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RESEARCH PRIORITIES FOR ACIAR AND INFORMATION TO ASSIST DECISION-MAKING

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Australian Centre for International Agricultural Research
International Service for National Agricultural Research

ACIAR and ISNAR have developed and are funding a set of projects dealing with agricultural research evaluation and research priority setting. These projects range from methodological development to national and international applications. The projects are based in a number of institutions and countries. ACIAR and ISNAR see a need for a medium to facilitate strong interaction between these projects and rapid communication of ideas.

This Project Paper Series is seen as one of the important ways we can facilitate this interaction. The series also provides a basis for wider interaction between these projects and those in other institutions.

The Project Papers have not been refereed and are intended as a means of generating discussion. It is expected that many will, after benefiting from this interaction, be submitted for formal publication.

These Papers represent the views of the Author(s) and do not necessarily reflect those of ACIAR or ISNAR.

Readers are encouraged to communicate comments directly to the authors of papers. However, communications regarding any other aspect of this series, or on the various projects, should be directed to the coordinators:

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1. INTRODUCTION

At its inception ACIAR placed primary emphasis on creating an institutional structure which identified individual collaborative research projects between Australian and developing country research institutions which the Centre could help support for funding. To function effectively this structure was based on a program or discipline orientation. Program co-ordinators were recruited and play a crucial role in identifying, developing, monitoring and reviewing projects. Project development involves ensuring projects take into account a range of important criteria. Attachment A provides a list of criteria suggested by program co-ordinators as important during project development. Although not well documented this list appears to be used eclectically in the project development process.

As well as individual project identification the question of institution wide research priorities is one that has been considered by most research institutions in recent years, especially as funding has tightened. From its early inception ACIAR has placed emphasis on this issue as well as developing an effective project-level system. In 1984 a preliminary paper was prepared and presented to ACIAR's fourth Policy Advisory Council (PAC) in Bogor, Indonesia. As a result of this paper the PAC suggested that a study be commissioned which would develop a systematic basis for providing information to assist in priority setting by both the PAC and the Board of Management (BOM). At PAC 6 in Western Samoa in 1985 a further paper was presented outlining a methodology which had been designed for use as a basis for a systematic information system to assist with research priority assessment and resource allocation in ACIAR.

The submission to PAC was based upon the work subsequently reported by Davis, Oram and Ryan (1987) who outlined a framework potentially useful in determining aggregate commodity research priorities if research policy objectives include maximising total economic benefits and/or ensuring particular distributive (equity) outcomes from research. They also presented preliminary results from an analysis of twelve major commodities. Davis and Ryan (1987a, b) discussed how this type of analysis can contribute to the research policy process, how it can be used taking either a national or an international perspective, and how it might be developed to facilitate institutionalisation as part of the research resource allocation decision-making process.

The project incorporating this work has three main tasks to fulfill before achieving its originally specified objectives. These include:

(i) Expansion of the analysis to include a more comprehensive set of commodities.

(ii) Undertaking an analysis of past, current and future research expenditure patterns in ACIAR and comparing these with commodity and regional research priority rankings.

(iii) Disaggregation of the analysis to generate information which can assist decision-making at national, institutional, program and project levels.

The objective of this paper is to provide an update on progress with all three of these tasks. The analysis has now been extended to include further commodities to the original twelve.

A preliminary analysis of all previous research expenditure by ACIAR and a comparison with regional/commodity research priority groupings is presented as a first step in developing an information system to support research decision-making.

Disaggregation and refinement of the framework and analysis has occurred through the set of national research priority assessment projects which are complementary to the aggregative analysis reported here.

Previous papers related to this priority setting effort have emphasised the importance of the evolutionary nature of the development of information systems to support decision-making. This paper provides a brief summary of the information which is generated and how it is currently used in ACIAR's decision-making process.

The first section of the paper summarises the framework used to develop commodity research priority groupings for each of the geographical regions of interest to ACIAR. The remainder of the paper illustrates how those priority groupings have been used to generate information to support decision-making in ACIAR. Four aspects have received emphasis. Information has been generated in ACIAR:

(i) to assist the annual project selection process, usually conducted around May each year prior to the annual budget round;

(ii) to provide a basic input into the in-house review process, where individual projects are critically assessed prior to submission to the BOM;

(iii) to provide some quantification of the likely extent of trade-offs between ACIAR's broader objectives and those of national agricultural research systems of individual partner countries. Individual countries will inevitably use national objectives in determining their research priorities. It is likely that these national objectives will not be the same as ACIAR's more global or regionally focused objectives. This background information can be useful during ACIAR's country consultations where an attempt is made to rationalise such competing objectives;

(iv) on commodity research priority rankings, which have been used in association with a project expenditure analysis to provide an indication of how, in an aggregate sense, past and current ACIAR project activities compare with the suggested priority rankings.

2. THE RESEARCH POLICY PROCESS AND ACIAR PRIORITY SETTING

Davis and Ryan (1987a,b) have discussed in detail the importance of establishing at which point in the research (science and technology) policy process research priorities are to be established. A simplified

representation of this research policy process is illustrated in Figure 1.

Three important stages are identified in the research policy process. The policy development stage requires decisions regarding the reason for government involvement in the research process, the form this intervention should take, how it should be funded, how it interacts with other government policies, and therefore what the objectives of research policy are. It is suggested that research policy might have both international and national dimensions.

Once research policies have been established, it is necessary to develop implementing institutions. If direct methods of intervention are used, implementation requires establishment of primary and secondary research organisations. The former are usually administering bodies which define major objectives to ensure policies are being implemented effectively and funds are allocated according to priorities which are consistent with these objectives. Secondary research organisations are the research institutes and experiment stations which undertake the research. These organisations must also determine priorities, but usually among programs and projects.

The final stage in the research policy process is the review stage. It is important to review research policies to determine: whether they are achieving the originally intended objectives; whether objectives have changed; and whether the implementation methods are effectively achieving policy objectives.

The establishment of ACIAR was part of the international dimensions of Australia's research policy; it is also clearly part of a close inter-relation with Australia's foreign policy. The Government has chosen direct involvement in research rather than subsidising the private sector and funds research through general Government revenue rather than a specifically targeted tax. The Policy Advisory Council (PAC), Board of Management (BOM), Executive and Research Programs of ACIAR can be regarded as the primary research organisation established to implement this aspect of Government policy. These groups establish the main objectives of ACIAR funding and choose aggregate regional/commodity priority emphases.

The secondary research organisations can be regarded as a combination of the Australian commissioned organisations and developing country partner institutions. Priorities are established between research areas within a program and between projects. Procedures have been established to identify, design, implement, monitor and evaluate the progress of each project and program area.

For ACIAR the review stage of the research policy process has three dimensions. The first two are designed to ensure implementation objectives are being achieved. Each project includes provision for a review after an initial phase has been completed. In addition, each BOM meeting is used as a focus for reviewing broad funding trends and their consistency with ACIAR objectives. At a global level the Act which established ACIAR makes provision for a 10-year review. This review is intended to assess whether implementation has been consistent with national policy objectives.

The initial emphasis of the research priority project is to develop an information system which supports priority setting and decision-making at

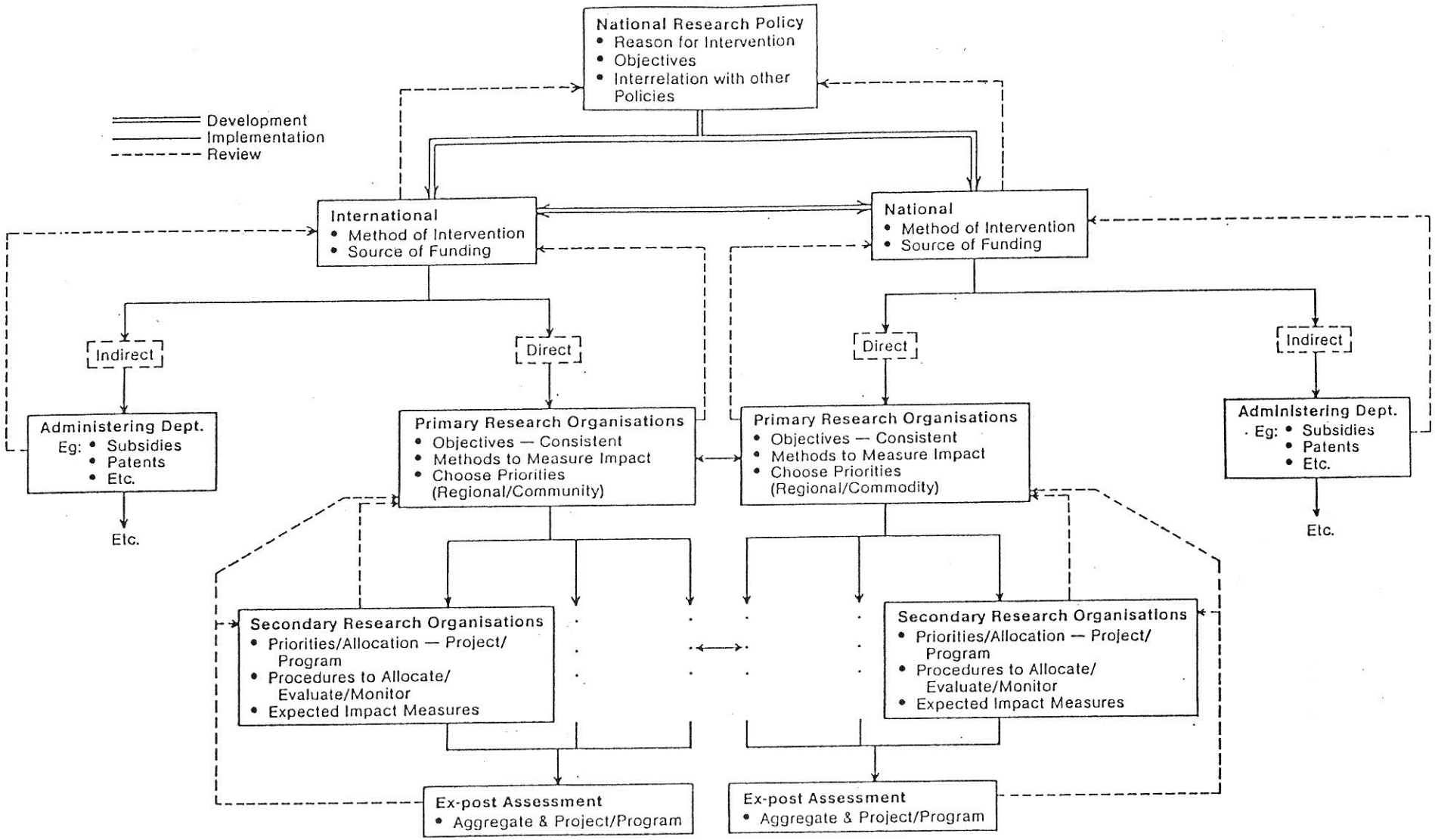

FIGURE 1. Schematic Representation of the Research Policy Process

the primary research organisation level of the implementation stage. Although this is the main focus, it is important to use a methodology which provides consistency with analyses that might take place at all other stages in this policy process. Davis and Ryan (1987a,b) discuss this point in more detail. This consistency is not only important to improve communications between primary and secondary organisations, but to facilitate interaction between the implementation and other stages in the research policy process. Considerable emphasis was placed on this point when choosing the methodology for use in the analysis undertaken.

Davis and Ryan (1987a,b) also emphasise the importance for primary research organisations to clearly identify research objectives consistent with overall research policy and developing measures which can be used to assess whether research resource allocation patterns are likely to result in research outcomes consistent with the objectives of policy.

It was concluded that most of these objectives can be classified into two groups. First are those associated with endeavouring to maximise the total economic benefits from research. The second involve attempting to distribute potential economic benefits to specified groups within particular communities. The latter are often called distributive or equity objectives.

3. THE NATURE OF THE APPROACH

After reviewing the literature, it was decided to use the producer-consumer surplus approach to measure the scope for research to contribute to welfare maximisation or redistribution objectives. This has the advantage of allowing comparisons to be made among commodities with different attributes, using the potential gross welfare benefits of research resulting from a shift of the supply curve to the right as an indicator of the priority which ought to be accorded to it. These benefits are generated by the reduction in output prices for the commodity (including those such as rice and rubber which cannot be compared by other measures such as nutritional value, area cultivated, etc.); while at the same time providing a measure of the distribution of those benefits between producers and consumers, both domestic and international. Moreover, it has already been shown to be a useful tool for evaluative purposes in previous work related to research benefits in Australia, Brazil, and the United States.

It is important to note here that in the current empirical application the framework will <u>not</u> indicate the distribution of benefits among individual components of the two broad groups of producers (small farmers, landless, women, etc.) and consumers (rich, poor), although it can be refined to do this if data permit. This will be discussed later in the paper. It is thus a means of allocating research resources to attempt to maximise the total size of new income streams which might result, although by using judgements as to the nature of commodity supply and demand, a general assessment of the probable distributive benefits of research can be also inferred.

For an organisation such as ACIAR, an important consideration in deciding its priorities is not simply to assess the benefits which might accrue to a country with which ACIAR is collaborating in a specific research project,

but also how widely those benefits might be distributed globally to other countries, particularly developing countries, thus achieving a multiplier effect from use of ACIAR resources. For this a closed economy single country producer-consumer surplus model is insufficient. It was therefore decided to utilise a more comprehensive model which would also give some indication of the potential 'spillover' benefits to other countries of research undertaken in a specific environment with international assistance. This has three advantages: First, it can provide a broader measure of payoff, even for an individual research project, to decide if it is worthwhile; second, it allows a more balanced assessment to be made among commodities competing for research resources; third, it could indicate whether a research effort focused on an individual country, or through developing a network linking a number of countries with similar needs, would be more productive. This is particularly important for commodities which are outside the mainstream of international research institutions, such as cotton, coconuts, sugar, bananas and plantains, and small livestock; as well as for ecological regions including many small countries such as the South Pacific, the Caribbean, and Central America. Coincidentally, these also tend to have economies heavily dependent on some of the commodities mentioned above.

