ECONOMIC EVALUATION UNIT

WORKING PAPER SERIES

NO. 18 FEBRUARY 1995

AN OVERVIEW OF ACIAR'S ECONOMIC EVALUATION ACTIVITIES WITH A FORESTRY PROGRAM FOCUS

Jeff Davis* and Godfrey Lubulwa**

Technical Editor: Keith Binnington

This paper was prepared for the ACIAR Forestry Project Leaders Meeting, Scarth Room, University House, Canberra, May 29 1995

ISBN 1 86320 164 5

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

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

CONTENTS

ABBREVIATIONS

EEU:	Economic Evaluation Unit, ACIAR
ACIAR:	Australian Centre for International Agricultural Research
PMIS:	Project Management Information System—now renamed PISA
PAC:	Policy Advisory Council, ACIAR
IRR:	Internal Rate of Return
BOM:	Board of Management, ACIAR
IARC:	International Agricultural Research Centres
PISA:	Project Information System, ACIAR
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 forestry program in 1992 was one of the first attended by ACIAR's Economic Evaluation Unit (EEU) group. At that meeting a detailed paper was presented (See Davis and Fearn [1992]). The paper focused on aggregate-priority-setting aspects of ACIAR's Information System and how this might be used to support the discussion of research options in the forestry research program area.

Since that meeting of forestry program 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 the future plans of the EEU and, therefore, when contact with project scientists might be useful and important.

This paper has been developed to complement and update the paper prepared for the 1992 meeting. It includes information which it is hoped will be useful to participants both during and 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 forestry area are provided. The project-level assessments are also summarised and those applicable to the forestry program area highlighted. The results of other attempts to evaluate forestry 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 forestry 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 of greater accountability 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.

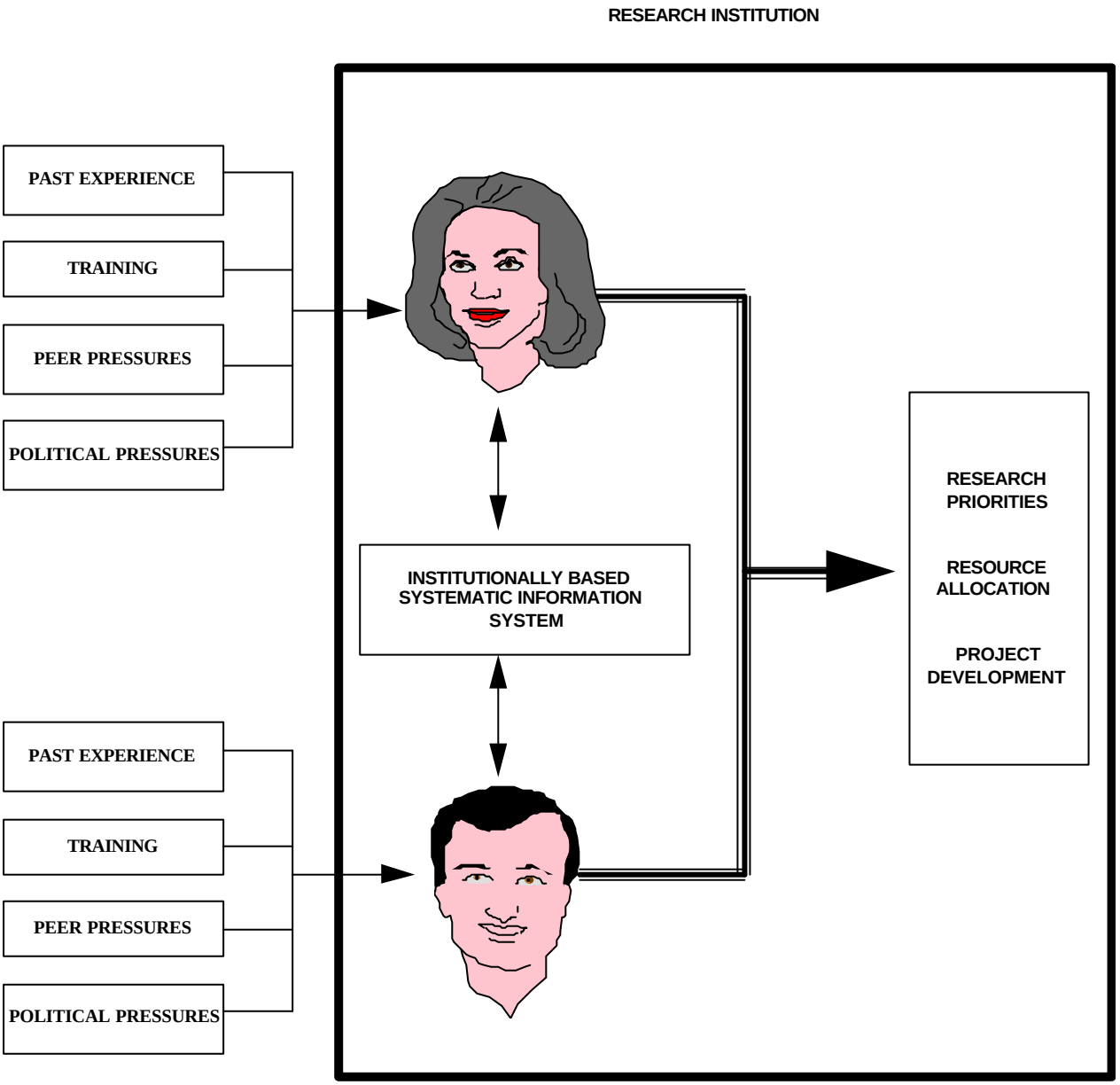

Figure 1. **The complementarity between institutionally based information systems and other information sources which support decision-making.**

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.

At ACIAR, initial efforts to develop an institutional information system included the use of, what is often called, a subjective 'scoring model' approach. As is usual with this approach staff of ACIAR were asked to list criteria they thought were important in determining research priorities. These were then scored and weighted to rank different possibilities. The activity had several positive impacts, for example, it encouraged staff to discuss issues

more broadly. However, personal biases which were not always obvious often dominated. Also, replication of outcomes did not always occur and it was not always clear why this was so. It was decided that a more rigorous basis for the information system was required.[1]

From ACIAR's perspective important requirements of the information system included:

- a focus on specific research institution objectives and the need to clarify these;
- assessment of the potential and actual research impacts should be developed in a manner that is consistent and comparable at all levels in the decision-making chain. For example, information to support aggregate-priority-setting should be consistent with individual project-level evaluations. It should also be possible to use the latter to strengthen the former as more project-level assessments become available;
- being a research institution it was important to adopt a scientific approach and, therefore, make full use of the extensive stock of knowledge on research evaluation methods. Drawing from and enhancing the existing extensive set of literature was regarded as an important component; and
- any analysis must be systematically based and be readily replicated.

Achievement of these requirements was soon found to depend on: developing a clear perspective of the research process; how the objectives of a research institution are influenced by the potential impact of research funding decisions; and how these impacts are best measured to determine how well objectives are being met by different strategies. Figure 2 illustrates the simplified two-region version of the research-process model and

related interactions which were used as the basis for ACIAR's information system.

