] Most Likely ($ million)	Internal Rate of Return (%)	Region	Co
1	8340	Salvinia Control	Crop Sciences	25.0	469	S Asia	Sr
3	8203/8601	Straw Utilisation by Livestock	Animal Sciences	117.0	100	S Asia	In

8	8307	Stored Grain Under Plastic	Post Harvest	9.2	38	S E Asia	Ph M
9	8309/8609/8311	Integrated Pesticide Use in Grain Storage	Post Harvest	24.3	43	S E Asia	Ph
5	8321	Tick-Borne Disease Control	Animal Sciences	30.7	68	S Asia	Sr
7	8334/8717	Newcastle Disease of Poultry	Animal Sciences	144.0	50	S E Asia	M In
12	8457/8848	Australian Trees for China	Forestry	115.0	37	China	Ch
10	8207	Grain Sorghum Book	Land and Water	9.2	38	S Asia	In
2	8343	Fruit Fly Control	Crop Sciences	176.2	260	S E Asia	M
6	8469/8839	Rapeseed Breeding	Crop Sciences	66.3	58	China	Ch
11	8332/8733	Giant Clam Mariculture	Fisheries	1.9	-	S Pacific	
South Pacific	Giant Clams	6					
4	8451/8929	Nematodes To Control Pests	Crop Sciences	97.0	80	China	Ch
		Sub-Total (Assessment 1-12)		*815.8*			
-	8543/9003	Tuna Bait Fish Biology	Fisheries	3.8	21	S Pacific	
South Pacific	Tuna	1					
	8355	Postharvest Technology for Banana	Postharvest	50.6	48	S E Asia	M
	8356	Chemical Control of Fruit Disease	Postharvest	36.6	41	S E Asia	M Th
	8844	Cool Storage, CA and Chemical Controls of Fruit	Postharvest	18.7	27	S E Asia	Th
	8319	Vacuum Infiltration of Fruit with Calcium	Postharvest	2.7	21	S E Asia	In

1. Values represented in 1990 dollars, with NPV estimated for 1990. All research costs, including expenditures by the collaborating and commissioned organisations are included.
ni not presently included in priority assessment commodity group.

Three of these completed-project assessments have been for projects in the animal science program. Two have investigated aspects of dairy cattle production in South Asia, while the third was the project on Newcastle's disease in chickens. The gains from these research areas have been very high. The commodities that the research outputs have had an impact on—milk, chicken meat and eggs—are in the top two priority groups for the regions where they were undertaken.

(ii) Project-Development Assessments

Project development assessments have been a more recent addition to ACIAR's **Information System**. They have been developed for a number of reasons. Important among these has been the need to compare projects from the diverse program areas within ACIAR. They are also used to demonstrate the types of conditions likely to result in high welfare gains from technically attractive projects that focus on—what appear on average—to be potentially lower research–benefit commodities. In addition, these activities have been found to provide a useful interdisciplinary interaction which often results in clearer project specification and objectives.

Table 8 includes a list of the 34 project development assessments that have been included in recent ACIAR project proposals. These assessments have been developed in a variety of ways. Some have been incorporated in proposals by researchers preparing the documents. Others have been developed with extensive interaction between project researchers and economists at ACIAR. There have been too few of these assessments to draw any firm trends from theinformation included in Table 8. The potentially low-priority commodities (group 5 and 6) do seem to require substantial impacts on the

commodity output. Otherwise they do not generate rates of return that are in the range of those found in past evaluations of agricultural research. Care is required at this stage because assessment procedures are not necessarily comparable between assessments. The full-interaction-internal assessments (there have now been twelve of these) have, in most cases, resulted in fruitful interactions. Both the scientists and economists have usually agreed that a better understanding of the issues have resulted. In addition, the project proposals have usually become much clearer as a result of the interaction.

Table 8. Recent project development assessments of projects considered for funding by ACIAR.