Spillover effects of research can stem from two sources:

i. The applicability/transferability of research results among similar production environments in different countries;

ii. the effect adoption of research results may have on commodity production and world prices.

Governments in developing countries may ignore these spillover effects and make research investment decisions only on the basis of likely national benefits, which would be perfectly rational on their part. International organisations such as ACIAR have presumably been established with a view to taking both national and international benefits into account when funding agricultural research. The foregoing framework can be extended to provide estimates of these global benefits, their distribution between countries, and also among groups within these countries.

Davis, Oram and Ryan (1987) describe in detail their adaptation of the Edwards and Freebairn (1984) methodology to enable intercountry or interregional (intracountry) spillover effects to be explicitly incorporated into an ex ante analysis of aggregate commodity and regional priorities in agricultural research, using the concepts of economic surplus couched in an international trade model. The Davis, Oram and Ryan framework allows differential probabilities of research success and ceiling adoption levels amongst commodities and regions to condition the expected economic benefits from alternative strategies and the distribution of these benefits among consumers, producers, importers and exporters.

International research support, whether bilateral, regional or multilateral, can be designed with the aid of the framework described, both to complement national research activities and in addition to generate maximum international or regional benefits, rather than just individual national research benefits. National research priorities also can be established with the framework by using the concept of regional homologues

to make research more cost effective. This can be achieved when selecting research portfolios by explicitly considering the likely extent of spillover benefits among countries or among regions within a country having similar production and socioeconomic environments[1].

Formulae have been developed to measure the expected welfare gains from research, and these have been converted into a Fortran computer program adapted for use on an IBM AT microcomputer.[2] These measures assume that commodity supply shifts resulting from research, impact neither on prices of other commodities or services, nor macroeconomic variables such as exchange rates and employment. World price effects are accommodated for the commodity experiencing technological change, however linear demand and supply schedules are assumed along with parallel supply shifts resulting from research. The current set of results assume static demand and abstract from the distortions caused by government taxes and subsidies.

The approach to the assessment of agricultural research priorities described offers no panacea to policy makers. However, to international or national agencies concerned with the allocation of scarce research resources, it does offer a means of collapsing the multifarious criteria which have been cited in support of particular decisions into a consistent framework. By being able to array the efficiency and equity trade-offs which might be involved in the choice of particular commodity and regional portfolios, policy makers can be better equipped to rationalise their choices with the declared objectives of agricultural research policy.

While the framework as developed can be used to take account of more detailed distributive effects, to achieve this is likely to be demanding in terms of information and computational requirements. What the information generated by an aggregative application of the model can highlight is the potentially high opportunity costs of using research policy to achieve distributive objectives, and also the complexity of this area. Scoring models do not in general offer such insights and also suffer from the same disadvantages when disaggregation of distributive effects is required.

The framework does not replace scientific judgements of experienced researchers and administrators. Indeed their input is required in order to assess likely research spillovers, indices of research strength or capacity, ceiling adoption levels, and research and adoption lags from alternative portfolios. Initial commodity and regional priorities assessed using the suggested framework "from the top down", should be continuously modified in the light of the experience of scientists working with extension staff and farmers "from the bottom up" (Figure 2).

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1 ACIAR has collaborative country studies underway in the Philippines, Thailand and Papua New Guinea which are refining and institutionalising the framework for use at the national level and is cooperating with ISNAR in a similar study in Indonesia.

2 The formulae and associated program will not be repeated here. Instead readers are referred to the Davis, Oram and Ryan monograph (1987).

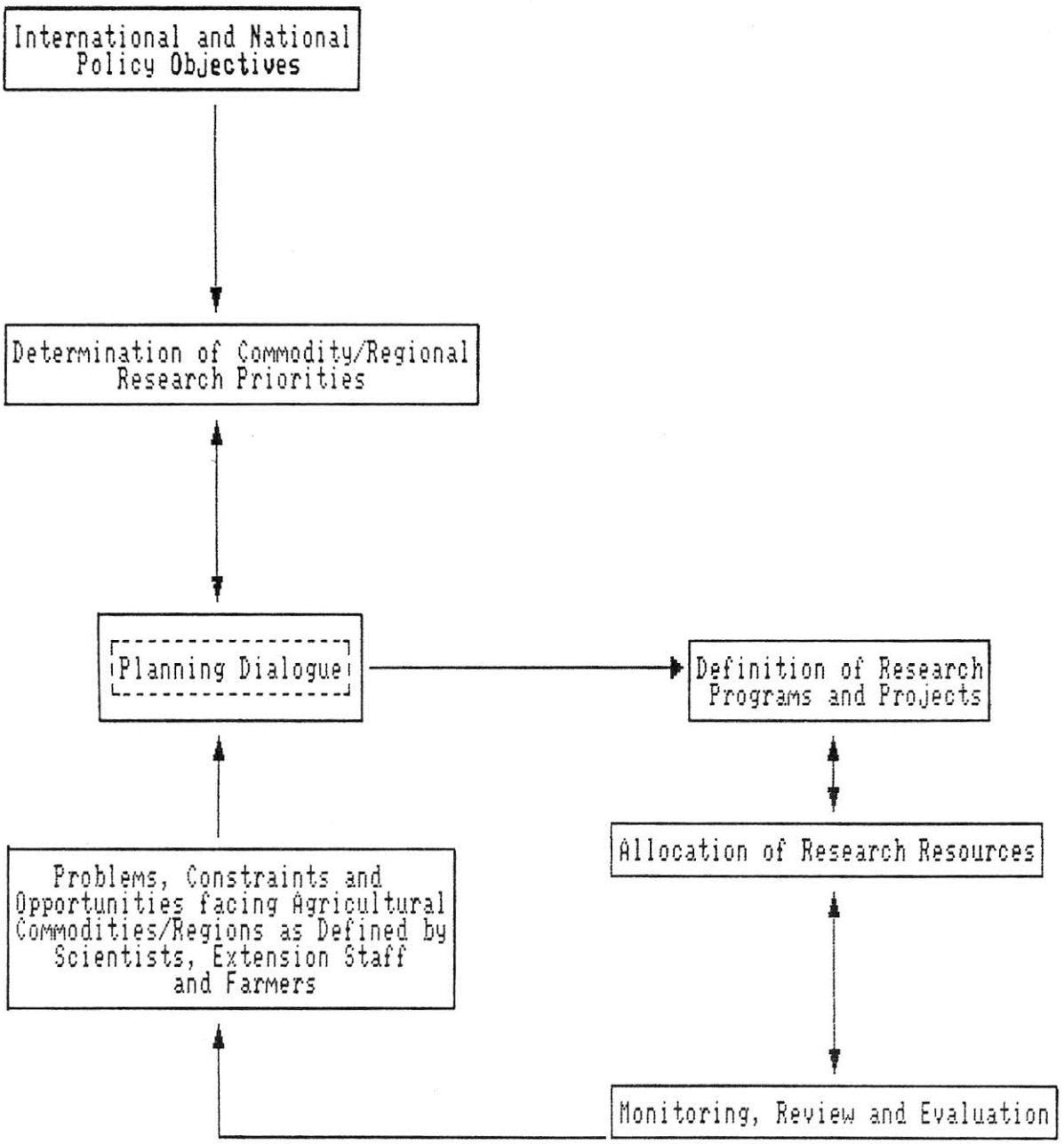

Figure 2: Intersection of International and National Policy Objectives and Research Opportunities

4. DATA REQUIRED TO QUANTIFY OBJECTIVE MEASURES AND ASSIST PRIORITY SETTING

Several types of information are required to implement the framework:

(i) Data on production and consumption of the commodities of interest, apportioned among countries and production environments within them. Ideally these data should relate to those expected to maintain at the time research begins to lead to adoption of resulting technology options by farmers, rather than to current levels.

(ii) Assessments of the likelihood that research on each candidate commodity will generate results that spillover into countries with similar production environments[3]. In other words the research leads to results which have the potential to increase productivity (or reduce unit costs) in other environments above levels currently generated from research in those environments.

(iii) Assessments of the relative strengths of national agricultural research systems (NARS), and transforming them into indices of research strength or capacity for each commodity in each country. These are estimated subjectively taking account of the numbers of qualified scientists undertaking research in the respective NARS and the financial resources NARS provide to them. An attempt is made to differentiate between the ability of the various NARS to conduct strategic or original research, and their ability to conduct adaptive research.

(iv) Estimates of the likely ceiling levels of adoption of technology options emanating from research are subjectively assessed at the country and commodity levels. Variables thought to influence ceiling adoption include the extent of rural infrastructure such as roads, fertiliser consumption etc.

(v) Research lags between the initiation of research and the availability of adoptable technology options for farmers were assumed to be eight years for all commodities, with a three year adoption lag before adoption reaches ceiling levels following

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[3] The notion of research spillovers is a complex issue. The nature of the research undertaken will have an important impact on the potential spillovers. For example, the output of what is often referred to as 'basic' research could be equally applicable in quite diverse production environments. On the other hand, some directly applicable knowledge arising from adaptive research may only be relevant to very specific locations. The spillovers used in this study refer to the means of the likely spillovers from an array of research for each set of production environments and each commodity. If the spillover distribution is felt to be multi-modal then it may be necessary to develop several spillover matrices for each type of research envisaged.

research in originating countries. In third countries a further period of four years was assumed to be required for adaptive research to be completed to enable spillover effects to be captured.

After the three year adoption lag in the current analysis it was assumed adoption would instantaneously reach assessed ceiling levels in each case. We are in the process of refining the adoption lags to better reflect the influence of variations in the extent and quality of extension systems among developing countries, and climatic influences. This will allow us to specify simple approximations to the standard sigmoid adoption curves asymptotic to the respective ceiling levels. These functions will approach the estimated ceiling adoption levels more rapidly for countries with strong extension networks and more slowly for those with weaker systems.

(vi) The social rate of discount chosen for the analysis so far is 12 per cent. Since this is a real rate, it is higher than often used in benefit-cost analyses. On the other hand, since most agricultural research evaluation studies show internal rates of return greater than this, it may be viewed as an appropriate opportunity cost of public research funds. Regardless, as long as research costs are assumed to be similar and lags the same among commodities and regions, only absolute sizes of economic surplus estimates will be affected by this assumption and not the relativities, which are of primary interest. Clearly, once lags and other parameters are allowed to vary among commodities, choice of this parameter takes on increased importance.

(vii) The prices of commodities are important inputs into the analysis as they may affect the size of the unit-cost reduction resulting from successful productivity-enhancing research. The estimation of the likely economic benefits from alternative commodity and regional research portfolios is first done by assuming each commodity has a standard 5 per cent reduction in its costs of production per tonne[4].

Ideally one would prefer to use world equilibrium prices to estimate the economic benefits of successful research, whether these accrue to exporters, importers, or those countries which are self-sufficient in the commodities concerned. The appropriate prices would refer to those expected to maintain (in the absence of the international research proposed) when adoption begins after the eight- (for originators) or twelve- (for adapters) year

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4 This can be varied subsequently based upon scientific judgement and intuition where it is felt some commodities and/or zones have better or worse research potentials than others. Recall however that other variables such as the index of research capacity and research spillovers further condition the 5 per cent figure, so that in effect some allowances are already made.

research lags have elapsed[5] . In practice it has been found difficult to obtain such figures for a comprehensive list of commodities, and for non-tradeable commodities such as yams, some pulses and sweet potato it is virtually impossible to establish a world price, even for current production. The analysis for now relies on a mixture of projected world prices for selected tradeable commodities as published by the World Bank (for 1995 only) and current prices where the Bank has not made projections. For non-tradeables, current prices in major producing countries in each region are used. In future analyses it is planned to use current prices, averaged over three years. To assess the sensitivity of assessed commodity and regional priorities to changes in relative prices, it is also proposed to conduct the analyses using average prices and quantities that reigned 10 and 20 years ago.

(viii) Estimates of the price elasticities of supply and demand for each commodity in each country and/or zone are required if one is particularly interested in measuring the distributive consequences of alternative commodity and regional research portfolios. Estimates of the aggregate economic benefits are not very sensitive to variations in the assumptions about price elasticities of supply and demand.

Price elasticity data are much less widely available than those on income elasticities, and even though we have tapped FAO, the World Bank, USDA, and a wide range of miscellaneous publications, there are still important gaps. Again these mainly affect tropical food crops, particularly those which are not internationally traded, although for others such as oilseeds, price elasticities of supply exist only in aggregate and not for individual oilseed commodities.

The above eight sets of data provide the inputs into the framework, which estimates the expected economic surplus from alternative commodity and regional research portfolios, and their distribution amongst producers and consumers. As stated earlier, the formulae required for this are described in Davis, Oram and Ryan (1987) and will not be repeated here[6].

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5 Price estimates are important only if it is contended that unit-cost reductions achievable by research on different commodities are directly related to their prices. If scientists can assess likely unit-cost reductions independently of prices, then the actual prices used in the model will have a minimal effect on the estimates of economic surplus. Production and consumption levels will continue to exert a major influence.

6 Note though that significant refinements to the framework described in Davis, Oram and Ryan (1987) have been and are continuing to be made.

5. INFORMATION SYSTEMS TO SUPPORT RESEARCH PRIORITY SETTING AND DECISION-MAKING IN ACIAR

5.1 The Current Information System

Any information system developed to assist management decision-making must be evolutionary in its development. Initial sets of information need to be considered by decision-makers and assessed in terms of their usefulness. These initial assessments will invariably lead to a need for adjustments to the form and detail of the information generated. More importantly, as the information is used to assist decision-making, the need for more comprehensive impact assessments is likely to develop. This interaction between decision-makers and the information generators is crucial to systems development.