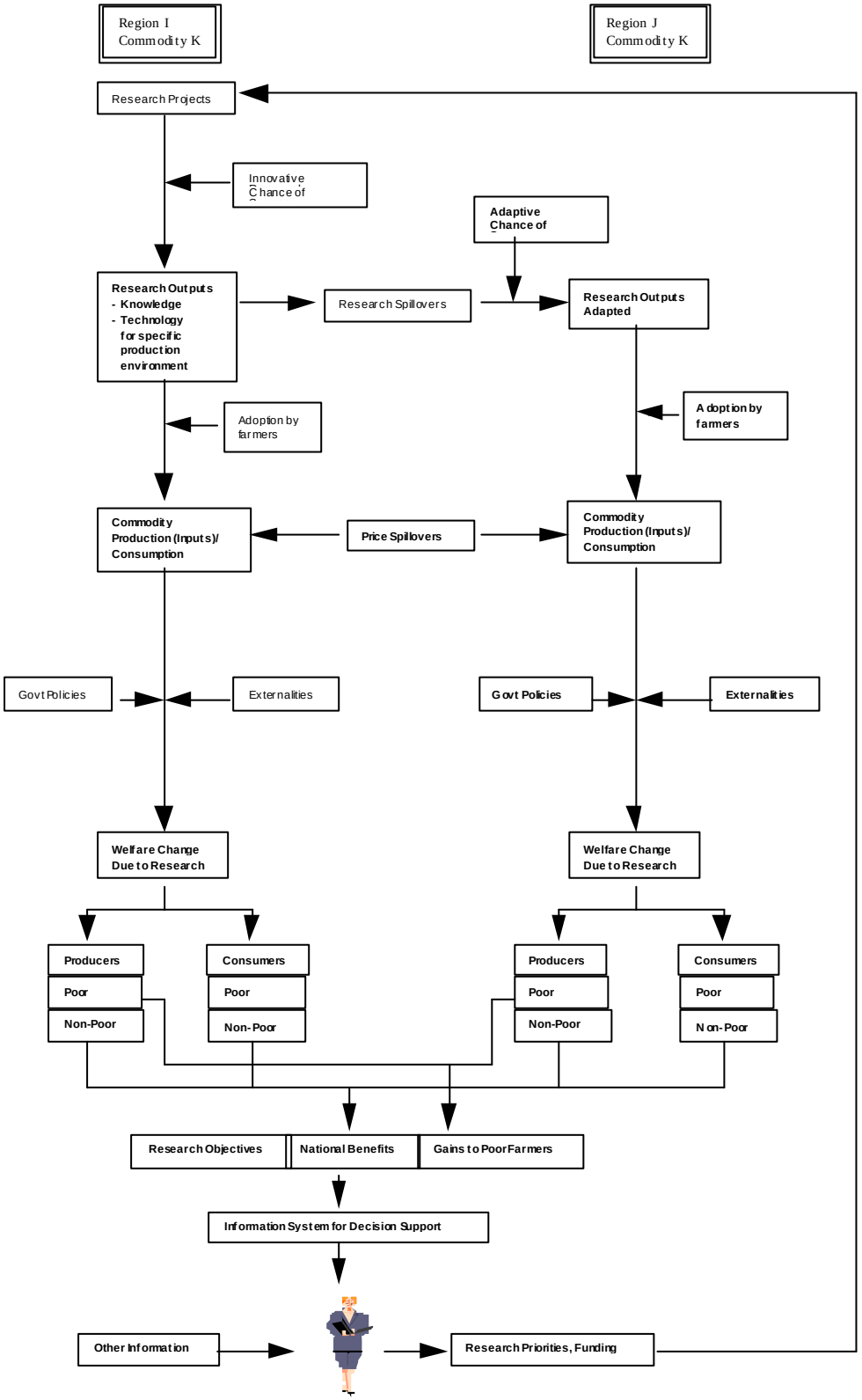

Figure 2. A simple multi-regional (country) model of the research process and decision-making.

A detailed discussion of each of the components of this model is given in Davis et al. (forthcoming). It consists of several important sub-components. The research activities at the top of the flow chart start with clearly defined research projects which, if successful, generate knowledge that may then be converted into technologies applicable to particular production environments. In many cases there will be spillover impacts of the research on other regions, often with the same or similar production environments. In most cases adaptive research is required before the technologies are applicable to these other regions. The same output or commodity is used for illustration in Figure 2, however, the research (and spillover) could also be applicable to other commodities or outputs. This is especially important for forestry research where several types of final outputs (commodities) are obtained from the one forest area and research often has an impact on all of the area.

Once useable technologies are generated they can be adopted by farmers or other producers and the research then begins to have an impact on the production and consumption of the products. Sometimes this can first be through an impact on one or more of the many renewable or non-renewable resources or inputs to the production process. Effects on production and consumption will also result in changes in the prices of inputs and outputs, which in turn can create price spillover impacts. This may be to regions where the research outputs were not applicable. If the potential influences of government policies and possible externalities are included, the research will eventually (often after a considerable passage of time) have an impact on the welfare of many groups in the community. It is this impact on the welfare of different groups which usually determines whether, and how well, research objectives are being met. Estimates of these welfare impacts are indicators of how well the research decisions will meet, or have met, research objectives.

Quantification of the potential impacts illustrated in Figure 2 was the foundation of ACIAR's information system. Particularly crucial was disaggregation of the model to include sub-models of each component of this process.

2.2 A brief overview of ACIAR's information system

As indicated earlier a detailed account of the evolution of ACIAR's Information System is provided in Davis and Ryan (forthcoming, chapters 8 to 11). Figure 3 provides a simple illustration of the structure of the institutional Information System developed by ACIAR and the interface between this System and groups within ACIAR and the institutions it collaborates with. The two-way flow of information is highlighted as a crucial aspect of the System. One important component comprises two databases. These are:

(i) A Project Management Database

The project management database was originally 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) and a much more user-friendly set of software is being introduced.

(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 the detailed interpretation of the research process—and the way this process interfaces with the technical and socio-economic aspects of a multi-country world as was briefly described in Figure 2 (See Davis, Bantilan and Ryan [forthcoming] for a more detailed discussion of this research process model).

The technical dimensions of the research process model, especially, 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[2]. 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 eventually 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. The forestry sector analysis was developed through detailed interaction between the EEU group and the forestry program coordinator, Dr John Turnbull. Dr Turnbull also drew on the knowledge of many forestry research experts in this process.[3]

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 3 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 forestry research program and in so doing illustrate how the information can be used to highlight some possibly important issues.

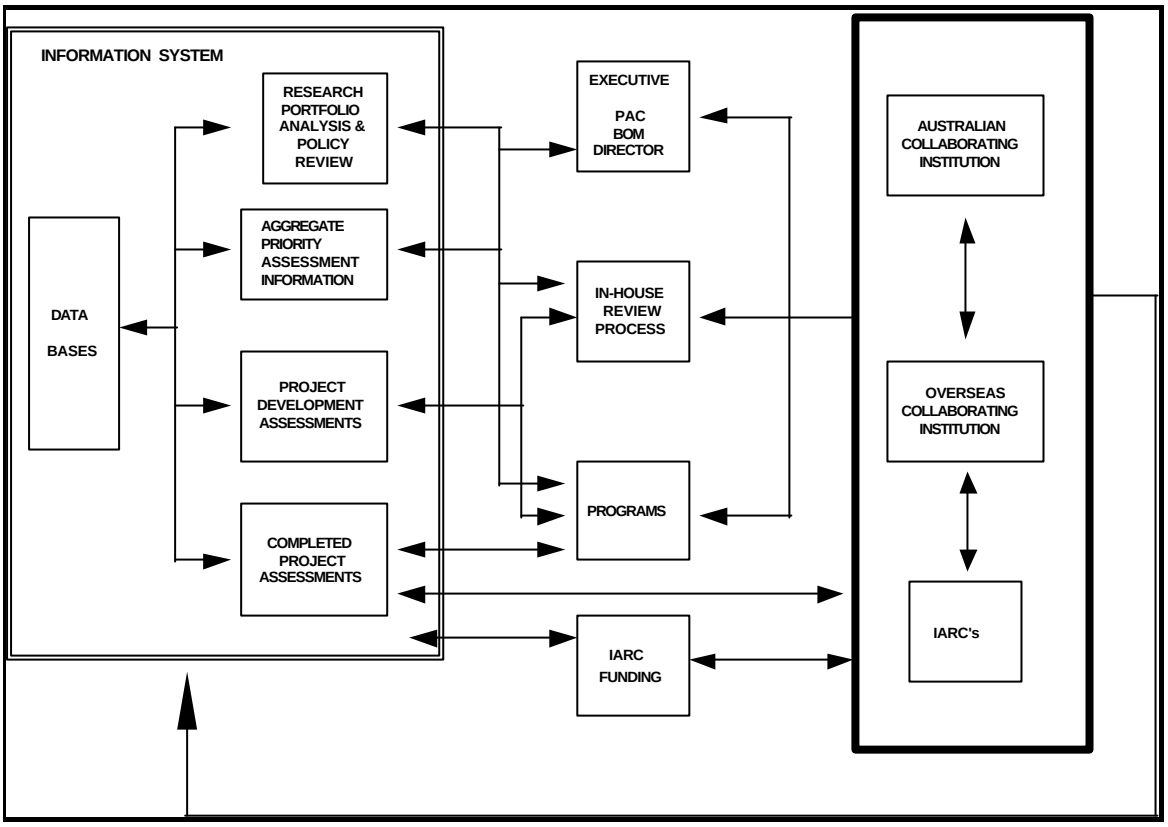

Figure 3. An illustration of the **Information System** interface with decision-making groups for ACIAR.