Project Number	Description	Program	Region	Country	Commodities		Priority Grouping	
Internal Rate of Return	Unit Cost	Change in	Level of Area Analysis		Primary	Other		Most I
9323	Dairy Policy in Indonesia	Economics	SEA	Indonesia	Milk		5	
94%	ne	na	na	Internal (FI)				
9318	Improved Ruminant Production through	Animal Science	SEA	Indonesia	Beef/Buffalo	Sheep/Goat	3/4	
71%	ne	na	10%	Internal (PI)				
	Efficient Use of Shrubs							
9109	Coconut Marketing and Policies in Philippines	Economics	SEA	Philippines	Coconut		1	
70%	ne	na	na	Internal (PI)				
9404	Water Management in Vietnam	Land & Water	SEA	Vietnam	Rice	Maize, Vegetables	1/2	
53%	28–64%	na	na	External				
9411	Prawn Health Management and Disease Control	Fisheries	SEA	Thailand	Prawns		2	
52%	38–72%	na	na	External				
9132	Self-Medicated Blocks for Ruminants	Animal Science	SA/SEA/SP	Fiji, India, Malaysia	Milk	Sheep/Goat	1/3	
50%	41–48%	na	na	Internal (PI)				
9105	Edible Coatings for Fruit and Vegetables	Post Harvest	SEA/China	Thailand, China	Durian	Lychee	ni	
50%	45–89%	na	na	Internal (FI)				
9123/9049	Liver Fluke Vaccine and Control in Indonesia	Animal Science	SEA	Indonesia	Beef/Buffalo		3	
41%	35–50%	15%	20%	Internal (FI)				
9045	Water Use in Fruit Production	Land & Water	China	China	Peaches		ni	
40%	50–150%	37%	40%	Internal (PI)				
8923	Economic Pressures on Thailand Agricriculture	Economics	SEA	Thailand	Rice	Maize, Cassava	1	
40%	34–77%	5%	na	External				
8940	Efficiency of Urea as Fertilizer	Plant Nutrition	China	China	Rice		1	
40%	40–73%	1.7%	8%	Internal (MI)				
9040	Soybean Improvement in Thailand	Crop Science	SEA	Thailand	Soybeans		5	
39%	26–54%	11.3%	20%	Internal (PI)				
9048	Improvement of Rainfed Rice	Crop Science	SEA	Thailand	Rice		1	
39%	21–49%	9.5%	15%	Internal (PI)				
9120	Boron Fertiliser in Oilseeds	Land & Water	China	China	Rapeseed		ni	
39%	28–82%	11%	25%	Internal (FI)				
9313	Non-Chemical Control of Fruit Disease	Postharvest	SEA	Thailand	Mango,	Avocardo, Longan, etc	2	
38%	30-45%	na	na	Internal (FI)				
9406	Replacements for Methyl Bromide in Timber	Postharvest	SEA	Malaysia	Saw & Veneer Logs NC		1	
34%	23–36%	na	na	Intemal (FI)				
8911	Mineral Limiting Sheep Production	Animal Science	China	China	Wool	Sheepmeat	5	
32%	14–40%	4.9%	10%	Internal (MI)				
9017	Control of Peanut Stripe Virus	Crop Science	SEA	Indonesia	Groundnuts		6	
32%	ne	ne	ne	External				
8938	Clay Soils	Land & Water	SEA	Philippines	Pulses	Rice	5	
31%	13–31%	20%	105%	Internal (FI)				
9003	Baitfish For Tuna in South Pacific	Fisheries	SP	Solomon Is, Kiribati, Fiji	Tuna		1	
30%	14–56%	2.25%	0	Internal (FI)				
9009	Use of Mix of Grain Protectants	Post Harvest	SEA	Philippines, Malaysia	Rice	Maize, Groudnuts	1	
30%	3–48%	ne	ne	External				
9039	Philippines Livestock Sector	Economics	SEA	Philippines	Beef/buffalo		3	
30%	20–40%	na	na	Internal (PI)				
9316	Trees for Salt Affected Land	Forestry	SA/SEA	Pakistan, Thailand	Fuelwood NC		1	
26%	18–37%	na	na	Internal (PI)				
8845	Grain Storage in Plastic Enclosures	Post Harvest	SEA	Philippines	Rice	Maize	1	
25%	–6–30%	ne	ne	External				
9303	Forages for Red Soils in China	Land & Water	China	China	Milk		4	
25%	20–50%	na	na	Internal (FI)				
9317	Plant Tissue Culture in Tea	Crop Science	SEA	Indonesia	Tea		ni	
23%	19–23%	30%	300%	Internal (FI)				
9407	Pineapple Quality Improvement	Postharvest	SEA	Malaysia	Pineapple		ni	
22%	18–25%	na	na	Internal (FI)				
9020	Economics of Native Forests Vanuatu	Economics	SP	Vanuatu	Saw&Veneer Logs NC	Tourism	1/?	
20%	19–28%	1%	na	External				
9107	Papaya Improvement in the Philippines	Crop Science	SEA	Philippines	Papaya	Fruit/veges	ni	
20%	15–40%	5.5%	360%	Internal (FI)				
9131	Pearl Oyster Resource Development	Fisheries	SP	Cook Is, Kiribati	Pearls		ni	
18%	0–26%	34–37%	133%	Internal (FI)				

9008	Multipurpose Grain Drying Systems	Post Harvest	SEA	Philippines	Maize	Rice	2/1
17%	14–20%	8%	0	External			
9206	Genetic ID & Stock Improvement of Tilapia	Fisheries	SEA/SP	Malaysia, Fiji	Tilapia		3
11%	4–25%	13%/22%	20%	Internal (FI)			
8913	Small Ruminants in South Pacific	Animal Science	SP	Fiji	Sheep/Goat Meat		5
11%	11%	12/25%	110%	Internal (PI)			
9302	Forage Production from Saline and Sodic Soils	Land & Water	SA	Pakistan	Sheep/Goat Meat	Beef/Buffalo	2/3
$12m NPV	$2–20m NPV	na	na	External			