The important aspects of the current information system for priority setting and research resource allocation in ACIAR can be summarised as:

(i) Specification of ACIAR's objectives. A crucial step in developing an information system is to have a clear outline of the implementing institution's objectives. In most cases institutional objectives are broadly defined and use descriptive terminology. It is important to concentrate attention on more specific statements of these objectives. The PAC has clearly defined objectives regarding the regional shares of ACIAR expenditure. Original and revised guidelines provided are as follows:

Geographic Region	Percentage share of Expenditure	
	Original 1985	Revised 1988
South East Asia	60	40-60
South Asia	9	10-20
China	10	10-20
South Pacific/PNG	12	10-20
Africa/West Asia	9	5-10

Within these regional guidelines objectives have been broadly stated in terms such as to "improve social, physical and material well being of the people in developing countries". As will become clearer later in this paper, to be able to assess whether such objectives are being achieved by particular research programs, more detailed interpretation is required.

(ii) Development of measures of the likely impact of ACIAR's research expenditure which facilitate assessments of whether objectives are being achieved.

(iii) Determination of priority groupings from expected impact measures which are consistent with specified objectives.

(iv) Comparison of past, current and planned expenditure patterns against these priority guidelines.

(v) Development of information which can be provided on a regular and/or irregular basis to assist decision-making.

(vi) Revisions of the information system at regular intervals to satisfy changes in demand as the information is used as an input to decision-making.

5.2 Existing Data Sources

A considerable volume of information is currently provided to assist decision-making in ACIAR. Much of this information relates to individual projects, in particular summarising details of new projects and progress on existing projects and to decisions and operations by the secondary organisations in the research policy process implementation stage (Figure 1).[7]

Information to assist decision-making at the primary organisation level is less extensive. Two main sources can be identified. The first is provided as background papers analysing ACIAR's cumulative and current research portfolio for most BOM meetings. These papers summarise the following:

(i) The distribution by geographic region of all ACIAR research expenditures.

(ii) The distribution by program areas of all ACIAR research expenditures.

(iii) The distribution by broad commodity groups of all ACIAR research expenditures.

The first set of information provides a clear measure of whether the distribution of all ACIAR research expenditure, both since its establishment and in current projects, has been consistent with the regional distribution objectives established by the PAC as described earlier. It also indicates how these shares are likely to change with the addition of the new projects presented at each BOM meeting.

ACIAR's program and commodity objectives have not been articulated in sufficient detail to enable assessments of whether expenditure patterns in (ii) and (iii) are consistent with their achievement.

In January 1987 ACIAR finalised its first Corporate Plan. The purpose of the Corporate Plan was to provide a basis for improved management

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[7] Fearn (1988) provides a detailed outline of these current information flows in ACIAR.

decision-making in all areas of ACIAR's operation; that is, the administration, research and communications programs. For the research program, which is of primary interest in this paper, the Corporate Plan outlined the objectives of ACIAR, as stated in the Act, and then discussed a detailed implementation plan. This plan included predictions of all existing and new projects that may be considered for funding between 1987/88 and 1989/90. Each project was categorised by region and commodity grouping and given a priority ranking of high, medium or low. The priority rankings were based on subjective assessments by project co-ordinators and the large majority were ranked high priority. As well, a set of effectiveness or performance indicators was suggested. Most of these indicators were different for each research program area and were in most cases descriptive in nature. If developed further they would not provide a basis for program comparisons.

5.3 Directions for Future Information System Development

The existing information systems in ACIAR can be assessed against the six points listed in section 5.1. The PAC regional expenditure guidelines provide specific statements of ACIAR's regional objectives; however, other objectives need to be clearly specified. As a result, current information provided to assist decision-making does not include consistent measures of the impact of research which can be compared among projects and across programs.

An objective of the Priority Assessment Study has been to develop consistent measures of the impact of research and use these to assess whether certain objectives are being achieved. An important constraint on this exercise is still a detailed specification of ACIAR's objectives other than the PAC regional guidelines. In the results of analyses presented so far it has been assumed that within the geographic regions of interest to ACIAR the objective is to choose commodities for research emphasis that are likely to result in the highest international (developed plus developing country) economic welfare gains. An alternative objective also illustrated is to maximise the share of benefits received by all developing countries in the choice of commodities, rather than aiming to maximise the share accruing to developed countries.

The results presented below will retain these assumed objectives and consider the possibility of a mixture of both. However, informal discussions have indicated that alternative objectives might be more appropriate. For example, maximising benefits accruing to countries within the geographical regions of primary interest to ACIAR may be the benefits of primary importance. These are South East Asia, the South Pacific, China, South Asia and Africa south of the Sahara, in that order. Increasingly projects are being sought which also offer significant mutual economic benefits to Australia. Benefits to developed countries and developing countries in Central and South America and West Asia and North Africa may not be very important.

In the next section measures of whether research on 24 commodities are likely to achieve these objectives in each region are developed. These measures are used to develop regional priority rankings for these commodities. The rankings are then used in section 7 to analyse ACIAR's current research expenditure patterns.

6. POTENTIAL INTERNATIONAL BENEFITS FROM RESEARCH AND THEIR DISTRIBUTION BETWEEN DEVELOPED AND DEVELOPING COUNTRIES

6.1 Expected International Benefits from Research

In Davis, Oram and Ryan (1987) initial results for twelve commodities were summarised in the form of simple average present values of benefits for five geographical regions separately, and for all developing countries taken together. It has been found that the average benefits for all developing countries is too aggregative to be useful in priority discussions. In addition, it has proven useful, at least within ACIAR, to disaggregate the five geographical regions into seven. The Asian region used previously now has been separated into South Asia, South East Asia and China.

In addition to the above changes in regional groupings, the aggregate results have been derived using data disaggregated to an individual country level, at least for the Asian and South Pacific/PNG regions. This has resulted in only minor changes to the regional average benefit estimates, but has greatly increased the usefulness of the information for more specific priority and research evaluation discussions. In this paper, however, only the regional average results are presented.

Table 1 summarises three types of information. The first column lists the commodities now included in the analysis. These include the major cereal and other food crops, livestock products such as meat, milk and wool, and "commercial" commodities such as rubber and palm oil.

The next seven columns contain the regional average present values of international benefits from research undertaken in each country of the region. For illustration the commodities are listed in descending order of expected international benefits for South East Asia. The research benefits expected from a five per cent unit cost reduction for each commodity are shown to vary considerably among and within regions. As was the case with the previous results, rice is found to dominate for the Asian regions and to a lesser extent for several other geographical regions.

The more disaggregated regional analysis and the addition of more commodities results in more variability in the ordering of commodities among geographical regions. For example, in South East Asia commodities such as wool and sorghum are low in the order, whereas for other regions such as South Asia they are ranked higher.

The information included in the last seven columns of Table 1 is the spillover benefit indicators. For each commodity and region the average percentage of total international benefits accruing to countries outside the region/country where the research is undertaken are reported. For example for rice in South East Asia, on average 79 per cent of the benefits from research undertaken in a country in this region are likely to accrue to other countries. These other countries may be also within South East Asia, but also include those in other regions of the developing and developed world.

TABLE 1: AVERAGE INTERNATIONAL ECONOMIC BENEFITS TO RESEARCH ON VARIOUS COMMODITIES CONDUCTED IN PARTICULAR GEOGRAPHIC REGIONS - PRELIMINARY ESTIMATES.

	AVERAGE PRESENT VALUE OF INTERNATIONAL BENEFITS ($US millions)							AVERAGE SPILLOVER BENEFITS (percentage)						
COMMODITY	SOUTH EAST ASIA	SOUTH ASIA	CHINA	S.PACIFIC &PNG	AFRICA	W.ASIA N.AFRICA	LATIN AMERICA	SOUTH EAST ASIA	SOUTH ASIA	CHINA	S.PACIFIC &PNG	AFRICA	W.ASIA N.AFRICA	LATIN AMERICA
RICE	844	1038	2334	0	333	400	442	79	73	15	0	96	88	94
POTATO	280	307	829	28	56	390	202	119	117	71	136	123	95	110
BANANA/PLANTAIN	161	114	114	120	104	24	147	87	85	97	97	78	92	71
MAIZE	144	140	728	0	59	147	170	93	86	52	0	92	90	76
SUGAR	142	201	203	148	71	133	155	88	54	68	95	92	80	65
BEEF & BUFFALO	132	204	721	0	123	387	548	97	97	99	0	92	98	89
MILK	131	305	967	0	322	783	915	99	83	97	0	97	97	94
PULSES	115	203	328	0	62	102	137	94	63	41	0	94	79	91
SWEET POTATO	113	150	447	12	63	39	130	91	95	3	92	97	100	98
WHEAT	108	312	542	0	57	421	283	100	60	60	0	98	84	94
PALM OIL/KERNAL	104	0	68	50	46	0	44	58	0	88	96	83	0	93
COCONUT	86	60	0	46	31	0	47	67	72	0	98	94	0	96
COFFEE	78	98	98	51	76	0	168	86	95	99	96	91	0	64
CASSAVA	70	89	79	49	94	0	84	76	89	89	100	67	0	81
ORANGES	66	186	152	0	43	119	95	95	90	96	0	100	87	80
SOYBEANS	48	339	342	0	133	99	241	94	99	87	0	99	99	88
COCOA	36	0	0	12	33	0	41	97	0	0	92	61	0	73
RUBBER	34	30	24	18	28	0	26	85	93	83	100	100	0	96
SHEEP/GOAT MEAT	31	103	164	0	36	91	102	94	72	72	0	86	70	92
GROUNDNUT	28	50	73	0	23	15	29	93	64	49	0	87	93	93
COTTONSEED	24	55	102	0	11	35	25	96	69	52	0	91	89	88
SORGHUM	19	114	149	0	36	26	56	95	54	63	0	86	96	80
MILLET	11	27	36	0	13	2	10	91	37	50	0	62	100	90
WOOL	0	127	174	0	40	109	99	0	94	85	0	93	94	86

a. These are calculated taking account of the economic importance of the commodity, the index of research capacity which are dependent upon the current research efforts, likely adoption levels as determined by rural infrastructure within different countries, and the likelihood that research in particular agroclimatic and socioeconomic regions can spillover to other regions. These factors are used to condition the 5 per cent unit cost reduction, assumed to apply initially to each commodity as a result of additional international research investment, achieved after 8-12 year research and adoption lags. For more details see Davis, Oram and Ryan (1987).

In Table 1 sweet potato research undertaken in China is found to result in only 3 per cent of total research benefits accruing to producers and consumers in all other countries. This result occurs, despite the fact that there are potential spillover effects to other countries from this research, because China is such a major producer and consumer of sweet potato. On the other hand, wheat research in South East Asia results in virtually all of the research benefits accruing to countries other than the one where the research is undertaken. This is largely due to potential spillover effects of research and a very small share of world production and even consumption of wheat by these countries.

Despite there being a wide variability in these shares across regions and commodities, Table 1 indicates that spillover benefits in general represent a high percentage of total international benefits. For most commodities and regions the percentages fall in the range of 80 to 95 percent. These results can have important research policy implications. For example, since national research administrators are likely to regard spillover benefits as external benefits, they may well ignore them when making research resource allocation decisions. This could result in misallocation and/or under allocation of research resources if an international perspective is considered relevant. Strong grounds may exist for encouraging cooperative internationally-oriented research activities. While determination of the appropriate instrument and sources of funding to undertake these initiatives is a complex issue, this information may support an efficiency basis for aid supported research which might complement the often expressed income redistribution objectives.

6.2 The Distribution of Research Benefits

Research policy objectives which aim to organise research investment so as to target benefits at particular groups in the community require careful assessment. It is often difficult to identify target groups and to determine whether these groups actually do benefit from research investments. The framework developed in Davis, Oram and Ryan (1987) can be used to assess whether these objectives are likely to be achieved and to what extent their achievement represents trade-offs in terms of the possible contributions of research to general economic growth objectives. However, two important details are usually required. First, the objectives need clear specification. In particular the target group(s) need to be clearly identified. Second, a considerable degree of disaggregation in the information base is usually required. Producers and consumers of commodities in countries will usually need to be separated into different income groups. On a global scale this information is rarely available and we have not attempted to do this here.

Despite the above comments, the aggregate analysis summarised in this paper can provide some useful information on the shares of benefits received by broad groups that are likely to be of interest. For each commodity the distribution of total benefits between producers and consumers for every country where the commodity is produced and/or consumed is estimated. Table 2 provides a condensed summary of this information for South East Asia.

The share of total international benefits likely to be received by consumers and producers is given in columns (3) and (7) respectively. The

TABLE 2: EXPECTED AVERAGE DISTRIBUTIVE EFFECTS AS A PERCENTAGE OF TOTAL INTERNATIONAL BENEFITS FROM RESEARCH IN SOUTH EAST ASIA.