2.3 AGGREGATE PRIORITY ASSESSMENT INFORMATION WITH A FORESTRY 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 ongoing, for example, the ACIAR **Policy Advisory Council (PAC)** meeting in December 1994 discussed this issue again. Currently, maximising the mandate-region welfare gains 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 which 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	Southeast 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 Ranking
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	Soybea
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	Macker
Tunas,bonitos etc	1	Millet	0	Cocoa	0	Sorghum	0	Orange
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 insetting priorities. Instead, several alternative formats have been tried. The first and most common 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.

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

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
Regional Relativities		2.7				5.8				1	

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 for the likely level of welfare gains that may result. The trend is towards 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.

The second presentational alternative is illustrated in Figure 4. This is a graphical presentation of the information in Table 1. The six priority groups are highlighted and the forestry outputs likely to be influenced by research identified. This format highlights the relative potential research impacts for the eight commodities most likely to be influenced by forestry research. It highlights the relative potential of non-coniferous fuelwood and non-coniferous saw and veneer logs for this region. As was emphasised above, care is always required in interpreting and using this information. An important additional point for forestry research is that it will often have a joint impact on several of these products. In these cases the potential benefits need to be added for each commodity. The potential relative importance of forestry research is increased if this is taken into account.

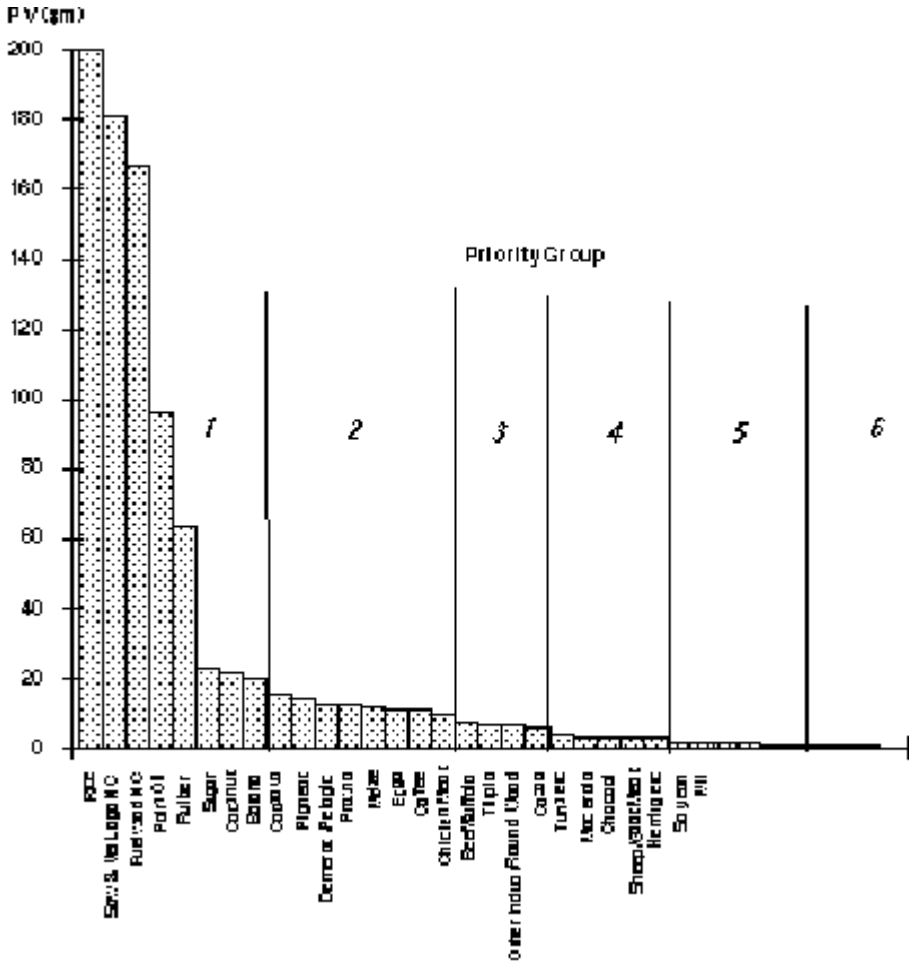

Figure 4. Graphical representation of potential research benefits and priority groupings - expected regional welfare gains to Southeast Asia.

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 forestry research. The sets of information covered in the rest of this section include: regional priority groupings for the sub-set of commodities relevant to Forestry research; an indication of past funding patterns by region and commodity; and discussion of benefits to Australia versus benefits to partner countries.

2.3.2 Aggregate regional priorities with a forestry focus

The commodities most likely to be directly influenced by forestry research are shown by shading in Table 2. These are the eight forest products directly related to timber (remember these are derived from the information in Table 1). Of course many other outputs from or inputs into the production of other final products can be influenced by forestry (and other) research. For example, other agricultural crops can be affected by the output of forestry research as too can several types of fisheries products. Many of these are included in the set of commodities so far included in the analysis. Other outputs, such as water for towns or cities and even tourism, can also be influenced. These latter 'commodities' although not yet included in the analysis, could be if they are felt to be potentially important.

The information in Table 1, and therefore Table 2, refers to the average regional benefit from research on problems relevant to the production environments most prevalent in the particular region. Recall that these benefits are calculated by assuming the research results in a standard 5% reduction in the unit cost of producing the particular forest product. What transforms the research results into this eventual cost reduction is often a very complex set of inter-relationships, both technical and economic. Discussion of these issues is beyond the scope of this paper, however such discussion is crucial.

Notice that for all regions the highest benefits from research that influences forest products are likely to come from research on non-coniferous fuelwood research in South Asia, with expectations of $US204m in present-value terms over 30 years from the start of the research. This is followed by research on non-coniferous saw and veneer logs in Southeast Asia with expected regional gains of $US181m.

The information is presented assuming that a particular research effort does not also have a direct impact on other forest products. For many projects this will not be the case, for example, with non-coniferous fuelwood and pulpwood. If research is likely to have an impact on both, then the research benefits should be added together and this total then 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, see Table 2. 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 forestry research issue; no good researchable

problems that can be identified; or the private sector may dominate research in a particular product or research area.

The information in Table 2 provides an opportunity to compare a hypothetical, standardised research-impact for forestry and two other important primary industry sectors, that is, agriculture and fisheries. The six priority groupings are based on the break-even relativities for the 45 commodities from each of the three sectors. Considerable caution is required in drawing conclusions from this information without a detailed understanding of the underlying assumptions. Nevertheless, the table highlights the fact that, research, especially that on non-coniferous fuelwood and saw and veneer logs has potential to generate welfare gains of a similar magnitude to those which might be expected from some of the major agricultural commodities. This conclusion applies to all of ACIAR's mandate regions and also to Australia.

This method for determining priorities assumes the same relative cost-reducing impact of the research for the agricultural and forestry products. It is possible that since forestry research has received less attention that some agricultural commodities, especially in ACIAR's mandate regions, that the cost-reducing impact of forestry research could be relatively higher than, say, for rice. If so the potential total research gains could be higher for the forest products. This conclusion needs to be tempered by the possibility that forest research could have longer lags than some of the agricultural commodities, and that this would reduce the present value of these gains.

Within the forest products there is, however, a significant spread between the different priority groupings. For example, pulpwood and pitprops consistently fall into groups 5 and 6 for most regions. This suggests that a good case would need to be made to justify funding of a project on these products in these regions. Alternatively, a project that included use of a tree species for several products would satisfy this condition, since the benefits resulting from the impact of the research on each product would be added. A combination of non-coniferous fuelwood and pulpwood is a good example.

At this stage the **Information System** does not distinguish between within-product (or discipline) research areas. With more interaction and expansion of the spillover model database this 'within-product' information could be provided. This is an important potential next step in the evolution of the Information System.