Notes:

ni not presently included in priority assessment commodity group
ne not directly estimated
na not applicable
Internal (MI)—Internal ACIAR assessment, minimal interaction
Internal (PI)—Internal ACIAR assessment, partial interaction
Internal (FI)—Internal ACIAR assessment, full interaction
External—External assessment by project proponents
Shaded Projects are in the Postharvest Program area

So far there have been five project-development assessments from the animal science program. Four of these assessments have been undertaken by the project proponents with partial interaction between the project scientists and the Economic Evaluation Unit at ACIAR. The evaluation of Project 8911 'Mineral Elements for Sheep in China' was one of the first detailed evaluations undertaken. Fearn (1994) reports the results of this analysis. More recent evaluations have included considerable interaction which the project scientists and the EEU is developing to provide more consistent and standardised evaluation methods. Of the five animal science projects evaluated, three have been from high-priority commodity groupings for the focus regions and two from the lower-priority groupings. Differences in estimates of the rate of return reflect this pattern.

Two important points highlighted by these project-evaluation activities are:

(i) It is important to recognise that the information from this type of system, and especially the economic assessments component, can only be used to support decision-making, and not to make decisions for, or replace, decision-makers. This is a crucial point to highlight and recognise. Often both technical scientists and economists fail to appreciate the importance of this point.

(ii) At the project/program level it is the interaction process between the technical and economic scientists which is as important, if not more important than, the assessment numbers generated. This interaction results in a clearer project specification and a better understanding of the potential research impact by both sides. For ACIAR, this improved clarity has usually resulted in a better understanding by others involved in the project review process, especially, the In-House-Review process.

2.5 A brief overview of previous evaluations of animal science research

As well as the recent evaluations of a few of ACIAR's animal science research projects, there have been several studies during the past 30 years that have focused on various areas of animal science research. The EEU has assembled an extensive set of research evaluation studies literature and has this available in a database form. At this stage there are about 1600 publications in this collection.

The Unit is slowly categorising these studies and summarising them in various forms. Table 9 summarises some of these studies on research related to animal products. At this stage this is not a complete list. It has been found useful to categorise research into different research areas. Apart from being useful for assessing the direction of a research program it is also important for choosing the evaluation method. Table 10 provides a list of the research categories ACIAR has been using. It is still in the development stages. Davis and Lubulwa (1993) discuss this categorisation in more detail.

Table 9. Summary of some previous animal sciences research evaluation studies.

Description	Commodity	Country	Research Type	Net Present Value ($M)	Internal Rate of Return (%)	Benefit Costs Ratio
Straw Utilisation by Livestock	Milk	India	Nutrition	117.0	100	
	Fleming (1991)					
Tick-borne Disease Control	Milk	Sri Lanka	Disease	30.7	68	
	Chudleigh (1991)					
Control of Newcastle's Disease	Chickens	Malaysia, Philippines,	Disease	144.0	50	
	Johnston & Cummings			in Poultry		Thailand,
Indonesia						(1991)
Pasture Improvement by CSIRO	Wool	Australia, Northern NSW	Purchased input		58–56	
	Duncan (1972)					
Pasture Improvement by CSIRO	Wool	Australia, Southern NSW	Purchased input		22–27	
	Duncan (1972)					
Pasture Improvement by CSIRO	Sheep, Wheat	Australia, Western	Purchased input		58–56	
	Duncan (1972)					
Phalaris Breeding in NSW	Wool	Australia, NSW	Purchased Input	309.2	20	
	Johnston et al. (1992)					
Introducing Stylo Pasture in	Beef	Australia, Queensland	Purchased Input	70.0	16	
	Johnston et al. (1992)					
Queensland						
Forage on Red Soils in China	Pigs, Milk	China	Purchased Input	6.3	25	
	ACIAR PDA					
Forage Scrub Production for	Sheep, Goat,	Pakistan	Purchased Input	4–20		
	ACIAR PDA					
Saline Soils	Beef					
Pigmeat Fat Reduction	Pigs	USA	Quality	977.5		
	PV of year 5 benefits no		Lemieux and Wohlgenant			
					research costs	
	(1989)					
Reduction in Dark-Cutting	Beef	Australia	Quality	905.0		
	potential benefits; no research		Voon and Edwards		in Beef	
					costs	(1990a)
Boxed to Tray Ready Beef	Beef	USA	Processing	845.6		
	annual impact; no research		Mullen et al.		Processing	
					costs included	
	(1988)					
Reduced Backfat Depth in Pigs	Pigs	Australia	Quality	66.0		
	potential benefits; no research		Voon and Edwards (1990b)			
	costs					
Wool Carding Improvement	Wool	Australia	Processing	21.9		
	benefits only; no research costs		Mullen and Alston (1990)		(Sirocard)	
					included	

Table 10. Summary of possible postharvest research area classifications.