COMMODITY	SHARE (%) OF ECONOMIC BENEFITS RECEIVED BY						
	CONSUMERS			PRODUCERS			
	ALL DEVELOPING COUNTRIES	ALL DEVELOPED COUNTRIES	TOTAL	ALL DEVELOPING COUNTRIES		ALL DEVELOPED COUNRIES	TOTAL
				GAINERS	LOSERS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
RICE	45	3	47	71	-16	0	53
POTATO	13	52	65	49	-4	-9	35
BANANA/PLANTAIN	40	5	46	57	-3	0	54
MAIZE	14	21	35	67	-3	2	65
SUGAR	32	29	60	59	-9	-8	40
BEEF & BUFFALO	19	46	65	45	-8	0	35
MILK	7	31	37	71	-1	-5	63
PULSES	29	9	38	69	-3	-1	62
SWEET POTATO	47	0	47	54	0	0	53
WHEAT	21	23	44	55	-3	5	56
PALM OIL	15	10	25	76	-1	0	75
PALM KERNAL	15	2	16	84	-1	0	84
COCONUT	36	6	42	59	-1	0	58
COFFEE	24	53	77	44	-21	0	23
CASSAVA	38	7	46	55	-1	0	54
ORANGES	34	53	87	40	-12	-13	13
SOYBEANS	27	55	82	71	-2	-49	18
COCOA	15	53	68	37	-5	0	32
RUBBER	25	53	79	25	-4	0	21
SHEEP/GOAT	54	31	85	55	-14	-23	15
GROUNDNUT	37	7	44	62	-5	0	56
COTTON LINT	N/A						
COTTON SEED	62	24	89	29	-1	-12	14
SORGHUM	34	8	42	75	-9	-6	59
MILLET	28	2	30	73	-2	0	70
WOOL	0	0	0	0	0	0	0

NOTE: Totals may not equal 100 due to rounding errors.
N/A Analysis not completed at this stage.

commodities are listed in descending order of total benefits (as determined in Table 1). To facilitate ready comparison among commodities the percentage share is given, not the absolute value of benefits. For example, rice research is shown to provide approximately equal shares of benefits to consumers and producers, that is 47 percent and 53 percent, respectively. On the other hand, soybean research in South East Asia is likely to provide 82 percent of total benefits to consumers of soybeans worldwide, and only 18 percent to producers.

The average shares can mask a more diverse underlying distribution of benefits. To illustrate this, both consumer and producers shares are separated into developing and developed country sub-groupings. To highlight an additional important distributive consequence, developing country producers are separated into those countries gaining from research and those likely to lose. The latter situation can occur if producers in a country do not receive any spillover effects from research in another country, but the research results in a fall in the (world) price of the commodity. These producers can lose because they produce with their cost conditions unaffected by research, but face lower commodity prices.

Columns (1) and (2) in Table 2 indicate the share of consumer benefits received by developing and developed country consumers. The results indicate some significantly different distributive effects for consumers among commodities. For example, most of the "consumers" share of benefits from rice research are received by developing country consumers. On the other hand, with soybeans, a major share of "consumer" benefits, and even total benefits, are received by developed country consumers.

Producer benefits reveal a more complex picture. In the case of rice, 71 per cent of total benefits (that is $844m) are received by some developing country producers. However, 16 per cent of total benefits also occurs as losses in producer surplus to other developing country producers. Allowing for some rounding errors, the net effect for all developing country producers will be gains of 53 per cent of total benefits. In column (6) the net effect (gains less losses) of rice research for developed country producers is approximately zero.

As with consumer benefits, the distribution between developing country producer gainers and losers, and developed country producers varies considerably for the set of commodities analysed.

7. REGIONAL COMMODITY RESEARCH PRIORITIES

7.1 Introduction

Having produced quantitative estimates of expected international benefits from research for this set of commodities, an important question arises: how can this information be used to support research resource allocation decision-making? As was suggested earlier, there is unlikely to be a single clear answer to this question. The implementation stage of the research policy process involves many types of decision-making situations and environments. Each may require different types of information. For some the summary information presented here may provide a useful overall set of indicators against which past, current and future research

expenditure patterns can be judged. For others considerably more disaggregated and complex information may be required.

Once this question of how detailed the information needs to be is resolved, how it is to be used still requires consideration. On observing information such as Table 1, many are often tempted to jump to the conclusion that all research funds should be allocated to rice research in, say, China because a focus on rice research there offers the highest expected total international economic benefits (row 1, column 4, Table 1). Such a conclusion might be justified if some of the underlying simplifying assumptions are ignored: (i) that research on all commodities costs about the same and results in a 5 per cent unit cost reduction. In reality the "research production function" is usually subject to diminishing returns and hence each 5 per cent reduction in unit costs of production is harder and harder to obtain as one increases research investments; (ii) that unlimited or at least a large number of such projects can be identified at any point in time and research personnel and facilities are available to undertake the research. Such a conclusion also ignores any possible income redistribution objectives of research policy.

A large number of studies in the research evaluation literature have attempted to address this issue by collecting detailed information on all possible research projects for all commodities. With this information relatively sophisticated optimisation models have been developed and used to attempt to identify optimal research portfolios. As far as these authors are aware all such studies have required substantial amounts of information and very complex mathematical models to achieve results. In all situations the resultant information system has been too demanding and complex to be adopted as an aid to decision-making. In many cases these analyses have attempted to replace the decision-makers with these models rather than generate information which is one input into their decision-making process.

We contend that what is required are summary indicators which attempt to alert decision-makers to possible lower benefit trends in research funding, rather than attempting to determine fine-tuned "optimum" research portfolios. Such indicators may well suggest that detailed examination of selected research proposals or programs are required, rather than detailed analysis of all of them.

The approach suggested here is to develop a set of relatively simple tables of regional commodity research priority rankings based on expected economic benefit measures. These are discussed in the ensuing sections.

7.2 Research Priorities Aimed at Maximising Expected Economic Benefits

If the objectives of research policy are to maximise the total international economic benefits from research investments, then Table 1 can be used to develop a summary table of research priority groupings. It is possible for decision-makers to use these as "rule of thumb" indicators in research resource allocation decision-making discussions.

Table 3 illustrates some commodity groupings that might result from this type of exercise. The commodities used in the analysis are separated into six research priority groups. Group VII is used to list the set of

TABLE 3: REGIONAL COMMODITY RESEARCH PRIORITY GROUPINGS USING TOTAL INTERNATIONAL BENEFITS AS PRIMARY RESEARCH POLICY OBJECTIVE.

COMMODITY PRIORITY GROUP	SOUTH EAST ASIA		SOUTH ASIA		CHINA		S.PACIFIC &PNG		AFRICA		W ASIA N AFRICA		LATIN AMERICA	
	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity
I	Rice	1.0	Rice	1.0	Rice	1.0	Sugar	1.0	Rice	1.0	Milk	1.0	Milk	1.0
	Potato	3.0			Milk	2.4	Banana/plantain	1.2	Milk	1.0	Wheat	1.9	Beef & buffalo	1.7
					Potato	2.8	Coffee	2.9	Soybeans	2.5	Potato	2.0	Rice	2.1
							Palm-total	3.0	Beef & buffalo	2.7	Rice	2.0		
							Cassava	3.0			Beef & buffalo	2.0		
II	Banana/plantain	5.2	Soybeans	3.1										
	Maize	5.9	Wheat	3.3	Maize	3.2	Coconut	3.2	Banana/plantain	3.2	Maize	5.3	Wheat	3.2
	Sugar	5.9	Potato	3.4	Beef & buffalo	3.2	Potato	5.3	Cassava	3.5	Sugar	5.9	Soybeans	3.8
	Beef & buffalo	6.4	Milk	3.4	Wheat	4.3			Coffee	4.4	Oranges	6.6	Potato	4.5
	Milk	6.4	Beef & buffalo	5.1	Sweet potato	5.2			Sugar	4.7			Maize	5.4
			Pulses	5.1	Soybean	6.8			Sweet potato	5.3			Coffee	5.4
			Sugar	5.2					Pulses	5.4			Sugar	5.9
			Oranges	5.6					Maize	5.6			Banana/plantain	6.2
			Sweet potato	6.9					Wheat	5.8			Pulses	6.7
									Potato	5.9			Sweet potato	7.0
III	Pulses	7.3	Maize	7.4	Pulses	7.1	Rubber	8.2	Palm-total	7.2	Wool	7.2	Sheep/goat meat	9.0
	Sweet potato	7.5	Wool	8.2	Sugar	11.5	Cocoa	12.3	Oranges	7.7	Pulses	7.7	Wool	9.2
	Wheat	7.8	Banana/plantain	9.1	Wool	13.4	Sweet potato	12.3	Wool	8.3	Soybeans	7.9	Oranges	9.6
	Palm-total	8.1	Sorghum	9.1	Sheep/goat meat	14.2			Sheep/goat meat	9.3	Sheep/goat meat	8.6	Cassava	10.9
	Coconut	9.8	Sheep/goat meat	10.1					Sorghum	9.3				
	Coffee	10.8	Coffee	10.6					Cocoa	10.1				
	Cassava	12.1	Cassava	11.7					Coconut	10.7				
	Oranges	12.8							Rubber	11.9				
									Groundnut	14.5				

TABLE 3: REGIONAL COMMODITY RESEARCH PRIORITY GROUPINGS USING TOTAL INTERNATIONAL BENEFITS AS PRIMARY RESEARCH POLICY OBJECTIVE (CONT').

COMMODITY PRIORITY GROUPING	SOUTH EAST ASIA		SOUTH ASIA		CHINA		S.PACIFIC &PNG		AFRICA		W ASIA N AFRICA		LATIN AMERICA	
	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity
IV	Soybeans	18	Coconut	17	Oranges	15.4								
	Cocoa	23	Cottonseed	19	Sorghum	15.7					Sweet potato	20.1	Sorghum	16.3
	Rubber	25	Groundnut	21	Banana/plantain	20.5					Cottonseed	22.4	Coconut	19.5
					Cottonseed	22.9							Palm-total	20.8
					Coffee	23.8							Cocoa	22.3
V	Sheep/goat meat	27.2	Rubber	34.6	Cassava	29.5								
	Groundnut	30.1	Millet	38.4	Groundnut	32.0			Millet	25.6	Sorghum	30.1	Groundnut	31.6
	Cottonseed	35.2			Palm-total	34.3			Cottonseed	30.3	Banana/plantain	32.6	Rubber	35.2
													Cottonseed	36.6
VI	Sorghum	44.4			Millet	64.8								
	Millet	76.7			Rubber	97.3					Groundnut	52.2	Millet	91.5
											Millet	391.5		
VII	Wool	N/A	Cocoa	N/A	Cocoa	N/A	Wool	N/A			Coconut	N/A		
			Palm-total	N/A	Coconut	N/A	Wheat	N/A			Rubber	N/A		
							Soybeans	N/A			Cocoa	N/A		
							Sorghum	N/A			Coffee	N/A		
							Sheep/goat meat	N/A			Cassava	N/A		
							Rice	N/A			Palm-total	N/A		
							Pulses	N/A						
							Oranges	N/A						
							Millet	N/A						
							Milk	N/A						
							Maize	N/A						
							Groundnut	N/A						
							Cottonseed	N/A						
							Beef & buffalo	N/A						
REGIONAL RELATIVITY	Rice	3	Rice	2	RICE	1.0	Sugar	15.8	Rice	7.0	Milk	3.0	Milk	2.6
									Milk	7				

N/A Not applicable to the region or not grown in sufficient quantities.
NOTE: Cotton includes cottonseed only at this stage. Cotton lint is still to be analysed and included in the results.

commodities that have relatively insignificant production in each of the seven geographical regions. The allocation of each commodity to a particular priority group is based on the estimated economic benefits of research on that commodity relative to the commodity with the highest expected benefits for that region. For example, in South East Asia rice is expected to provide the highest level of benefits. If this benefit estimate is divided by the expected benefits for each other commodity in the same region, an indication of relative benefits is found. This information is given in the second column in Table 3 for each region. It was used to allocate each commodity to a research priority group using the following:

Priority Ranking	Range of Break-Even Relativity
I	1 to 3
II	>3 to 7
III	>7 to 15
IV	>15 to 25
V	>25 to 40
VI	>40

Groups I and II can be considered to contain high, III and IV medium, and V and VI low priority commodities for research.

In addition to providing a basis for defining priority group boundaries, this information is useful as an indicative guide for discussing research allocations in more detail. For example, the assumption that research on all commodities potentially results in a 5 per cent unit cost reduction is unlikely to be realistic. Decision-makers may therefore find it useful to be able to answer questions such as: how much larger would the impact of research on one commodity need to be to give approximately equal expected total benefits to research on another? The information presented answers this question. For example, for South East Asia, from Table 3 research on pulses in group III would need to generate 7.3 times the cost-reducing effects as possible research on rice to provide similar expected international benefits. Commodities such as sorghum in group VI require 44 times the cost-reducing effects of rice to break even. As the likelihood of achieving these differences is very low, sorghum is therefore judged to be a low priority commodity for research support in this region when economic growth contribution is the primary objective.

Inspection of Table 3 indicates that although some commodities such as rice and potato are considered to be high priorities for most of the seven regions, there is considerable variability among the rest. If maximising total international research benefits is the important research policy objective, research expenditure patterns would be expected to emphasise different commodities across these major geographical regions.

The last row of Table 3 provides an indication of the regional research relativities. This row lists for each region how the commodity with the

highest expected benefit compares to the benefits generated from rice research in China, which offers the highest of all benefits. Consider the example of rice research in South East Asia where, to produce total international benefits similar to rice research in China, the cost-reducing effects of research would need to be about three times higher. Relatively simple multiplication and division of this information and the relative benefits figures for each region facilitates similar comparisons between all commodities in all regions. For example for millet research in South East Asia to provide the same total economic benefits to the world as would research on rice in China, millet productivity would have to increase some 230 times more than rice productivity from the same level of investment in both (3 times 76.7).

7.3 Research Priorities with Distributive Objectives

As has been mentioned earlier and discussed by Davis and Ryan (1987a) and Ryan and Davis (1988), using research investment to achieve income redistribution objectives is a complex issue and it is not difficult to demonstrate in many situations that research funding can be an inappropriate policy instrument for achieving these objectives. Nevertheless many government and/or research organisations do adopt these objectives as part of research policy. If this occurs, then it is important for policy implementing organisations to attempt to determine which research resource allocation alternatives are likely to best achieve these objectives and at what sacrifice. If nothing else, such assessments may provide useful future input into the policy review and future development stages of the research policy process.

The framework used in this paper can produce such assessments. It first requires a clear definition of the income redistribution objective; in particular, identification of the targeted group or groups. To illustrate how priorities might be developed using distributive objectives a relatively simple one will be used: that is, that the benefits of research should accrue primarily to producers and consumers in developing countries and not to those in developed countries. Information in Table 2 can be used to develop commodity research priority rankings based on this objective (Table 4).