2.3.3 Past forestry research expenditure patterns in ACIAR

Information can be generated that draws on both databases in the Information System. Table 3 combines program and commodity expenditure information from the PMIS database with the priority grouping information from the Research Evaluation database (Table 2). This is available for each region. Several points can be highlighted.

Table 3. Forestry 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	
Fuelwood NC	1	4, 389	1, 938	2, 450	Fuelwood NC	1	629	357	271	
S&V Logs NC	1	1, 289	120	1, 168	Wheat	1	26	0	26	

Total		*5, 678*	*2, 058*	*3, 619*	*Total*		*655*	*357*	*297*
O I R	3	700	260	440	S&V Logs NC	2	121	22	99
Pulpwood	5	1, 405	120	1, 284	OIR	5	44	44	0
					Pulpwood	5	121	22	99
Wheat	6	6	0	6	*Total*		165	66	99
Sub Total		**7, 790**	**2, 439**	**5, 350**	**Sub-Total**		**943**	**446**	**497**
Honey	ni	278	0	278					
Total		**8, 068**	**2, 439**	**5, 628**	**Total**		**943**	**446**	**497**

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

Commodity	Priority Group	South Pacific & PNG ($'000)			Commodity	Priority Group	Africa ($'000)		
		1982–94	1982–88	1989–94			1982–94	1982–88	1989–94
S&V Logs NC	1	1, 041	0	1, 041	Fuelwood NC	1	2, 451	1, 859	593
					OIR	2	548	153	395
OIR	6	126	126	0					
Sub Total		**1, 167**	**126**	**1, 041**	**Sub-Total**		**2, 999**	**2, 011**	**989**
Total		**1, 167**	**126**	**1, 041**	**Total**		**2, 999**	**2, 011**	**989**

Table 3 presents the research expenditure for each ACIAR mandate region broken down by the forest products plus other commodities expected to be effected by the research. It also separates expenditure into two time periods, 1982–1988 and 1989–1995. This information highlights several points:

- The main regional research emphasis has been in Southeast Asia and China with a significant share in Africa but least in South Asia. The relative emphasis has been maintained in Southeast Asia, China and South Asia between the two time periods, however, there has been a reduction in research funding in Africa and an increase in the South Pacific.

- Fuelwood has been the product that has received the most research attention. However, due to the multi-product nature of many trees, pulpwood and saw logs have also received significant attention.

- The majority of projects have primarily focused on forest products. However, some are expected to have an impact on other products, for example, wheat—through a salinity project—and honey. It is important to note that there are projects from other research programs in ACIAR that are also expected to have impacts on forest products, for example in the animal science area. Also there is one economics program project that is investigating public policy issues in natural forest management.

Table 4 summarises this expenditure information for the six research priority groups. It is clear that the emphasis of the forestry program has been on the high priority groups. When this has not been the case, especially for China, it has been because of expected joint impacts on both high and low priority commodities.

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

Priority Group	Southeast Asia China			Priority Group	South Asia			Priority Group	1
	1982–1995	1982–1988	1989–1995		1982–1995	1982–1988	1989–1995		
1	70. 4	84. 4	64. 0	1	69. 5	80. 0	60. 0	1	0
2	0	0	0	2	12. 9	5. 0	20. 0	2	42. 2
3	8. 7	10. 7	8. 0	3	0	0	0	3	8. 8
4	0	0	0	4	0	0	0	4	12. 0
5	17. 4	4. 9	23. 0	5	4. 7	10. 0	0	5	0
6	0	0	0	6	12. 9	5. 0	20	6	37. 0
Not Included	3. 4	0	5	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	89. 3	0	100	1	82. 0	92. 4	60. 0
2	0	0	0	2	18. 0	7. 6	40. 0
3	0	0	0	3	0	0	0
4	0	0	0	4	0	0	0
5	0	0	0	5	0	0	0
6	10. 7	100	0	6	0	0	0
Not Included	0	0	0	Not Included	0	0	0

2.3.4 Australia benefits as an objective for ACIAR

The impact of ACIAR-funded research on Australian forestry 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, in some areas, especially agriculture, lobby 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 that are of potential importance to Australian conditions.

Table 1 included estimates of the benefits to Australia from research undertaken in Australia and focused on the important production environments for the commodity in Australia (see the last column). 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 2a (last column). It seems likely from this information that Australian forestry research institutions will place research emphasis on a different set of forest products than might be the case with collaborating partner country institutions or is even as preferred in terms of ACIAR's regional benefits objective. Therefore, it seems likely that Australian forestry research institutions might support research on a different set of forest products than might be the case with collaborating partner country institutions or is even as preferred in terms of ACIAR's regional benefits objective.

In Table 2 it is seen that to maximise benefits to Australia research on forestry products should be directed at coniferous and non-coniferous saw and veneer logs and pulpwood. Perhaps surprising is the position of non-coniferous fuelwood which is in the medium range. It is interesting to note that research on these forest products has the potential to match some of the important agricultural commodities in Australia. (As mentioned earlier an important point to bear in mind, however, is that research and adoption lags have been assumed to be the same for all commodities. Any conclusions drawn may need to be treated with some caution, especially for saw and veneer log products.)

It is possible to use the information in Table 2 to highlight the possible conflicts that may arise between different research objectives. Figure 5 is in the form of what has been termed a box diagram. The priority groupings of commodities for two different research objectives can be compared and potential conflicts readily identified. Listed in six rows against the vertical axis are the priority rankings for Australian benefit objectives. The horizontal axis lists in six columns the corresponding priority rankings for a Southeast Asian benefits objectives. Commodities are entered in the intersection box for the appropriate groupings. For example, non-coniferous saw and veneer logs are group 1 priority for both objectives and is, therefore, entered in the upper right hand corner. On the other hand, coniferous saw and veneer logs are priority group 1 for Australian benefits but group 5 for Southeast Asian regional benefits.