Research Area	Type of Evaluation Model	Comments
Pre-Farm gate		
Genetic Enhancement	Single or multi-regional, multi-commodity supply shift model with a productivity increase.	Need to consider the importance of a shift in the minimum TAC associated
Disease	Single or multi-regional, multi-commodity supply shift model	Private/Public sector relevance can be important.
Pests/Weeds	Single or multi-regional, multi-commodity supply shift model	
Nutrition	Single or multi-regional, multi-commodity supply shift model	
Purchased Input Use	Single or multi-regional, multi-commodity supply shift model	
Natural Resource Use	Single or multi-regional, multi-commodity supply shift model	Inclusion of externalities important.
Farming, Forestry & Fisheries Systems Practices	Single or multi-regional, multi-commodity supply shift model	Multi-commodity models are likely to be especially important.
Post-Farmgate		
Wastage Reduction	Multi-regional vertical market model	Wastage reduction version can be useful simplification.
Processing Methods	Multi-regional vertical market, probably factor-biased, model	Private sector relevance since most research gains are appropriable.
Transport	Multi-regional vertical market model	Private sector relevance since most research gains are appropriable.
Farm & Off-Farm		
Product Quality	Multi-commodity, related in consumption, vertical market model	Care is required if a simple increase in price model is used.
New Product	Single or multi-regional, multi-commodity supply shift model subject to more error.	Quantity associated with minimum TAC required. Care is required as estimates are
Policy	Value of information with saving in dead weight loss model.	Model not well developed and few applications.
Price and Marketing	Value of information with saving in dead weight loss model.	Model not well developed and few applications. Analysis
Environmental/Natural Resource Management	Single or multi-regional, multi-commodity supply shift model	Other areas also involve environmental issues.
Human Health	Labour supply shift, demand for health services	Models not well developed or applied.

Institutional Analysis	Value of information with saving in dead weight loss model.	Model not well developed and few applications	
Sustainability other research areas	Model required not clear. Usually a research context.	Concept still requires clearer definition in	part of

It is seen that there have been a range of studies, covering many research areas and animal products.

Table 11. Summary of ACIAR's animal sciences completed projects*.

Project Description	Project Number	Type of Research	Type of Evaluation Return (%)	Internal Rate of
Increased efficiency of straw utilisation by cattle & buffalo	8203/8601/ 8817	Nutrition	CPA	100
Tick ecology and epidemiology	8303	Pests	None	–
The life cycle of *Toxocara vitulorum* in buffaloes	8316	Pests	None	–
Control of tick-borne diseases of ruminants in Sri Lanka, with particular reference to babesiois and anaplasmosis	8321	Disease	CPA	68
The etiology and epidemiology of malignant catarrhal fever in Indonesia and Australia	8333	Disease	None	–
Vaccination of Malaysian village poultry with an avirulent Australian Newcastle Disease virus	8334/8717	Disease	CPA	50
Genetic identification of strains and genotypes of buffaloes and goats in SE Asia	8364	Genetic Enhancement	None	–
Research and development of foot and mouth disease diagnostic methods in Thailand	8367/8835	Disease	None	QDPI
Utilisation of fibrous agricultural residues as ruminant feeds	8373	Nutrition	CPA	UPLB
The establishment of improved methods for the diagnosis and control of livestock diseases in SE Asia using enzyme-linked immunosorbent assay (ELISA)	8382/8907/ 9202	Disease	None	–
The epidemiology and control of gastrointestinal nematodes of small ruminants in the South Pacific	8418	Pests	None	–
Mineral nutrition studies of small ruminants in northwestern and northeastern China	8454/8911	Nutrition	PDA	32
Epidemiology of ephemeral fever in China	8455/8909	Disease	None	–
Sheep breeding for improved wool quality in Northwest China	8456	Genetic Enhancement	None	–
Improved immunological methods for the control of brucellosis in ruminants	8464	Disease	None	–
Evaluation of different buffalo genotypes for draught, meat and milk production	8515/9123	Pests	PDA	41
Self medication of ruminants in tethered husbandry systems	8523/9132	Pests	None	–
Multidisciplinary studies of draught animal power systems in SE Asia—Phase 1	8546/ 8547/ 8908	Farm Practice, Nutrition	None	–
The effects of helminths and nutrition on sheep production in Northern China	8555	Disease, Nutrition	None	–
Development of an improved haemorrhagic septicaemia vaccine	8565	Disease	None	–
Forage production and utilisation in Nigeria (?)	8721	Nutrition	None	–
Ecological and host-genetic control of internal parasites of small ruminants in the Pacific Islands	8913	Pests	PDA	11
Improved methods for the diagnosis and control of bluetongue in small ruminants in Asia	9011	Disease	None	–

Improved methods in the epidemiology and control of mites and other diseases of bees in Papua New Guinea	9028/9417/ 9418	Pests	None	–

* Excludes small projects

UPLB To be evaluated as part of the collaborative ACIAR/UPLB evaluation activity.