Seven research priority groupings were chosen using information based on the percentage share of total international benefits received by all developing country producers and consumers. The following share ranges were used to group and rank commodities:

Priority Ranking	Percentage Share to Developing Countries
I	100 to >90
II	90 to >80
III	80 to >60
IV	60 to >40
V	40 to >20
VI	20 to >0
VII	No significant production

TABLE 4: PRIORITY GROUPING USING DISTRIBUTION OF BENEFITS TO DEVELOPING COUNTRIES AS PRIMARY RESEARCH POLICY OBJECTIVE.

COMMODITY PRIORITY GROUP	SOUTH-EAST ASIA		SOUTH ASIA		CHINA		SOUTH PACIFIC		AFRICA		W.ASIA N.AFRICA		LATIN AMERICA	
	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)
I	Sweet potato	100	Sweet potato	100	Sweet potato	100	Sweet potato	100	Sweet potato	100	Sweet potato	98	Sweet potato	99
	Sorghum	99	Millet	98	Rice	96	Sorghum	99	Pulses	98	Rice	93	Banana/plantain	95
	Millet	98	Pulses	98	Banana/plantain	94	Maize	99	Rice	98	Millet	90	Coconut	94
	Rice	97	Rice	97	Cassava	93	Rice	99	Millet	98			Rice	93
	Pulses	95	Coconut	95	Millet	92	Pulses	98	Banana/plantain	96			Pulses	93
	Coconut	94	Banana/plantain	95	Pulses	91	Groundnut	97	Coconut	95			Cassava	92
	Banana/plantain	94	Cassava	93			Banana/plantain	97	Cassava	93				
	Groundnut	94	Groundnut	91			Coconut	94	Groundnut	93				
	Cassava	93	Sorghum	90			Cassava	93						
	Palm oil	90												
II	Sugar	82	Sugar	87	Palm oil	89	Palm oil	89	Palm oil	89	Banana/plantain	88	Palm oil	89
			Sheep/goat	86	Groundnut	88	Sugar	88	Sorghum	89	Pulses	84	Millet	88
							Sheep/goat	80			Groundnut	83	Sugar	86
											Sheep/goat	82	Groundnut	85
													Sorghum	84
III	Maize	78	Maize	72	Sorghum	71	Potato	60	Sugar	79	Sorghum	70	Sheep/goat	73
	Milk	77	Wheat	72	Sheep/goat	62			Maize	69	Wheat	62	Maize	71
	Wheat	73	Potato	69	Potato	61			Sheep/goat	66			Wheat	61
	Sheep/goat	69							Beef & buffalo	64				
	Oranges	61							Wheat	62				

TABLE 4: PRIORITY GROUPING USING DISTRIBUTION OF BENEFITS TO DEVELOPING COUNTRIES AS PRIMARY RESEARCH POLICY OBJECTIVE (CONT').

COMMODITY PRIORITY GROUP	SOUTH-EAST ASIA		SOUTH ASIA		CHINA		S.PACIFIC		AFRICA		W.ASIA N.AFRICA		LATIN AMERICA	
	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)	Commodity	Average Share to Developing Countries (%)
IV	Potato	58	Milk	58	Sugar	53	Cocoa	48	Potato	58	Sugar	47	Potato	53
	Beef & buffalo	55	Coffee	47	Maize	53	Rubber	45	Oranges	57	Potato	47	Oranges	51
	Rubber	47	Rubber	47	Wheat	52	Coffee	43	Milk	49			Cocoa	51
	Cocoa	47	Oranges	42	Rubber	48			Rubber	46			Rubber	46
	Coffee	47	Beef & buffalo	42					Coffee	45			Coffee	46
	Soybeans	45							Cocoa	44			Beef & buffalo	42
													Wool	41
V			Wool	36	Coffee	37			Soybeans	31	Wool	39	Soybeans	27
			Soybeans	28	Wool	36			Wool	24	Oranges	28	Milk	21
					Oranges	31					Soybeans	23		
					Soybeans	27					Maize	22		
											Milk	22		
VI					Milk	11					Beef & buffalo	13		
					Beef & buffalo	11								
VII	Wool	0	Palm oil	0	Cocoa	0	Milk	0			Coffee	0		
			Cocoa	0	Coconut	0	Millet	0			Rubber	0		
							Oranges	0			Cocoa	0		
							Wheat	0			Coconut	0		
							Beef & buffalo	0			Cassava	0		
							Soybeans	0			Palm oil	0		
							Wool	0						

NOTE: Potato and coffee exclude the large distorting negative effects of developed country producers from the totals of distributive share's reported reported.

In Table 4 the second column for each of the seven geographical regions includes this information for each commodity. The commodities are listed in descending order of developing country shares.

Inspection of Table 4 reveals similar conclusions to those using total expected benefits as a research objective. Some commodities are consistently in priority grouping I for all regions. Examples include sweet potato, rice and cassava. However, some commodities do shift between priority groupings depending on the region considered. Most of the commodities are in the high (I and II) and medium (III and IV) priority groupings.

It is important to recognise the limitations of using percentage shares. One is that the absolute dollar benefits received by developing countries are not obvious. For example, although the share of benefits from millet research is high to developing countries, the absolute benefits are low. Thus in South East Asia, total dollar benefits to developing countries may be higher for beef and buffalo research as opposed to millet, even though the percentage share is considerably smaller.

With this very aggregated distributive objective consideration is not given as to whether the producers and consumers are considered more important for one commodity versus another. Detailed distributive objectives need to be outlined before such additional factors can be taken into account.

7.4 A Comparison of Distributive and Growth Objectives

In many situations research policy objectives include both economic growth and distributive dimensions. As can be seen from Tables 3 and 4, there are often potential conflicts in achieving these multi-dimensional objectives. This issue has been addressed quite extensively in the literature on research evaluation and priority setting. Methods for including multiple objectives include sophisticated, mathematically defined social welfare functions, subjective scoring models and opting to leave these trade-off judgements to research (policy) decision-makers and concentrating on quantifying the contribution of research alternatives to each objective separately. In the information system being developed as part of this project the latter approach is adopted. This way decision-makers are encouraged to understand more clearly many of the complex interactions and trade-offs that occur. With the other approaches, especially scoring models, decision-makers are often able to avoid understanding these complexities by substituting subjective, yet often arbitrary weightings of competing objectives.

Although priority rankings and impact assessments are usually analysed separately for each objective, it is still possible to summarise them together and provide an overview of the likely conflicts among objectives. Tables 5 and 6 illustrate one way of representing priority rankings for both growth and distributive objectives developed in previous sections. South East Asia and China were chosen to highlight the different implications that can result from such an analysis. These tables list the commodity priority rankings for total economic benefit maximisation (or the potential contribution to economic growth) on the vertical axis and the share of the benefits accruing to developing countries on the horizontal.

TABLE 5: COMPARISON OF COMMODITY PRIORITIES SUGGESTED BY ECONOMIC GROWTH VERSUS DISTRIBUTIVE OBJECTIVES - SOUTH EAST ASIA

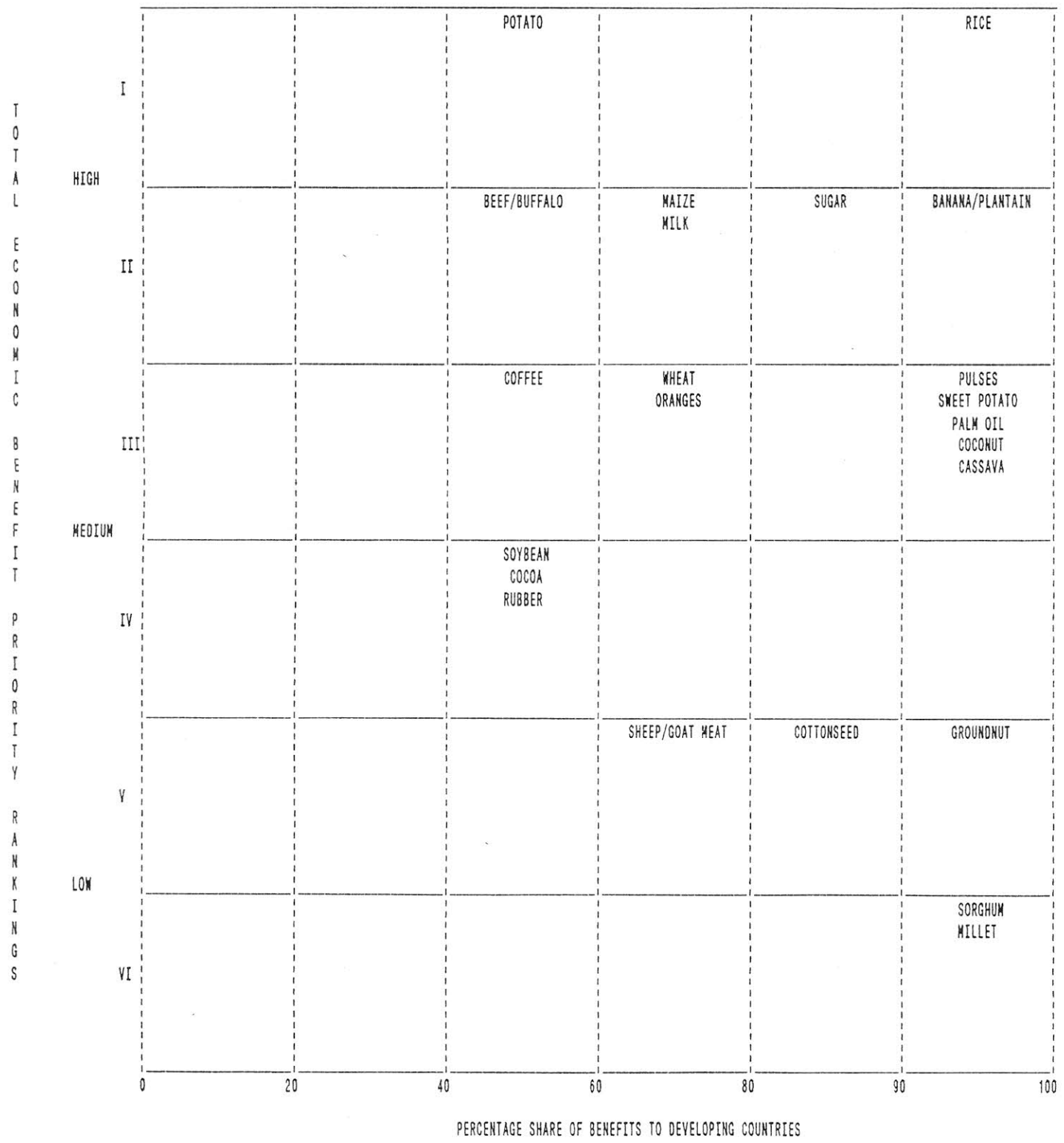
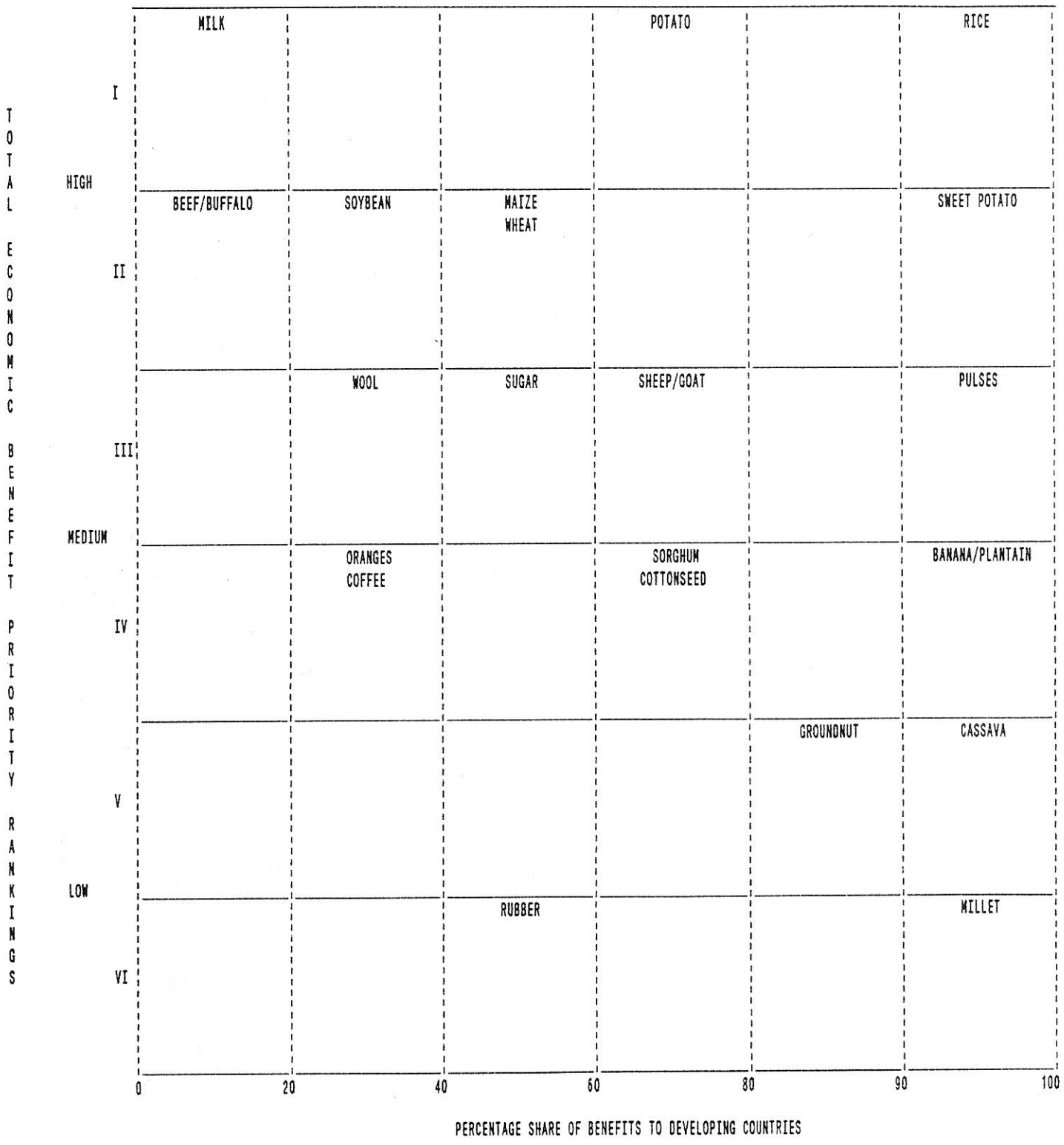


TABLE 6: COMPARISON OF COMMODITY PRIORITIES SUGGESTED BY ECONOMIC GROWTH VERSUS DISTRIBUTIVE OBJECTIVES - CHINA



The diagonal cells of these tables and each of the quadrants provide a useful indication at a glance of the efficiency/equity trade-offs that are likely to be required for each region. Consider Table 5. For commodities in the diagonal cells - that is, rice, sugar, wheat, oranges, soybean, cocoa and rubber - either objective gives the same priority ranking. If all commodities were included on this diagonal, trade-offs between total economic benefits and distributive effects would not be required. The further away from the diagonal the particular commodity is located, the more significant the trade-off is likely to be.