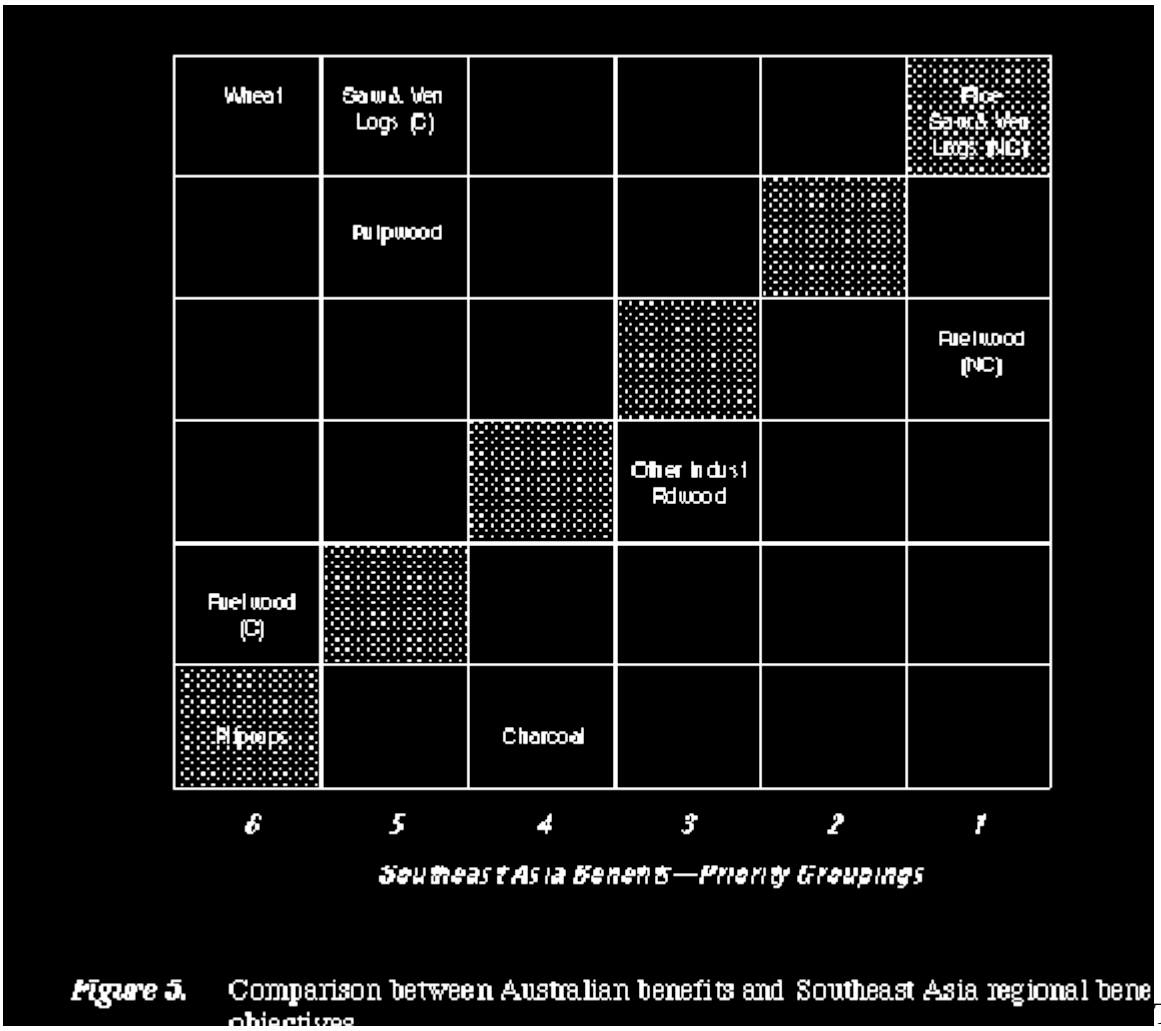

Figure 5. Comparison between Australian benefits and Southeast Asia regional bene objectives

The upward sloping diagonal from left to right indicates the forest products with matching priorities for each objective. The further off the diagonal, the more likely there is to be a conflict in objectives. As well as the diagonal, the four quadrants in this figure indicate issues that may need resolving. Products in the top right hand quadrant are likely to achieve both objectives reasonably well. Notice that, for this example, these are non-coniferous saw and veneer logs and non-coniferous fuelwood. The bottom left hand quadrant indicates products that are unlikely to achieve either objective well. The top left hand quadrant satisfies Australian benefits but not Southeast Asian regional benefits. The opposite applies for the lower right hand quadrant.

In summary, this information indicates that Australian research institutions may push for research on some products that may not necessarily be attractive to ACIAR's potential partner countries. It follows that such research would also not be attractive to ACIAR if it maintains an aid-related Southeast Asian regional-benefits research objective. In the forestry program, in which many species can be used to produce several products, scope for a non-coniferous fuelwood and pulpwood mixed project could provide a potentially attractive compromise. This probably explains the emphasis on these commodities as seen in the expenditure figures in the previous section. Projects on coniferous saw and veneer Logs in Southeast Asia are not likely to be attractive to ACIAR, based on this information.

Products falling in the bottom right quadrant might indicate the need for research on a contracting rather than collaborative basis if ACIAR wishes to fund such projects. That is, Australian institutions may not find these projects very attractive.

Figure 6 presents a similar comparison for China although there are some differences. The importance of a fuelwood/pulpwood mix project is highlighted again. However, the coniferous saw and veneer log possibility now enters the top right hand quadrant.

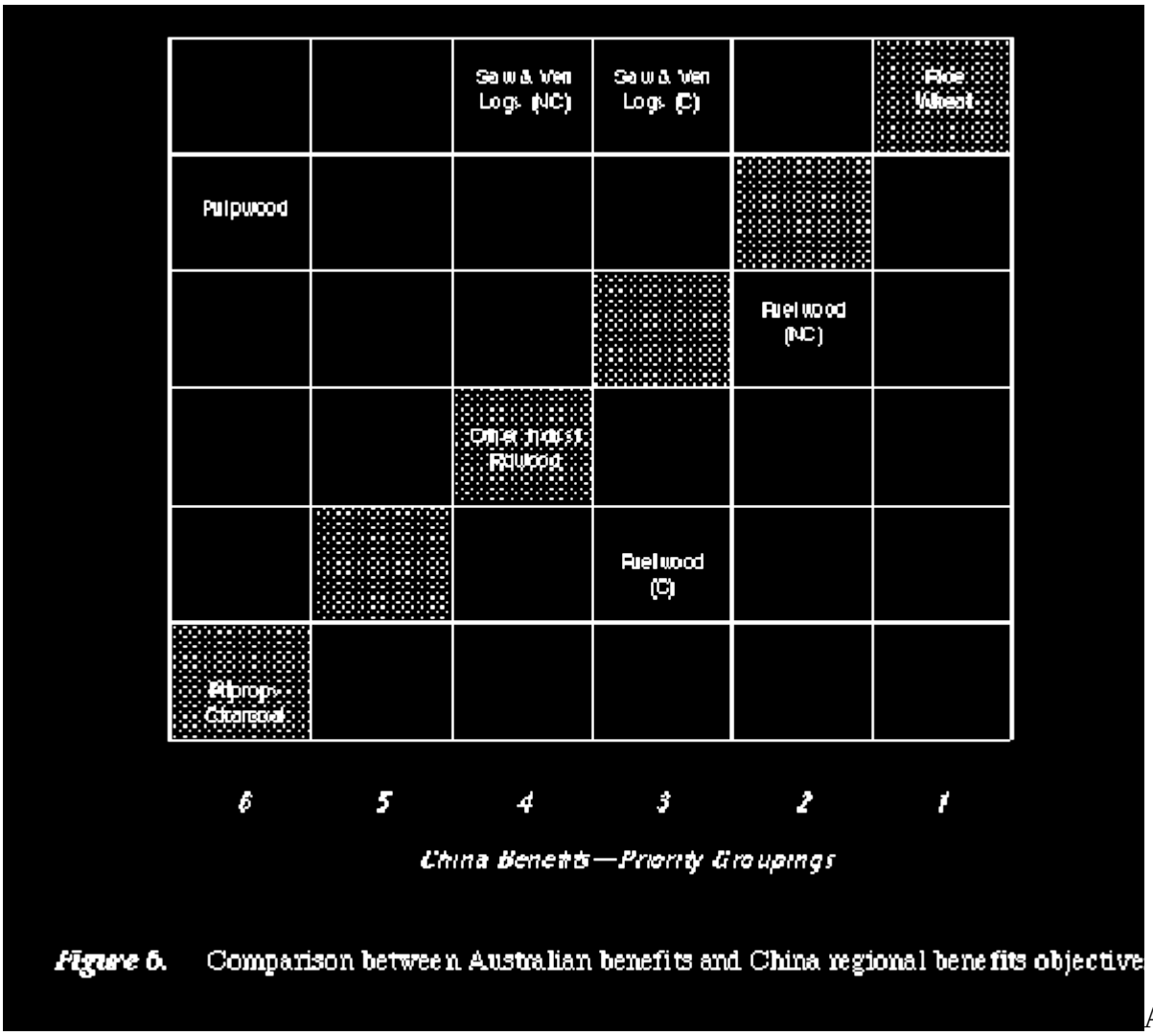

Figure 6. Comparison between Australian benefits and China regional benefits objective

Also to be considered is the possibility that an ACIAR project is developed that focuses primarily on the production environments of most importance to the country of the collaborating partner. In this case the potential gains to Australia will depend on the similarity in production environments and 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 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 forestry issues in 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 per cent of those possible from research designed solely to increase Australian production. 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. Gross Present Value of Australian Welfare Gains from Research Focused on A Specific Region's Production Environments ($USm).