QDPI Consultant evaluation undertaken by Bartholomew and Culpitt (1992).

One important reason for assembling this type of information is to support project development activity. Past evaluation studies in a similar area can be very useful as a basis for new evaluations. The Unit has copies of these papers and can make them available on request.

Table 12. Summary of ACIAR's animal sciences Current Projects*.

Project Description	Project Number	Type of Research	Type of Evaluation Return (%)	Internal Rate of
Increased efficiency of straw utilisation by cattle & buffalo	8203/8601/ 8817	Nutrition	CPA	100
Identification of mineral elements limiting sheep production in northern China	8911	Nutrition	PDA	32
Improved management for production of honey and pollination of tropical forests by bees in Indonesia (Animal Sciences/ Forestry)	9001	Farm Practice	None	–
Acaracide resistance in ticks in Africa	9047	Pests/Disease	None	–
Evaluation of antigens for vaccination against liver fluke in cattle and buffalo in Indonesia	9049	Pests	PDA	41
Fowl cholera vaccines for Asia	9116	Disease	None	–
Management of footrot in small ruminants in hill districts of Nepal	9117	Disease	None	–
Improved methods for the diagnosis and control of bovine babesiosis and anaplasmosis in Zimbabwe and Australia	9118	Disease	None	–
Towards effective control of infectious bursal disease and infectious bronchitis in poultry	9119	Disease	None	–
Control of fasciolosis in cattle and buffalo in Indonesia	9123	Pests	PDA	41
Strategies for sustainable control of gastrointestinal parasites of ruminants using urea-molasses blocks	9132/8523	Pests	PDA	50
Diagnosis and control of haemorrhagic septicaemia	9202/8382/ 8907	Disease	None	–
Identification and production of recombinant antigens for a vaccine against screwworm fly (*Chrysomya bezziana*)	9203	Pests	None	–
Improved methods in diagnosis epidemiology, economic and information management in Australia and Thailand	9204	Disease	None	–
Improved diagnosis and control of infectious coryza in China and Australia	9205	Disease	None	–
Diagnosis and epidemiology of bluetongue	9301	Disease	None	–
Feeding and management strategies for improved reproduction efficiency in cattle	9312	Nutrition, Farm Practice	None	–
Improved ruminant production through the use of tannin containing shrub legumes in Indonesia	9318	Nutrition	PDA	71
Control of bee mites in PNG & Irian Jaya	9028/9417/ 9418	Pests	None	–
Management of rodent pests in southeast Asia	9420	Pests	None	–

* Excludes small projects.

2.6 Summary

ACIAR has been developing an extensive **Information System** which includes aggregate-priority-setting and project-level assessments for several years. In this section we have used the aggregate-priority information to summarise the trends in ACIAR's animal science research program. We have found that there have been a range of trends in the animal science funding patterns which may be worth looking at more closely. Some of these trends may be due to the lumpiness of projects. That is, projects in the pipeline and ones just finished may distort the summary information. Also small projects have not been included in the information. These have been an important aspect of the animal science program.

The existing set of ACIAR completed-project assessments suggests that the higher return projects have mostly been on the high-priority commodities for particular regions. All of the animal science projects that have been evaluated were in this category.

The project development assessments of animal science projects confirm that the lower-priority-commodity areas tend to have lower rates of return. This suggests that it is probably important to check that projects on lower-priority issues are likely to have larger than average impacts and therefore warrant allocation of scarce funds.

As these few examples illustrate, evaluations of the impacts of individual projects are becoming increasingly important for supporting decision-making at ACIAR. (This is also a trend with many other research funding bodies). It is therefore useful to consider in more detail some further aspects of this evaluation process.

3. THE PROJECT EVALUATION PROCESS FOR ANIMAL SCIENCE RESEARCH

3.1 ACIAR's project evaluation process in perspective

The current range of project evaluation work undertaken by and in association with ACIAR has been undertaken for several reasons and in many cases to satisfy reasonably narrow objectives. One of the reasons for the establishment of the Economic Evaluation Unit was to consolidate this effort, develop consistency in approaches and establish a program for the integration of this information into the institutional **Information System**.

The experience, so far in this area, has revealed that there are several sources of gains from this process. In particular, the interaction between project scientists and economists has been found to be especially important. This has generated more effective understanding of the research process and potential impacts by both groups. The clarity of project proposals has also been enhanced by this interaction.

Several of the early assessments were undertaken quickly and involved minimal interaction between the research proposers and the economists. While the information generated did prove useful to decision-makers, these benefits were often not clear to the researchers preparing the proposals. Since they were often undertaken at the later stages of the project-development cycle, they ran the risk of being viewed negatively by the researchers. More recently, assessments have been made earlier in the project-development cycle and there has been more interaction between the research proponents and economists. While it is often not wise to generalise, these assessments have resulted in positive interaction and a genuine interchange of ideas. The result, it has usually been agreed, has been an improvement in the specification of the projects and also presentation of proposals that have been easier to understand.