Commodities in the south/west quadrant are of low priority for both objectives. Most commodities in the north/east quadrant will be regarded as high priority, with either single and/or dual objectives. Commodities in the remaining two quadrants have high priority for one objective but low on the other. Thus if more importance is placed on one objective, then attention might be directed to considering commodities in either the south/east and north/west quadrants more closely.

The results for South East Asia and China reveal contrasting patterns of priorities for the commodities considered. South East Asia has a concentration of commodities in the joint high priority north/east quadrant. Those outside this mostly have high priority from a distributive view point. On the other hand, the China region has a more even spread of commodities over all quadrants. Relatively few commodities are included in the joint high priority quadrant. Allocation of research funds within this region would therefore require careful consideration of the importance of trade-offs between the two objectives.

7.5 Comparison of Potential ACIAR Research Priorities and Collaborating National Research System Priorities

If commodity research priorities are available for individual collaborating partner countries, these can be compared with ACIAR research priorities suggested by the analyses shown in Table 4, for possible matches or conflicts. This type of information can be useful when country planning meetings are held to develop collaborative research programs or when reviewing existing programs.

Although national commodity research priorities are not readily available for all collaborating countries, priorities can be developed for some by employing the same framework used to develop ACIAR's priorities. Four ASEAN countries are used as examples to illustrate the type of information that can be produced. The four countries chosen are Indonesia, Malaysia, the Philippines and Thailand. Three of these countries are involved in research priority assessment projects currently being undertaken by ACIAR and ISNAR jointly with the countries concerned.

The objectives of individual national agricultural research systems are likely to differ from those of ACIAR, in particular regarding the importance of regional benefits or benefits accruing to other countries through spillover effects of research. For illustration here it is assumed that these national research systems use the objective of maximisation of national economic benefits from research when determining commodity priorities.

Table 7 develops research priority groupings for the four ASEAN countries using this information and the national objective discussed above. The national priority rankings are compared with ACIAR's for South East Asia. Although some of the commodities have the same priority ranking using both national and regional objectives, there are significant differences between ACIAR's South East Asian regional priorities and those of the individual countries. There are also differences in priorities among the four countries used in the comparison.

As an example, Table 8 presents this information for the Philippines in a form which facilitates comparisons of the priorities. Commodities read across each row of the table are included in one priority group for ACIAR, the top row representing the high priority commodities. Each column of the table lists the Philippines priority groupings, with the right column used for the highest priority commodities. The northeastern diagonal boxes in Table 8 contain commodities in which there would be no conflict between an ACIAR regional objective and a Philippine national objective, both based upon the relative size of the prospective economic benefits. The more commodities included in the north/west and south/east quadrants of Table 8 the less consistent are the two objectives. Also important is the north/east quadrant, which consists of commodities which are medium to high priority for both ACIAR and the Philippines.

There are some commodities in the off-diagonal sections of Table 8, although most are not in the extreme off-diagonal sections, thus indicating reasonable consistency in priority rankings for either objective. There are a number of commodities in the high priority north/east quadrant, indicating that there are commodities which offer research opportunities that are likely to satisfy both ACIAR's regional and Philippines' national objectives.

These conclusions depend heavily on the nature of the assumed national and regional objectives. As indicated earlier, the results should only be treated as the first stage in the development of the proposed information system. The importance of verifying the objectives of both partners in this evolution should be clear.

8. PRELIMINARY ASSESSMENT OF ACIAR'S PROJECT EXPENDITURE PATTERNS

8.1 Introduction

Measurement of the economic impacts of research alternatives requires analysis on a commodity-by-commodity and country-by-country basis. To be able to use these measures as a basis for assessing ACIAR's research expenditure patterns, individual projects need to be categorised in the same way. As part of the priorities project, a data base information system for research projects has been developed in a consistent and readily accessible form for all projects.[8]

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[8] See Fearn (1988) for a detailed description of this system and the procedures used to compile this information for all projects.

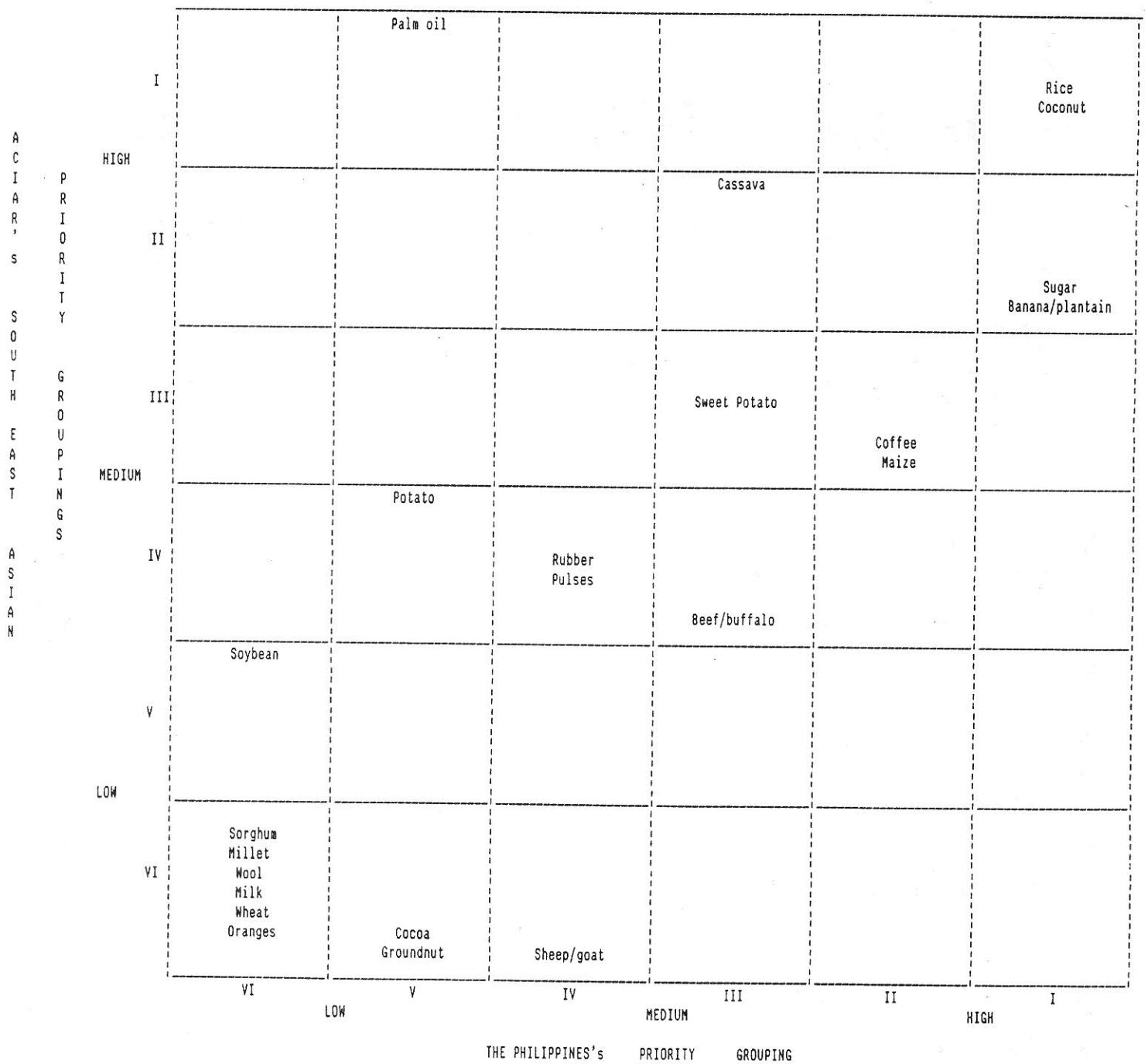
TABLE 7: POTENTIAL ACIAR RESEARCH PRIORITIES AND COLLABORATING NATIONAL RESEARCH SYSTEM PRIORITIES.

COMMODITY PRIORITY GROUP	ACIAR's REGIONAL OBJECTIVE SOUTH EAST ASIA		NATIONAL OBJECTIVE INDONESIA		NATIONAL OBJECTIVE MALAYSIA		NATIONAL OBJECTIVE PHILIPPINES		NATIONAL OBJECTIVE THAILAND	
	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity
I	Rice	1	Rice	1	Palm Oil	1	Rice	1	Rice	1
	Palm-total	5	Coconut	7			Coconut	2		
	Coconut	5					Banana/Plantain	2		
							Sugar	2		
II	Banana/plantain	8	Coffee	15	Rice	3	Maize	7		
	Sugar	11	Palm Oil	17	Rubber	6	Coffee	7	Cassava	9
	Cassava	11	Sugar	18	Coconut	10			Sugar	10
			Banana/Plantain	19						
III	Maize	15	Maize	23	Banana/Plantain	17	Sweet Potato	13	Maize	16
	Sweet potato	19	Cassava	43	Maize	39	Beef & Buffalo	14	Beef & Buffalo	17
	Coffee	21	Beef & Buffalo	45	Cocoa	39	Cassava	17	Banana/Plantain	24
			Sweet Potato	45					Pulses	34

TABLE 7: POTENTIAL ACIAR RESEARCH PRIORITIES AND COLLABORATING NATIONAL RESEARCH SYSTEM PRIORITIES (CONT').

COMMODITY PRIORITY GROUP	ACIAR's REGIONAL OBJECTIVE SOUTH EAST ASIA		NATIONAL OBJECTIVE INDONESIA		NATIONAL OBJECTIVE MALAYSIA		NATIONAL OBJECTIVE PHILIPPINES		NATIONAL OBJECTIVE THAILAND	
	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity	Commodity Ranking	Break-even Relativity
IV	Pulses	30	Rubber	57	Beef & Buffalo	111	Rubber	68	Rubber	49
	Rubber	34	Pulses	57	Sugar	125	Pulses	77	Coconut	56
	Beef & Buffalo	35	Groundnut	62	Cassava	125	Sheep/Goat Meat	144	Sweet Potato	77
	Potato	40	Soybeans	66						
			Sheep/Goat Meat	70						
V	Soybean	70	Oranges	98	Coffee	200	Palm Oil	231	Sorghum	131
							Groundnut	289	Soybeans	159
							Potato	385	Groundnut	202
							Cocoa	578	Oranges	247
									Coffee	371
VI	Groundnut	87	Potato	192	Groundnut	500	Oranges	N/S	Sheep/Goat Meat	N/S
	Oranges	92	Milk	415					Millet	N/S
	Milk	105	Cocoa	554						
	Sheep/goat meat	138								
	Cocoa	189								
	Millet	256								
	Sorghum	398								
	Wheat	398								
VII	Wool	N/S	Millet	N/S	Sweet Potato	N/S	Wool	N/S	Palm Oil	N/S
			Sorghum	N/S	Millet	N/S	Soybeans	N/S	Wool	N/S
			Wheat	N/S	Soybeans	N/S	Millet	N/S	Cocoa	N/S
			Wool	N/S	Sorghum	N/S	Sorghum	N/S	Potato	N/S
					Oranges	N/S	Wheat	N/S	Wheat	N/S
					Wheat	N/S	Milk	N/S	Milk	N/S
					Milk	N/S				
					Wool	N/S				
					Sheep/Goat Meat	N/S				
					Pulses	N/S				
					Potato	N/S				

TABLE 8 : COMPARISON OF POSSIBLE ACIAR SOUTH-EAST ASIAN AND THE PHILIPPINES RESEARCH PRIORITIES.



Two analyses are undertaken. The first takes an ACIAR-wide focus by summarising expenditure information for all ACIAR projects and compares these expenditure patterns with commodity priority rankings on a regional basis. A similar but disaggregated assessment is also provided at the program level to provide information summarising how each program has contributed to the overall ACIAR expenditure profile.

The results presented in this paper are only preliminary for the following reasons:

(i) The objective used to provide regional commodity priority rankings is maximisation of total international economic benefits from research. This still requires confirmation as the appropriate objective for ACIAR.

(ii) Compilation of detailed expenditure information for all projects has been completed, but since this has not been finally rechecked it should be treated as preliminary.

8.2 Aggregate ACIAR Assessment

The project expenditure data base developed as part of the priority assessment project enables ACIAR research expenditure to be aggregated in several different ways. The primary initial emphasis has been at the commodity and country levels. A summary of expenditure by commodity and for the regions of primary importance to ACIAR is therefore possible.