Research In South Asia		Research in **Southeast** Asia		Research in China		Research in South Pacific	
Commodity	Australian Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits
Wheat	7	Saw&Ven. Logs (NC)	2	Wheat	11	Saw&Ven. Logs (NC)	1
Saw&Ven. Logs (NC)	3	Pulpwood	1	Rice	1	Saw&Ven. Logs (C)	1
Saw&Ven. Logs (C)	2	Saw&Ven. Logs (C)	1	Saw&Ven. Logs (NC)	1	Pulpwood	1
Pulpwood	2	Wheat	1	Pulpwood	1	Charcoal	0
Rice	1	Rice	0	Saw&Ven. Logs (C)	1	Fuelwood (Con.)	0
Fuelwood (NC)	0	Soybean	0	Soybean	0	Fuelwood (NC)	0
Oth. Ind. Rdwood	0	Charcoal	0	Fuelwood (NC)	0	Oth. Ind. Rdwood	0
Soybean	0	Fuelwood (Con.)	0	Charcoal	0	Pitprops	0
Charcoal	0	Fuelwood (NC)	0	Fuelwood (Con.)	0	Rice	0
Fuelwood (Con.)	0	Oth. Ind. Rdwood	0	Oth. Ind. Rdwood	0	Soybean	0
Pitprops	0	Pitprops	0	Pitprops	0	Tunas, bonitos etc	0
Tunas, bonitos etc	0	Tunas, bonitos etc	0	Tunas, bonitos etc	0	Wheat	0

Research In Africa		Research in W Asia/ N Africa		Research in Latin America		Research in Australia	
Commodity	Australian Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits	Commodity	Australian Benefits
Saw&Ven. Logs (NC)	2	Wheat	20	Wheat	7	Wheat	63
Saw&Ven. Logs (C)	1	Saw&Ven. Logs (NC)	3	Saw&Ven. Logs (NC)	2	Saw&Ven. Logs (NC)	10
Pulpwood	1	Pulpwood	2	Saw&Ven. Logs (C)	1	Rice	7
Rice	0	Saw&Ven. Logs (C)	2	Pulpwood	1	Saw&Ven. Logs (C)	6
Soybean	0	Fuelwood (NC)	1	Rice	0	Pulpwood	6
Charcoal	0	Oth. Ind. Rdwood	0	Soybean	0	Fuelwood (NC)	3
Fuelwood (Con.)	0	Rice	0	Fuelwood (NC)	0	Tunas, bonitos etc	1
Fuelwood (NC)	0	Fuelwood (Con.)	0	Oth. Ind. Rdwood	0	Oth. Ind. Rdwood	1
Oth. Ind. Rdwood	0	Soybean	0	Charcoal	0	Soybean	1
Pitprops	0	Charcoal	0	Fuelwood (Con.)	0	Fuelwood (Con.)	1
Tunas, bonitos etc	0	Pitprops	0	Pitprops	0	Pitprops	0
Wheat	0	Tunas, bonitos etc	0	Tunas, bonitos etc	0	Charcoal	0

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. Estimation of research impact relativities (in a similar fashion to Table 2) are not presented here. However, these indicate that for all regions, even though the absolute level 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. In addition there is still a divergence between the important products from a regional perspective.

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. As was indicated earlier for the forestry component, the technical information included in the **Information System** has been developed with the assistance of the previous ACIAR coordinator and some project research leaders. There is a need to review and possibly revise some of this information.
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 are 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 3 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 forestry 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 criteria were 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 6 summarises the results of the seventeen assessments completed to-date. A detailed description of these studies is given in Menz (1991), Fearn (1991) and Lubulwa and Davis (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.

Table 6. 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 South Pacific	8332/8733 Giant Clams	Giant Clam Mariculture 6	Fisheries	1.9	-	S Pacific	
4	8451/8929	Nematodes To Control Pests	Crop Sciences	97.0	80	China	Ch
		Sub-Total (Assessment 1-12)		*815.8*			
- South Pacific	8543/9003 Tuna	Tuna Bait Fish Biology 1	Fisheries	3.8	21	S Pacific	
	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 (net present values) estimated for 1990. All research costs, including expenditures by the collaborating and commissioned organisations are included.

ni Not presently included in priority assessment analysis.

Note: Shaded projects are in the Forestry Program.

Only one forestry research effort (two projects) has been evaluated. This was the tree assessment work in China and this was shown to have been one of the highest pay-off projects evaluated so far (McKenney et al. [1993] report the updated results of this evaluation). The EEU has plans to evaluate all of the completed forestry projects during the next year or so.

(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 7 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 the information included in Table 7. 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 7. Recent project development assessments of projects considered for funding by ACIAR.

Project Number	Description	Program	Region	Country	Commodities		Priority Grouping	Internal Rate of Return
					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)				
9048	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)				
9045	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	Internal (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 Forestry Program area

So far there has only been one project-development assessment from the forestry program. This was for the 'Tree Growing on Salt-Affected Lands in Asia' Project 9316. As is indicated in Table 7, this project-development assessment was undertaken with only partial interaction between the scientists and economists in the EEU. While the assessment was useful it did not result in a detailed documentation so is not readily available to provide others with a clear indication of the methods used and information collected. More detailed assessments are important as they provided a better information base to assess future new projects quickly.

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.

(iii) The forestry program has not had a very large share of projects evaluated. The EEU plans to focus on the forestry program during the coming year.

2.5 A brief overview of previous evaluations of forestry research

Research in the agricultural sector has received considerable attention during the past 30 years. There is a well developed set of evaluations that can be used as a partial indication of the potential pay-off for research undertaken. The EEU has assembled an extensive collection of literature on evaluating research and has this available in a database form. At this stage there are about 1600 publications in this collection. This database reveals that there have been relatively few evaluations of forestry research during the period covered by the collection.

One service the EEU feels it can provide is to slowly categorise these studies and summarise them in various forms. Table 8 summarises studies that have focused on forestry-related research. 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 to use. Table 9 provides a list of the research categories ACIAR has been using. It is still in the development stages. Davis and Lubulwa (1992) discuss this categorisation in more detail.

Table 8. Summary of some previous forestry research evaluation studies.

Description	Commodity Comments	Country Source	Research Type	Net Present Value ($M)	Internal Benefit Rate of Return (%)	Internal Benefit Costs Ratio
Structural Particleboard Research	Particle-board ni	USA	Processing Methods Bengston (1984)	ni	18-22	
Timber Utilisation Research	S & V Logs ni	USA	Processing Methods Haygreen et al. (1986)	ni	14-36	
Forest Seedling Research	S & V Logs ni	USA	Forest Practices Westgate (1986)	ni	37-111	
Aggregate Lumber & Products	S & V Logs ni	USA	All Areas Bengston (1985)	ni	34-40	
Regional Forest Nutrition	S & V Logs ni	USA	Nutrition Bare & Loveless (1885)	ni	9-12	
Optimal Stand Growth &	S & V Logs 16:1	USA	Forest Practices Chang (1986)	ni	ni	
Australian Trees for China Yield Information	Fuelwood ni	China	Genetic A/E McKenney et al. (1993)	115. 0	37	
Softwood Plywood Research	S & V Logs (C) ni	USA	Processing Methods Hyde et al. (1992)	2, 840. 0	499	
Sawmill Research	S & V Logs (C) ni	USA	Processing Methods Hyde et al. (1992)	25, 960. 0	28	
Woodpulp Research	S & V Logs (C) ni	USA	Processing Methods Hyde et al. (1992)	4. 0	15	
Wood Preservatives Research	S & V Logs (C) ni	USA	Wastage Hyde et al. (1992)	252. 0	293	

It is seen that, although there have been fewer evaluations than for agriculture, there have been several and this number is increasing. Most of those in Table 8 have been of postharvest or off-forest research with most of the research in the processing area. All except the ACIAR evaluation have been for the USA. It is seen that there have been substantial variations in the returns to research. There have been several with very high and others with very low rates of return. The majority have used an aggregate-all-research-in-the-area method for evaluating research, rather than the project and specific technology focus which is adopted in the ACIAR evaluations.

Table 9. Possible classification of research areas and associated research evaluation methods.

Research Area	Type of Evaluation Model	Comments
Pre-Farm gate		
Genetic Assessment/ 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-	Other areas also involve environmental commodity supply shift model 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	Model required not clear. Usually a research context.	Concept still requires clearer definition in part of other research areas

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.

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 forestry research program. We have found that forestry research could have impact as significant as most agricultural research areas.

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

There has been only one project-development assessment of a forestry project. The EEU plans to concentrate on the forestry program during the next year or so.

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 detail some further aspects of this **evaluation process**.

3. THE PROJECT EVALUATION PROCESS FOR FORESTRY 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 (EEU) 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 7 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 2 of the project-development cycle. Many of the previous partial and minimal interaction assessments

have commenced at the end of the Phase 2 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 forestry projects in relation to these activities.