There is clearly a considerable way to go and the processes still require refinement. There are no easy blackbox procedures, and the interaction is critical. It is important to continually assess whether the costs of this type of activity is matched by improvements in the decision-making and research process.

Although they may not always be warranted, it is useful to develop some guidelines for the consistent application of project-level assessments. This has two primary advantages: first, the results of this type of activity will then be more readily comparable and it should reduce the resources required to generate them; and second, while the economic methodology used is reasonably well documented, the mechanisms for incorporating them within different decision-making environments has not been. Consistency in the development of assessments should assist in resolving these application problems and issues.

Figure 3 illustrates the evaluation mechanisms being adapted at ACIAR to integrate project evaluation with the proposal-development cycle currently used by ACIAR. Important features are:

(i) Interaction ideally should begin early in the project-development process. For ACIAR this would mean at, or just after, the Phase I stage of a project. This initial interaction could involve supplying basic economic information as background for clarifying ideas; for example, by providing time-series data on production levels of the commodities likely to be involved.

(ii) Linkage with the **Information System** to avoid duplication in data collection and analysis.

(iii) Early clarification of the technical aspects of the research effort and then translation of this into a cost-analysis format. This has proven to be an important step in the evaluation process. This is because simple assessments of only output changes have often resulted in considerable overestimation of the potential gains from research.

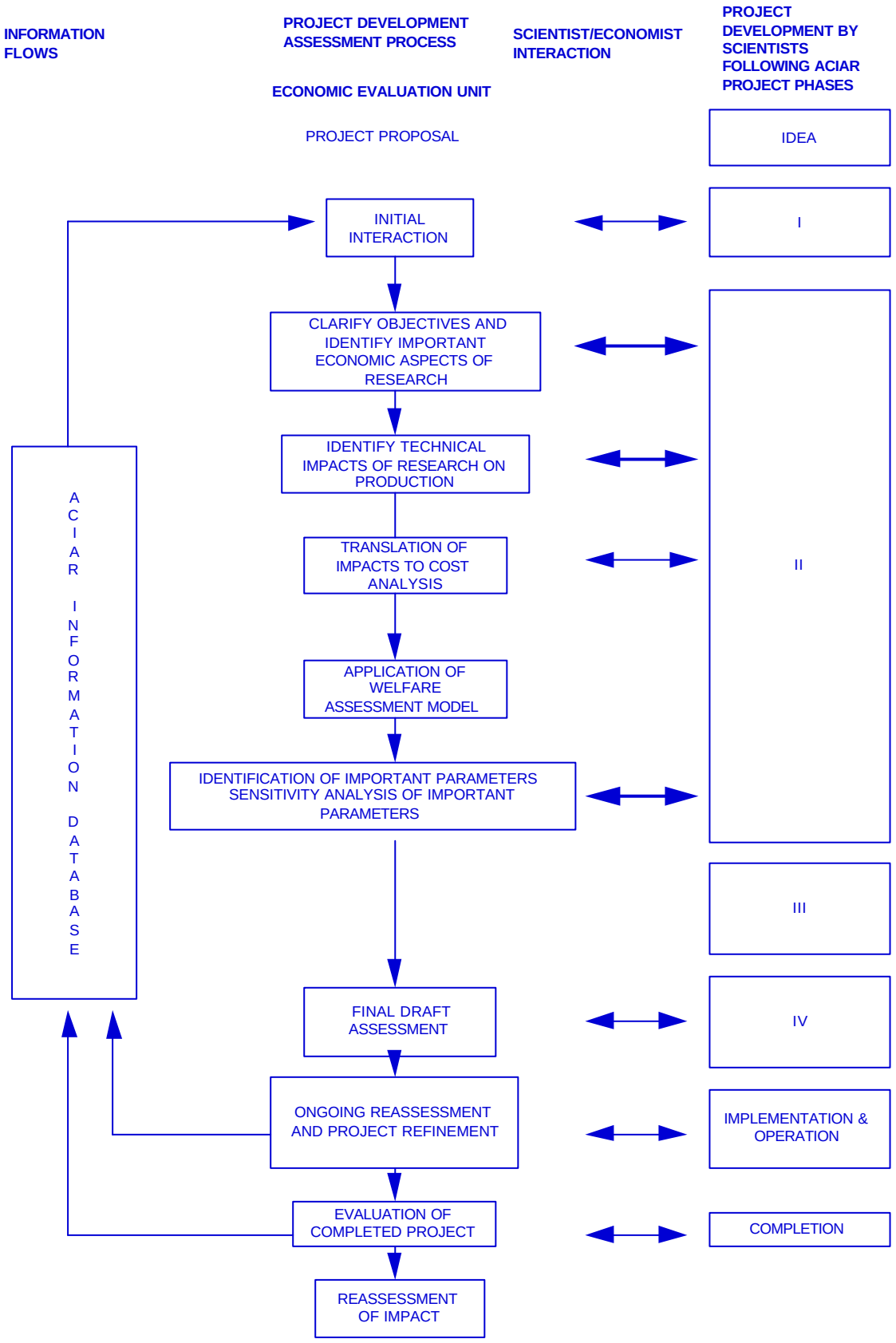
(iv) Incorporation of a sensitivity analysis. This often provides useful information for improving the focus of the research effort.