For the discussion here all projects since ACIAR's inception in 1982 are included. Commodities are separated into two broad groups - those included in the priority assessment analysis to date and those not included. Tables 9 and 10 list this information for acquitted expenditure up to March, 1988. Table 9 includes both completed and current projects while Table 10 only includes current projects. Several important points stem from this analysis. Total ACIAR expenditure on research projects since 1982 has been $56.1m (Column 2 of Table 9). Of this $41.6m or 74 per cent has been on projects which cover the commodities included so far in the research priority assessment work. The main omissions are fisheries (6 per cent), forestry (7 per cent) and poultry (2 per cent). Most of the remaining commodities are other fruit and vegetable crops.

On a regional level the 24 commodities used so far represent from 59 per cent to 100 per cent of ACIAR's research funding. The final two rows of tables 9 and 10 report the regional distribution of research expenditure and the original PAC regional guidelines. On a cumulative basis Asia has received slightly less than the 1985 PAC guidelines, with the South Pacific and Africa receiving just above these levels.

Table 11 provides a condensed summary of ACIAR's expenditure for each geographical region, using the commodity priority rankings developed in section 7.2. Priority rankings of high, medium and low are used, with two sub-groupings within each. Several conclusions can be drawn from this aggregate information. First, for each region, a substantial proportion of research expenditure has been on high priority commodities. In all cases this is above (often well above) half the expenditure for the commodities

TABLE 9: ACIAR ACQUITTED PROJECT EXPENDITURE FOR ALL PROJECTS AND PROGRAMS AS AT MARCH 1988.

COMMODITY	TOTAL EXPENDITURE ($)	%	S-E ASIA ($)	%	S. ASIA ($)	%	CHINA ($)	%	SP/PNG ($)	%	AFRICA ($)	%	W.ASIA & N.AFRICA ($)	(%)	GLOBAL ($)	%
Commodities included in Priority Assessment to Date																
Rice	12,918,916	23	10,189,539	35	1,045,474	26	1,277,377	21	0	0	0	0	0	0	406,526	15
Potato	21,461	0	6,000	0	0	0	0	0	0	0	0	0	0	0	15,461	1
Banana	948,795	2	502,797	2	5,164	0	0	0	376,669	5	0	0	0	0	64,165	2
Maize	2,728,148	5	1,412,099	5	0	0	56,211	1	0	0	903,000	14	0	0	356,838	13
Sugar	174,612	0	62,429	0	0	0	84,316	1	27,867	0	0	0	0	0	0	0
Beef/buffalo	7,819,586	14	2,934,836	10	722,165	18	173,769	3	78,471	1	3,859,637	58	0	0	50,708	2
Milk	1,168,206	2	69,069	0	868,137	22	0	0	0	0	231,000	3	0	0	0	0
Pulses	2,215,115	4	1,578,611	5	343,932	9	0	0	215,562	3	0	0	0	0	77,010	3
Sweet potato	438,540	1	4,056	0	0	0	0	0	434,484	6	0	0	0	0	0	0
Wheat	1,223,091	2	52,781	0	326,302	8	696,568	12	0	0	0	0	18,713	20	128,727	5
Palm oil	53,705	0	18,648	0	0	0	0	0	35,057	0	0	0	0	0	0	0
Coconut	1,826,105	3	291,737	1	7,745	0	0	0	1,526,623	21	0	0	0	0	0	0
Coffee	465,979	1	84,542	0	0	0	0	0	381,437	5	0	0	0	0	0	0
Cassava	227,430	0	84,153	0	0	0	0	0	143,277	2	0	0	0	0	0	0
Oranges	125,987	0	81,628	0	0	0	0	0	44,359	1	0	0	0	0	0	0
Soybeans	2,627,710	5	2,139,643	7	83,204	2	0	0	27,734	0	338,625	5	0	0	38,504	1
Cocoa	539,206	1	36,211	0	0	0	0	0	502,995	7	0	0	0	0	0	0
Rubber	104,560	0	104,560	0	0	0	0	0	0	0	0	0	0	0	0	0
Sheep/goat	1,297,290	2	451,342	2	22,920	1	291,951	5	434,324	6	6,510	0	74,850	80	15,393	1
Groundnuts	2,614,050	5	2,488,947	8	83,204	2	0	0	27,734	0	0	0	0	0	14,165	1
Cotton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	247,653	0	8,056	0	239,597	6	0	0	0	0	0	0	0	0	0	0
Millet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wool	1,822,387	3	0	0	0	0	1,822,387	30	0	0	0	0	0	0	0	0
SUB-TOTAL	41,608,532	74	22,601,684	77	3,747,844	93	4,402,579	73	4,256,593	59	5,338,772	80	93,563	100	1,167,497	44
Commodities NOT included in Priority Assessment to Date																
Fisheries	3,579,552	6	1,923,890	7	0	0	0	0	1,655,662	23	0	0	0	0	0	0
Forestry	3,829,596	7	1,457,786	5	3,206	0	1,063,921	18	6,813	0	899,767	14	0	0	398,733	15
Mungbeans	1,015,891	2	638,762	2	0	0	0	0	0	0	338,625	5	0	0	38,504	1
Mangoes	732,986	1	732,986	2	0	0	0	0	0	0	0	0	0	0	0	0
Passionfruit	61,120	2	0	0	0	0	0	0	61,120	1	0	0	0	0	0	0
Fruit/veges	1,361,809	0	477,830	2	0	0	315,486	5	543,250	8	0	0	0	0	25,243	1
Kenaf	33,662	0	33,662	0	0	0	0	0	0	0	0	0	0	0	0	0
Taro	215,658	0	0	0	0	0	0	0	215,658	3	0	0	0	0	0	0
Yams	51,793	0	0	0	0	0	0	0	51,793	1	0	0	0	0	0	0
Kava	120,626	0	0	0	0	0	0	0	120,626	2	0	0	0	0	0	0
Pigs	218,000	0	214,378	1	0	0	0	0	0	0	0	0	0	0	3,622	0
Poultry	1,313,980	2	1,044,373	4	262,364	7	0	0	0	0	0	0	0	0	7,243	0
Duck	19,200	0	19,200	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapeseed	220,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Indust. Rdwd	0	0	334,999	1	0	0	0	0	307,006	4	72,000	1	0	0	1,035,299	39
Non-specific	1,749,304	3	0	0	0	0	220,100	4	0	0	0	0	0	0	0	0
TOTAL	56,131,809	100	29,479,550	100	4,013,414	100	6,002,086	100	7,218,521	100	6,649,164	100	93,563	100	2,676,141	100
Regional Percentage		100		53		7		11		13		12		0		5
PAC Guidelines				60		9		10		12		9				-

* acquitted and approved funds to 1991-1992

TABLE 10: ACIAR ACQUITTED PROJECT EXPENDITURE FOR CURRENT PROJECTS FOR ALL PROGRAM AREAS AS AT MARCH 1988.

COMMODITY	TOTAL EXPENDITURE ($)	%	S-E ASIA ($)	%	S. ASIA ($)	%	CHINA ($)	%	SP/PNG ($)	%	AFRICA ($)	%	W.ASIA & N.AFRICA ($)	(%)	GLOBAL ($)	%
Commodities included in Priority Assessment to Date																
Rice	8,812,975	20	6,476,133	30	952,485	28	1,277,377	21	0	0	0	0	0	0	106,980	11
Potato	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Banana	474,403	1	112,271	1	5,164	0	0	0	356,968	6	0	0	0	0	0	0
Maize	2,172,948	5	1,128,153	5	0	0	56,211	1	0	0	903,000	14	0	0	85,584	9
Sugar	174,612	0	62,429	0	0	0	84,316	1	27,867	0	0	0	0	0	0	0
Beef/buffalo	6,568,624	15	2,070,712	10	688,756	20	173,769	3	30,657	1	3,604,730	57	0	0	0	0
Milk	852,050	2	20,185	0	600,865	18	0	0	0	0	231,000	4	0	0	0	0
Pulses	1,472,804	3	1,014,228	5	343,932	10	0	0	114,644	2	0	0	0	0	0	0
Sweet potato	343,813	1	0	0	0	0	0	0	343,813	6	0	0	0	0	0	0
Wheat	1,099,724	2	36,745	0	326,302	10	696,568	12	0	0	0	0	18,713	20	21,396	2
Palm oil	53,705	0	18,648	0	0	0	0	0	35,057	1	0	0	0	0	0	0
Coconut	1,795,608	4	291,737	1	7,745	0	0	0	1,496,126	25	0	0	0	0	0	0
Coffee	465,979	1	84,542	0	0	0	0	0	381,437	6	0	0	0	0	0	0
Cassava	144,016	0	82,669	0	0	0	0	0	61,347	1	0	0	0	0	0	0
Oranges	120,786	0	81,628	0	0	0	0	0	39,158	1	0	0	0	0	0	0
Soybeans	2,460,385	6	2,010,822	9	83,204	2	0	0	27,734	0	338,625	5	0	0	0	0
Cocoa	539,206	1	36,211	0	0	0	0	0	502,995	8	0	0	0	0	0	0
Rubber	37,296	0	37,296	0	0	0	0	0	0	0	0	0	0	0	0	0
Sheep/goat	1,279,987	3	449,432	2	22,920	1	291,951	5	434,324	7	6,510	0	74,850	80	0	0
Groundnuts	2,048,012	5	1,937,074	9	83,204	2	0	0	27,734	0	0	0	0	0	0	0
Cotton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sorghum	8,056	0	8,056	0	0	0	0	0	0	0	0	0	0	0	0	0
Millet	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wool	1,822,387	4	0	0	0	0	1,822,387	30	0	0	0	0	0	0	0	0
SUB-TOTAL	32,747,376	74	15,958,971	74	3,114,577	92	4,402,579	73	3,879,861	64	5,083,865	80	93,563	100	213,960	21
Commodities NOT included in Priority Assessment to Date																
Fisheries	3,224,829	7	1,604,555	7	0	0	0	0	1,620,274	27	0	0	0	0	0	0
Forestry	3,769,294	9	1,457,786	7	3,206	0	1,063,921	18	6,813	0	899,767	14	0	0	338,431	34
Mungbeans	977,209	2	638,584	3	0	0	0	0	0	0	338,625	5	0	0	0	0
Mangoes	81,628	0	81,628	0	0	0	0	0	0	0	0	0	0	0	0	0
Passionfruit	61,120	1	0	0	0	0	0	0	61,120	1	0	0	0	0	0	0
Fruit/veges	620,067	0	244,887	1	0	0	315,486	5	59,694	1	0	0	0	0	0	0
Kenaf	33,068	0	33,068	0	0	0	0	0	0	0	0	0	0	0	0	0
Taro	51,793	0	0	0	0	0	0	0	51,793	1	0	0	0	0	0	0
Yams	51,793	0	0	0	0	0	0	0	51,793	1	0	0	0	0	0	0
Kava	120,626	0	0	0	0	0	0	0	120,626	2	0	0	0	0	0	0
Pigs	214,378	0	214,378	1	0	0	0	0	0	0	0	0	0	0	0	0
Poultry	1,306,737	3	1,044,373	5	262,364	8	0	0	0	0	0	0	0	0	0	0
Duck	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapeseed	220,100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Indust. Rdwd	0	0	222,606	1	0	0	0	0	194,828	3	0	0	0	0	445,786	45
Non-specific	863,220	2	0	0	0	0	220,100	4	0	0	0	0	0	0	0	0
TOTAL	44,343,238	100	21,500,836	100	3,380,147	100	6,002,086	100	6,046,802	100	6,322,257	100	93,563	100	998,177	100
Regional Percentage		100		48		8		14		14		14		0		2
PAC Guidelines				60		9		10		12		9				-

* acquitted and approved funds to 1991-1992

TABLE 11: ACQUITTED ACIAR RESEARCH EXPENDITURE BY COMMODITY PRIORITY RANKINGS - TOTAL AND CURRENT PROJECTS (PERCENTAGE)

Priority Group		Region									
		South East Asia		South Asia		China		South Pacific and PNG		Africa	
		Total[a]	Current	Total	Current	Total	Current	Total	Current	Total	Current
High	I	36	29	31	38	30	30	11	11	81	80
	II	16	15	58	58	23	22	24	32	0	0
Medium	III	7	5	9	1	28	29	16	19	0	0
	IV	7	12	3	4	0	0	0	0	0	0
Low	V	10	12	0	0	0	0	0	0	0	0
	VI	0	0	0	0	0	0	0	0	0	0
	VII	0	0	0	0	0	0	14	11	0	0
TOTAL - 24 commodities[b]		78	73	100	100	81	81	65	73	81	80
Other Commodities[c]		22	27	-	-	19	19	35	27	19	20
Regional %		54	46	8	9	9	14	13	15	11	15
Original 1985 PAC Guidelines		60	60	9	9	10	10	12	12	9	9

a. Total expenditure refers to both current and completed projects.

b. Refers to expenditure on the commodities included so far in the priority assessment analysis reported earlier.

c. Refers to expenditure on commodities which as yet have not been included in the priority assessment analysis.

so far included. Despite this the information does show that a significant share of funding has been targeted at medium and low priority commodities.

While the information is too aggregative to allow firm conclusions to be drawn, it does suggest that closer consideration of some funding areas is required to determine whether all expenditure is in fact contributing as well as it could be to achievement of ACIAR's economic growth objectives. Another important point is the need to expand the commodity coverage in the priority assessment analysis for regions other than perhaps South Asia.

Although Table 11 provides a summary of how expenditure patterns compare with commodity priority rankings, it does not provide sufficient information to be able to draw conclusions about why these patterns have emerged and whether they are in fact likely to be consistent with ACIAR's objectives. Individual project assessment is most likely required to finally resolve this issue. Disaggregation of the information included in Table 11 can, however, provide some general implications and serve as a guide to which individual programs or projects may warrant closer consideration.