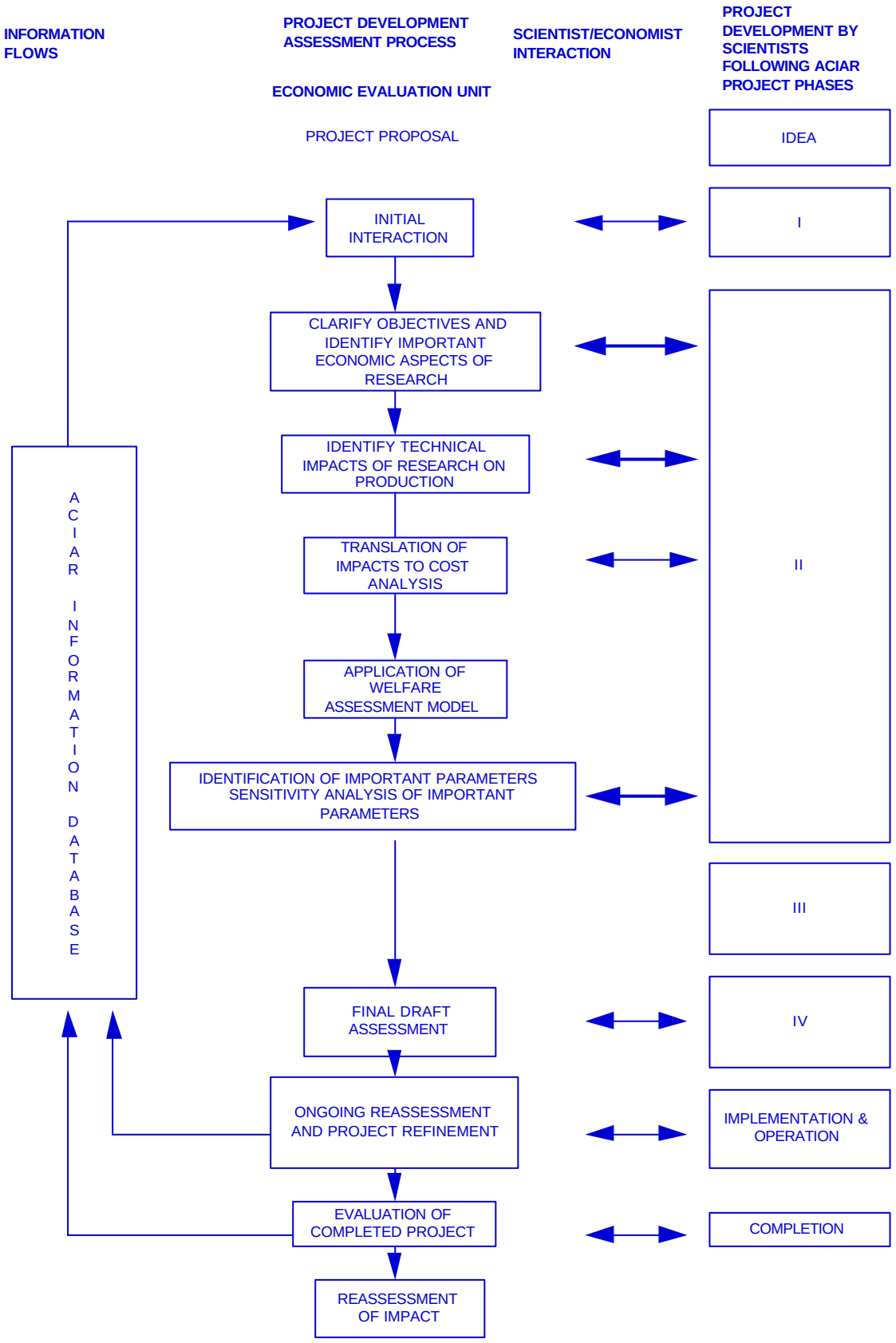
INFORMATION FLOWS
PROJECT DEVELOPMENT ASSESSMENT PROCESS
SCIENTIST/ECONOMIST INTERACTION
PROJECT DEVELOPMENT BY SCIENTISTS FOLLOWING ACIAR PROJECT PHASES
ECONOMIC EVALUATION UNIT
PROJECT PROPOSAL
IDEA
INITIAL INTERACTION
I
CLARIFY OBJECTIVES AND IDENTIFY IMPORTANT ECONOMIC ASPECTS OF RESEARCH
IDENTIFY 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

Figure 7. Project development process at ACIAR and assessment interaction.

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 the boxes in the centre of Figure 7 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 forest level.
- Estimates of the levels and costs of all inputs at the forest 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 pesticides 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 forestry program is likely to focus on are forest level activities. For evaluating this research, the relatively well developed 'single or multi-regional, multi-commodity-supply-shift research-evaluation model' is the most appropriate. However, if natural forest management and other environmental types of projects are developed some of the more complex models will need to be adapted.

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 etc.
- 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 forestry research projects

Tables 10 and 11 list all past and current forestry projects. They also list for each project 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). As was highlighted before, only one set of completed projects has been evaluated and one has been the focus of a project development assessment. Several other projects are being evaluated through the current evaluation of all African projects, which is due for completion at the end of this year, and the UPLB collaborative evaluation activity. As was also indicated earlier, the EEU plans to evaluate all other completed projects during the next year or so.

Table 10. Summary of ACIAR's forestry completed projects*.

Project Title	Project Number	Type of Research	Type of Evaluation Return (%)	Internal Rate of
Australian Hardwoods for Fuelwood & Agroforestry I	8320/8808	Genetic A/E	None	AFRICA
Australian Hardwoods for Fuelwood & Agroforestry II	8331/8809	Genetic A/E	None	AFRICA
Casuarina for Fuelwood and Nitrogen Fixation	8357	Genetic A/E	None	
Australian Broadleaved Tree Species for China	8457/8848	Genetic A/E	CPA	37
Wattle Silviculture and Tannin	8458/8849	Genetic A/E	None	
Multi-Purpose Trees and Sandalwood Silviculture	8613/9043	Genetic A/E	None	
Australian Tropical Acacias	8630	Genetic A/E	None	

Tree Growing on Salt Affected Lands	8633/9316	Genetic A/E	None
Nutrition and Mycorrhizal Requirements for Tropical Trees	8736/9114	Nutrition	None

* Excludes small projects

AFRICA To be evaluated as part of all ACIAR African Projects evaluation**.**

Table 12 summarises all of these projects in terms of the research areas listed in Table 7. It is seen that 88% of projects have been in the genetic assessment/enhancement area with the remaining 12% in the nutrition and pests areas.

Table 11. Summary of ACIAR'sforestry current projects*.

Project Title—Completed Projects	Project Number	Type of Research	Type of Evaluation Return (%)	Internal Rate of
Multi-Purpose Trees and Sandalwood Silviculture	8613/9043	Genetic A/E 50% Silviculture 50%	None	
Nutrition and Mycorrhizal Requirements for Tropical Trees	8736/9114	Genetic A/E 50% Nutrition 50%	None	
Improving and Sustaining Productivity of Eucalypts In Southeast Asia	9115	Genetic A/E 60% Nonwood forest products 10% Nutrition 30%	None	
Improvement of Tree Establishment for Tropical Dryland Conditions in East Africa	9126	Genetic A/E 50% Physiology 50%	None	
Predicting Tree Growth for General Regions and Specific Sites in China, Thailand and Australia	9127	Modelling 100%	None	
Tree Establishment Technologies in the Philippines	9208	Genetic A/E ? Silviculture ?	None	UPLB
Australian Acacias for Sustainable Development in China, Vietnam and Australia	9227	Genetic A/E 33% Nutrition 33% Insects 33%	None	
Physiology and Genetic Improvements of *Acacia auriculiformis*	9310	Genetic A/E 20% Physiology 80%	None	
Tree Growing on Salt Affected Lands	8633/9316	Genetic A/E 20% Physiology 80%	None	PDA

* Excludes small projects.

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

Table 12. Summary of ACIAR's forestry projects by research area and project status.

Research Area	Completed Projects	Current Projects	All Projects	Percentage
Genetic Assessment/ Enhancement	13	8	21	88
Nutrition	1	1	2	8
Pests	0	1	1	4
Total	**14**	**10**	**24**	**100**

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 forestry research projects. It has highlighted some recent trends in the forestry research program, especially using the aggregate-priority-assessment information as a guideline. Products likely to be influenced by forestry 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.