(v) Linkage of the ***project development assessment*** with additional assessments during the course of the project and then a ***completed project assessment***. This can reduce the effort required at each stage and ensure that appropriate information is collected during the course of the project.

(vi) Completed project assessment and re-assessment after the technology has had sufficient time to have a full impact.

It is important that researchers and economists continue to liaise on project-development assessments during phase II of the project-development cycle. Many of the previous partial and minimal interaction assessments have commenced at the end of the Phase II stage. This has usually eliminated the scope for sufficient and productive interaction.

In the rest of this section we will highlight some of the different aspects of what we are calling project development and completed project assessments and then provide an overview of all current and past animal science projects in relation to these activities.


INFORMATION FLOWS
PROJECT DEVELOPMENT ASSESSMENT PROCESS
SCIENTIST/ECONOMIST INTERACTION
PROJECT DEVELOPMENT BY SCIENTISTS FOLLOWING ACIAR PROJECT PHASES
ECONOMIC EVALUATION UNIT
PROJECT PROPOSAL
IDEA
INITIAL INTERACTION
I
CLARIFY OBJECTIVES AND IDENTIFY IMPORTANT ECONOMIC ASPECTS OF RESEARCH
IDENTIFY TECHNICAL IMPACTS OF RESEARCH ON PRODUCTION
TRANSLATION OF IMPACTS TO COST ANALYSIS
APPLICATION OF WELFARE ASSESSMENT MODEL
IDENTIFICATION OF IMPORTANT PARAMETERS SENSITIVITY ANALYSIS OF IMPORTANT PARAMETERS
II
III
FINAL DRAFT ASSESSMENT
IV
ONGOING REASSESSMENT AND PROJECT REFINEMENT
IMPLEMENTATION & OPERATION
EVALUATION OF COMPLETED PROJECT
COMPLETION
REASSESSMENT OF IMPACT
ACIAR INFORMATION DATABASE

3.2 Desirable features of a detailed project development assessment

3.2.1 Introduction

To improve the understanding of the project development assessment activities it is useful to discuss boxes 1, 2, 3, 4, 5 and 6 in the centre of Figure 3 in more detail. The activity included in these boxes provide the basis for developing sections 2.2 and 2.7 of a phase 2 ACIAR document. The discussion can be separated into several specific areas. These include: the need to provide details of the industry background, and how the problem to be addressed relates to the industry; a clear description of the potential technical impacts of the research if successful; the types of information that need to be collected to facilitate the evaluation; and the types of quantitative models that can be used to determine the welfare impacts of the research. Each of these are briefly discussed in this section.

3.2.2 **Industry background and perspective of the problem to be addressed** (Section 2.2 of project document)

It is important to provide a clear perspective of the industry(ies) the research has potential to affect. The following issues are often important to consider:

- The commodity(ies) likely to be affected by the research output.
- The level of production of these commodities in the country of focus.
- An indication of the country's position in the world market for the commodity(ies).
- The regional distribution of the commodities and whether the research is likely to have a uniform regional impact.

In many cases the aggregate databases in ACIAR's **Information System** can be drawn upon to provide much of this information.

3.2.3 **Description of the potential technical impact of the research** (Section 2.7 of project document)

It is important to clearly identify the potential technical impacts of the research effort. This description should include details of both the scientific nature of the research and how this is likely to influence the cost or other dimensions of the production process. In addition, efforts should be made to identify whether the impact on output is uniform both for different types of products that might be produced, and for different regions of the country. Some indication of whether the research will influence the use of all inputs or just a sub-set is important.

3.2.4 **Information required to undertake a project evaluation** (Section 2.7 of project document)

Once the description of the technical aspects of the research has been clarified, a range of information is required to transform this assessment into an indication of the potential welfare effects of the research. In most

cases this set of information is likely to be different depending upon the type of research undertaken. Nevertheless, there is a common set of information that is required. This includes:

- Estimates of the production expected by the time the results of the research are available.
- Estimates of the consumption in the country(ies) and therefore whether imports or exports are important.
- Estimates of the prices at the farm level.
- Estimates of the levels and costs of all inputs at the farm level and especially the change in these costs after the research results have had an impact.
- Assessments of the research lag or time that is expected before the research will result in useable technologies.
- Assessments of the time and factors likely to influence the final level and rate of uptake of the technology once it becomes available. Also whether the impact of the research depreciates after the ceiling adoption level is reached. For example, if resistance to drenches occurs.
- Applicability of the research to other areas or potential spillover effects of the research. Especially whether this spillover is likely to be to other substitute commodities.
- The responsiveness to price of the production and consumption of the commodity. Also whether there are close substitutes for the commodity or products produced from it. These factors can have an important bearing on whether certain groups will gain or lose as a result of the research.
- The length of time the research results are likely to take to generate benefits to society and whether the nature of the technology is such that its effects will be short-lived.
- Whether there are any external effects of the technology that are not likely to be imposed on those actually using it. For example, pollution effects, increased government subsidies or taxes.

A crucial aspect of this evaluation is the model used to transform this list of information into a measure of the welfare effects of the research, and in some cases the distribution of these welfare impacts between different groups. Most of the research areas the animal science program is likely to focus on are at the farm level. For evaluating this research, the relatively well developed 'single or multi-regional, multi-commodity supply-shift research evaluation model' is the most appropriate.

3.3 Important features of ACIAR's completed project assessment activities

The completed-project assessment activities follow closely the project development assessment processes. In the **Information System** developed for ACIAR, consistency in approaches and methods between all evaluation activities has been an important consideration. Some of the first twelve completed project assessments did not necessarily use the same methods and approaches. The impact benefits are not therefore perfectly comparable. The longer-term aim at ACIAR is to standardise these assessments and, as was discussed at the beginning of section 3, ensure there is integration between the project development and completed project assessments—since eventually one will be an update of the other. Even after this longer-term standardisation, there will be differences, especially, for example, in the types of information collected to estimate the impacts. Completed-project assessments place important emphasis on identifying the impact of the research and verifying the adoption levels through time.

In addition, after completing the project, it should be possible to assess some other important aspects of the lasting impact of the initial research. These include such things as the contribution of the research to the general scientific stock of knowledge which can be very important to subsequent research impacts. Also, many ACIAR and other research projects include scientific human capital development activities that have important implications for future research activities and chances of success in both partner countries and Australia.

ACIAR has recognised the possibilities of this range of ultimate impacts of research activities and has developed as part of the completed-project assessment mechanism a preliminary assessment survey form. This is being used as the first stage of a completed-project assessment activity and also to provide a preliminary overview of a larger set of projects. The survey form includes the following sets of questions:

- Basic project information, such as, title, project leaders, commodity/country focus, funding levels.
- Scientific and other publications output.
- Indications of links to other research projects and efforts.
- Brief descriptions of the technologies or other useable outputs from the project.
- Summaries of whether and how the technologies or other project outputs have been used in production activities and adoption patterns.
- Training aspects of the project activity—these may be both formal degree training and less formal training in research methods etc.
- Physical capacity building such as equipment supplementation.
- Any intellectual property rights aspect of the project output.

3.4 Summary of current and past ACIAR animal sciences research projects

As the preceding discussion has highlighted there has been a large share of project-level evaluations for the animal sciences research program. To place them in perspective, Tables 11 and 12 list all past and current animal science projects. They also summarise the research area, type of evaluation activity, if any, and the summary internal rate of return for each project (or set of projects when they have been related). For completed and current projects about 25% have been evaluated at different levels of detail.

The EEU has plans to increase its efforts to evaluate projects in the animal sciences area during the next year. Project-development assessments employing full interaction between the EEU and project scientists will be developed for some phase 1 proposals. In the completed-project area, all projects in Africa will be evaluated this year, and this includes a few animal science projects. The Unit has just commenced a collaborative evaluation activity with the Economics Department of the University of the Philippines at Los Baños (UPLB). This will evaluate the 16 projects with scientists at UPLB, and at least one of these is an animal science project area. Further collaboration is being developed with other groups in the Philippines and Thailand which it is hoped will start during this year. Several additional animal science projects will be included in these efforts. The EEU is in the process of updating some of the earlier completed-project assessments.

Table 13 summarises all of these projects in terms of the research areas listed in Table 8. It is seen that about 40% of projects have been in the animal disease area, 30% in animal pests, 20% in animal nutrition and the remaining 10% in farming practices and genetic enhancement.

4. OVERVIEW

This paper has highlighted some of the features of the **Information System** which have been developed at ACIAR to support research decision-making. It has presented a sub-set of this information to illustrate some of the aspects likely to be important in developing-project-level evaluations for animal sciences research projects. It has highlighted some recent trends in the animal sciences research program, especially using the aggregate-priority-assessment information as a guideline. Products likely to be influenced by animal science research efforts vary from region to region in their potential to be affected by high-priority-research. Also most of these products are in the high priority area for Australia. It was concluded therefore that ACIAR is likely to face several challenging trade-offs when developing, and deciding to fund, animal science projects.

At a project level the animal science projects evaluated so far have all been found to have major impacts and high rate of return. These have been on the high-priority products for the regions concerned. The limited project-development assessments which have been completed suggest that the projects on higher-priority products have higher returns than those on the lower-priority ones. This can only be regarded as preliminary since not many of these have been completed, and consistent results have not always been obtained for the completed ones.

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