At a project level only two forestry projects have been evaluated so far. One was a completed project which was found to have a major impact and high rate of return. Only one project has been the focus of a project development assessment. The EEU plans to expand its evaluation activities in the forestry area during the next 12 to 18 months.

1 Ryan and Davis (forthcoming) provide a more detailed account of the evolution of the **Information System**.

2 For example, Davis 1991 provides a detailed discussion of the model used to estimate the spillover effects from research.

3 Davis, McKenney and Turnbull (1994) provide additional documentation of this effort.

REFERENCES

Bare, B and Loveless, R. 1985. A case history of the regional forest nutrition research project: investments, results and applications, Report submitted to USDA Forest Service, Northeast Forest Experiment Station General Technical Bulletin under project PNW 82–248.

Bengston, D N. 1984. Economic impacts of structural particleboard research, Forest Science, Volume 30, No 3, pp. 685–697.

Bengston, D N. 1985. Aggregate returns to lumber and wood products research: an index number approach, in Risbrudt, C and Jakes, P, USDA Forest Service, Northeast Forest Experiment Station General Technical Bulletin NE-111, St Paul Minnesota.

Chang, S J. 1986. The economics of optimal stand growth and yield information gathering, report submitted to USDA Forest Service, Northeast Forest Experiment Station under Research Agreement 23-83-27.

Davis, J S and Ryan, J G. (Forthcoming). Designing information systems to support priority assessments in agricultural research. Concepts and Practices for International and National Institutions, ACIAR Monograph No 17, Canberra.

Davis, J S, Bantilan, M C and Ryan, J G. (Forthcoming). Chapter 2 in Davis and Ryan (Forthcoming).

Davis, J S, McKenney, D W and Turnbull, J W. 1994. The international impact of forestry research and a comparison with agricultural and fisheries research, Canadian Journal of Forest Research, Volume 24, pp. 321–336.

Davis, J S and Lubulwa, G. 1993. Benefit–cost methods in research evaluation: ACIAR's experience and perspective, in Chudleigh, P D and Bond, K A (ed.) Proceedings of Grains Research and Development Corporation Benefit–Cost Workshop, Canberra, May 1993.

Davis, J S and Fearn, M J. 1992. Information to support resource allocation for forestry research: aggregate priorities and project level assessments, Paper Prepared for ACIAR Forestry Program Project Leaders' Meeting, February 4–5.

Davis, J S. 1991. Spillover effects of agricultural research: importance for research policy and incorporation in research evaluation models, ACIAR/ISNAR Project Paper No. 32, February.

Fearn, MJ.An Evaluation of the Impacts of Research on Bait Fish for the Tuna Fisheries of Selected Developing Countries. Masters of Economics Thesis, Unpublished. University of New England, Armidale 1991.

Haygreen, J, Gregersen, H, Holland, I and Stone, R. 1986. The economic impact of timber utilisation research, Forest Products Journal, Volume 36, No 2, pp. 12–20.

Hyde, WF, Newman, DH, Seldon, BJ. 1992. Summary, conclusions and policy implications, in The economic benefits of forestry research, Iowa State University Press, Iowa.

Lubulwa, A S G and Davis, J S. 1994. An economic evaluation of postharvest tropical fruit research. Some preliminary results, Economic Evaluation Unit Working Paper No. 9, ACIAR, Canberra.

Lubulwa, A S G and Davis, J S. 1994. An economic evaluation of postharvest tropical fruit research: some preliminary results, in Champ, BR, Highley, E,and Johnson, GI (ed.) Postharvest handling of tropical fruits: proceedings of an international conference held at Chiang Mai, Thailand 19–23 July 1993, ACIARProceedings No. 50.

McKenney, D W, Davis, J S, Turnbull, J W and Searle, S D. 1993. Impact of Australian tree species selection research in China: An Economic Perspective, Forest Ecology and Management, Volume 60, May 1993, pp. 59–76.

Menz, K. 1991. Overview of economic assessments 1–12, Economic Assessment Series, ACIAR, Canberra.

Westgate, R A. 1986. The economics of containerised forest tree seedling research in the United States, Canadian Journal of Forest Research, Volume 16, pp. 1007–1012.

PAPERS IN THE ECONOMIC EVALUATION UNIT WORKING PAPER SERIES

Fearn, M, Davis, J S and Ringrose-Voase, A. 1994. Project Development Assessment: Management of Clay Soils for Lowland Rice-Based Cropping Systems: Project 8938. Economic Evaluation Unit Working Paper No. 1, ACIAR, Canberra.

Fearn, M, Mather, P, Macaranas, J and Capra, M. 1994. Project Development Assessment: Genetic Identification and Stock Improvement of Tilapia in Malaysia and Fiji: Project 9206. Economic Evaluation Unit Working Paper No. 2, ACIAR, Canberra.

Davis, J S. 1994. Disaggregation rather than Mathematical Manipulation for Incorporating Research Impacts on Supply. Economic Evaluation Unit Working Paper No. 3, ACIAR, Canberra.

Davis, J S. 1994. A Model for Evaluation of Waste Reducing Postharvest Research. Economic Evaluation Unit Working Paper No. 4, ACIAR, Canberra.

Fearn, M. 1994. Project Development Assessment: Mineral Elements Limiting Sheep Production in China: Project 8911. Economic Evaluation Unit Working Paper No. 5, ACIAR, Canberra.

Fearn, M, Smith, B and Davis, J. 1994. Project Development Assessment: Pacific Island Pearl Oyster Resource Development: Project 9131. Economic Evaluation Unit Working Paper No. 6, ACIAR, Canberra.

Davis, J S. 1994. Some Economic Aspects for Considering Future Directions for Tropical Forage Research. Economic Evaluation Unit Working Paper No. 7, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1994. Evaluation of Postharvest Research: Results for an Application to Tropical Fruit Research Projects and some further Methodological Issues. Economic Evaluation Unit Working Paper No. 8, ACIAR, Canberra.

Lubulwa, A S G and Davis, J S. 1994. An Economic Evaluation of Postharvest Tropical Fruit Research: Some Preliminary Results. Economic Evaluation Unit Working Paper No. 9, ACIAR, Canberra.

Lubulwa, A S G and Davis, J S. 1994. Estimating the Social Costs of the Impacts of Fungi and Aflatoxins. Economic Evaluation Unit Working Paper No. 10, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1994. An Overview of ACIAR's Economic Assessments of the Postharvest Program Projects. Economic Evaluation Unit Working Paper No. 11, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1994. Collaboration Between ACIAR and Other Research Institutions in Research Evaluation: Experience in the Asian, Pacific and African Regions. Economic Evaluation Unit Working Paper No. 12, ACIAR, Canberra.

Lubulwa, A S G and Davis, J S. 1994. Inclusion of Environmental and Human Health Impacts in Agricultural Research Evaluation: Review and Some Recent Evaluations. Economic Evaluation Unit Working Paper No. 13, ACIAR, Canberra.

Lubulwa, A S G, Arifin, M S and Davis, J S. 1994. Project Development Assessment: The Application of Plant Tissue Culture Techniques to the Propagation and Breeding of Tea in Indonesia. Economic Evaluation Unit Working Paper No. 14, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1995. An Overview of ACIAR's Economic Evaluation Activities with an Animal Sciences Program Focus Economic. Evaluation Unit Working Paper No. 15, ACIAR, Canberra.

Lubulwa, A S G, Desmarchelier, J and Davis, J S. 1995. Incorporating atmospheric environmental degradation in research evaluation of options for the replacement of methyl bromide: A project development assessment of ACIAR project PN 9406. Economic Evaluation Unit Working Paper No. 16, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1995. Integration Of Research Evaluation Analysis Into Research Institution Decision-Making: An Overview of Progress at ACIAR. Economic Evaluation Unit Working Paper No. 17, ACIAR, Canberra.

Davis, J S and Lubulwa, A S G. 1995. An Overview Of ACIAR's Economic Evaluation Activities With A Forestry Program Focus. Economic Evaluation Unit Working Paper No 18, ACIAR, Canberra.