Table 12 provides a commodity breakdown of the information in Table 11. It indicates which commodities have received research attention and which have not. South East Asia can be used to illustrate the type of implications that can be drawn.

Rice has clearly dominated ACIAR's research expenditure in South East Asia, with 35 per cent of regional funds. In addition, of the fifteen commodities in the top three priority rankings, only five have received a significant share (greater than 0.5 per cent) of research expenditure. Sugar and palm oil and kernels have received no research support to-date. On the other hand, of the remaining nine commodities in the lower priority groups, five have received research funding. Groundnuts and soybeans in particular have received significant shares of regional expenditure. The information in Table 3 suggested that groundnut research would need to have 15 to 30 times the cost-reducing effects as priority I commodities to give similar research benefits. To be comparable with group II commodities, 5 to 6 times the cost-reducing effects would be required. In the light of this information it seems relevant to question more closely why research has concentrated on these low priority commodities rather than on some of the higher priority commodities, especially perhaps those that have received little if any funding.

It must be emphasised at this point that this aggregated information should only be used to generate research resource allocation questions and should not be used to provide conclusive answers to these questions. A detailed analysis may reveal that, because of the particular research problem identified the necessary large differences in research impacts are likely to occur. Alternatively, it may be found that research on low priority commodities might be part of a multi-commodity project, some of which are high priority commodities. In the latter case the spillover effects to the low priority commodities are additional benefits to those achieved via the direct effects on the high priority commodities.

Despite the above reservations, if the economic growth objective used in the analysis is considered appropriate for ACIAR, this aggregative

TABLE 12: CUMMULATIVE REGIONAL ACIAR ACQUITTED RESEARCH EXPENDITURE BY COMMODITY PRIORITY RANKING (To March 1988).

COMMODITY PRIORITY GROUP	SOUTH EAST ASIA		SOUTH ASIA		CHINA		S.PACIFIC &PNG		AFRICA		W ASIA N AFRICA		LATIN AMERICA	
	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %
I	Rice	35	Rice	26	Rice	21	Sugar	*	Rice	0	Milk	0	Milk	1
	Potato	*			Milk	0	Banana/plantain	5	Milk	4	Wheat	20	Beef & buffalo	2
					Potato	0	Coffee	5	Soybeans	0	Potato	0	Rice	2
							Palm-total	1	Beef & buffalo	68	Rice	0		
							Cassava	2			Beef & buffalo	0		
Total		35		26		21		13		72		20		
II	Banana/plantain	2	Soybeans	2	Maize	1								
	Maize	5	Wheat	8	Beef & buffalo	3	Coconut	21	Banana/plantain	0	Maize	0	Wheat	3
	Sugar	*	Potato	0	Wheat	12	Potato	0	Cassava	0	Sugar	0	Soybeans	4
	Beef & buffalo	10	Milk	22	Sweet potato	0			Coffee	0	Oranges	0	Potato	5
	Milk	*	Beef & buffalo	18	Soybean	0			Sugar	0			Maize	5
			Pulses	9					Sweet potato	0			Coffee	5
			Sugar	0					Pulses	0			Sugar	6
			Oranges	0					Maize	14			Banana/plantain	6
			Sweet potato	0					Wheat	0			Pulses	7
									Potato	0			Sweet potato	7
Total		17		59		16		21		14		0		
III	Pulses	5	Maize	0	Pulses	0	Rubber	0	Palm-total	0	Wool	0	Sheep/goat meat	9
	Sweet potato	*	Wool	0	Sugar	1	Cocoa	7	Oranges	0	Pulses	0	Wool	9
	Wheat	*	Banana/plantain	*	Wool	30	Sweet potato	6	Wool	0	Soybeans	0	Oranges	10
	Palm-total	*	Sorghum	6	Sheep/goat meat	5			Sheep/goat meat	1	Sheep/goat meat	80	Cassava	11
	Coconut	1	Sheep/goat meat	*					Sorghum	0				
	Coffee	*	Coffee	0					Cocoa	0				
	Cassava	*	Cassava	0					Coconut	0				
	Oranges	*							Rubber	0				
									Groundnut	0				
Total		6		6		36		13		1		80		

TABLE 12: CUMMULATIVE REGIONAL ACIAR ACQUITTED RESEARCH EXPENDITURE BY COMMODITY PRIORITY RANKING (To March 1988) (CONT').

COMMODITY PRIORITY GROUP	SOUTH EAST ASIA		SOUTH ASIA		CHINA		S.PACIFIC &PNG		AFRICA		W ASIA N AFRICA		LATIN AMERICA	
	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Expenditure %	Commodity Ranking	Relative Benefits
IV	Soybeans	6	Coconut	*	Oranges	0					Sweet potato	0	Sorghum	16
	Cocoa	*	Cottonseed	0	Sorghum	0					Cottonseed	0	Coconut	20
	Rubber	*	Groundnut	2	Banana/plantain	0							Palm-total	21
					Cotton	0							Cocoa	22
					Coffee	0								
Total		6		2		0						0		
V	Sheep/goat meat	2	Rubber	0	Cassava	0			Millet	0	Sorghum	0	Groundnut	32
	Groundnut	8	Millet	0	Groundnut	0			Cottonseed	0	Banana/plantain	0	Rubber	35
	Cottonseed	0			Palm-total	0							Cottonseed	37
Total		10		0		0				0		0		
VI	Sorghum	*			Millet	0					Groundnut	0	Millet	92
	Millet	0			Rubber	0					Millet	0		
Total		0				0						0		
VII	Wool	0	Cocoa	0	Cocoa	0	Wool	0			Coconut	0		
			Palm-total	0	Coconut	0	Wheat	0			Rubber	0		
							Soybeans	4			Cocoa	0		
							Sorghum	0			Coffee	0		
							Sheep/goat meat	6			Cassava	0		
							Rice	0			Palm-total	0		
							Pulses	3						
							Oranges	1						
							Millet	0						
							Milk	0						
							Maize	0						
							Groundnut	1						
							Cottonseed	0						
							Beef & buffalo	1						
Total		0		0		0		16				0		
SUBTOTAL - 24 COMMODITIES		74		93		73		63		87		100		
OTHER COMMODITIES [b]		26		7		27		37		13		-		
REGIONAL %		53		7		11		13		12		*		
ORIGINAL 1985 PAC GUIDELINES		60		9		10		12		9		-		

* Less than 0.5 per cent.
a,b. See Table 9.

information does provide some guidance as to possible areas for emphasis in new project development.

8.3 ACIAR Program Expenditure Patterns

Before individual project assessments are undertaken it is possible to disaggregate the cumulative ACIAR expenditure information to provide indications of some important areas to concentrate on. Possibilities include: analysis of expenditure for only current projects rather than all past and present projects; separation of expenditure for single-commodity and multiple commodity projects; and separation of expenditure on a program basis. In this section expenditure for each program area in ACIAR is used to illustrate the type of disaggregated information that can be produced to support research decision-making.

Table 13 lists the same information as provided for South East Asia in Table 11 but it is divided into the eleven research programs used in ACIAR. This information can be used to indicate whether the total ACIAR priority/expenditure pattern is reflected in each research program or whether there are significant differences among programs. Table 13 indicates that programs can be separated into two groups in the way they have emphasised different commodity priorities.

Ignoring fisheries and forestry research, as they are not yet included in the commodity analysis, six of the nine programs have allocated virtually all of their research funds to high priority commodity research in South East Asia. The remaining three program areas: plant improvement, plant nutrition, and soils, water and land use management have allocated significant shares of their resources to medium and low priority commodity research.

As is usually the case with this type of analysis, the information raises more questions than it answers. It indicates that there are clear differences between ACIAR program areas. Is this due to the different nature of research problems between program areas for the same group of commodities? For example, is the potential impact of plant improvement research on low priority commodities substantially different than for the high priority commodities? Why is the potential impact likely to be higher for other program research problems? Are high priority commodities well researched by other international institutions for some program areas but not others, thus influencing the availability of researchable problems? If so does this justify funding low priority commodity research in those programs or should funds be gradually shifted to other programs?

To answer these and many other questions that arise from this type of information further disaggregated analysis at the project level is required.

9. INFORMATION TO ASSIST IN PROJECT SELECTION

ACIAR has a detailed and rigorous project development mechanism based on its research programs (see Attachments A and B). Program Coordinators identify important collaborative research themes and develop project proposals to address them. These proposals are presented to the BOM for

TABLE 13: ACIAR PROGRAM EXPENDITURE PATTERNS FOR SOUTH EAST ASIA AS OF MARCH 1988 (percentages).

PRIORITY GROUP		ANIMAL HEALTH	ANIMAL PRODUCTION	FARMING SYSTEMS	FISHERIES	FORESTRY	PLANT IMPROVEMENT	PLANT NUTRITION	PLANT PROTECTION	POST HARVEST	SOCIO-ECONOMICS	SOILS, WATER & LAND USE MANAGEMENT
HIGH	I	22	62	100	-	-	28	11	61	56	62	38
	II	37	34	0	-	-	6	24	0	19	2	11
MEDIUM	III	0	0	0	-	-	40	4	13	1	1	16
	IV	0	0	0	-	-	8	30	0	1	7	10
LOW	V	2	2	0	-	-	20	28	1	0	0	10
	VI	0	0	0	-	-	0	0	0	0	0	0
	VII	0	0	0	-	-	0	0	0	0	0	0
TOTAL - 24 COMMODITIES [a]		62	99	100	-	-	96	96	75	78	73	85
OTHER COMMODITIES [b]		38	1	-	100	100	4	4	25	22	27	15
REGIONAL SHARE		7	10	1	6	3	16	17	5	25	6	2

a See Table 10
b See Table 10

approval at both the preliminary and final stages of development. In-house and external peer reviews are a crucial component of this process.

ACIAR receives an annual budget appropriation from the Government and must contain the set of projects funded within this budget. Although projects are developed and approved by the BOM throughout the year, once a year a decision must be made by the BOM as to which subset of approved projects should receive funding. In all but the very early years of ACIAR more projects were available to fund than the annual budget would allow, even after projects were screened to ensure their scientific excellence, the Australian comparative advantage in research on the theme, their relevance to Australia, and that they reflect the collaborative mandate of ACIAR. Therefore choices of those to fund could not be based on these criteria alone as these represent necessary but not sufficient conditions.

For the May, 1988 ACIAR budget discussions a more systematic information system was developed to provide background for these funding allocation decisions. The commodity priority groupings were included as an important component. Table 14 illustrates the type of information that was provided as a basis for discussion. Columns 1 to 7 of this table provide background information for each project considered for funding. This includes a brief description, the program area and the commodities most likely to be influenced by resulting technology.

Columns 8 to 12 contain criteria indicating how well ACIAR's objectives and operating constraints are met by each of the prospective projects. Column 8 indicates into which regional priority group the primary commodity influenced by the project falls. These are taken from Table 3. Column 9 is incorporated as a check indicator of whether it is felt that the project involves a research issue which is appropriate for public sector financing. It is important, especially in the case of developing countries, to ensure that public research investment does not act to crowd-out the development of an effective private research and development sector of the economy. It has been argued that many agricultural research possibilities have "public good" characteristics or include external benefits which could result in underinvestment in this activity by the private sector. However, not all agricultural research fits into these categories, which requires care by those making public sector investment decisions.

Columns 10 and 11 of Table 14 provide an assessment of the impact of each project on ACIAR's regional and program balance. The regional balance allows for exclusion of projects which, if funded, might result in a significant divergence from the PAC regional percentage guidelines. ACIAR's research management structure relies on a program emphasis. Program Coordinators manage all projects in a particular discipline and or/theme. The program balance constraint ensures that each coordinator is not being expected to manage too many projects and hence reduce his or her effectiveness. In addition, at least in the short term, Program Coordinators with a small number of projects might have a project given preference to ensure effective use of the Coordinator's time. In the longer term, if a program continues to develop projects which have impacts on low priority commodities or do not satisfy other criteria of importance to ACIAR's objectives, then allocation of funding for that program may need to be reconsidered. As an operational guide given its current staffing

TABLE 14: ACIAR PROJECTS FOR 1988/89 BUDGET DISCUSSIONS

Project Number (1)	Project Type (2)	Description (3)	Program Area (4)	Region (5)	Commodity Primary (6)	Commodity Other (7)	Priority Grouping (8)	Public Sector (9)	Regional Balance (10)	Program Balance (11)	Executive Judgement (12)	Funding 1988/89 (13)	Cummulative Funding (14)
South Asia													
8337	Replacement	Wheat Rust	Cereals	S Asia	1 Wheat		2					200000	200000
8523	New	Self Medicated Blocks	Animal Science	S Asia	1 Milk		2					309000	509000
8817	Replacement	Straw Utilization India NDDB	Animal Science	S Asia	1 Milk		2					100000	609000
8366	New	Zinc Deficiency in India/Australia	Plant Nutrition	S Asia	1 Sorghum	Wheat	3					210753	819753
8619	New	Forage Scrub - Saline Soil Pakistan	Forages	S Asia	1 Sheep/Goat		3					157539	977292
South East Asia													
8814	Replacement	Plant Viruses	Plant Protection	S E Asia	2 Rice	Pulses	1					105977	105977
8730	Replacement	Rice Flooding	Cereals	S E Asia	2 Rice		1					60000	165977
?	New	Moisture and Fumigant Movement	Postharvest	S E Asia	2 Rice	Maize	1					31207	197184
8806	New	Fungi and Mycotoxins	Postharvest	S E Asia	2 Rice	Maize,Wheat	1					192662	389846
?	New	Storage Design	Postharvest	S E Asia	2 Rice	Maize,Wheat	1					37609	427455
8822	New	Rural Income & Employment Indonesia	Socieconomic	S E Asia	2 Rice		1					35000	462455
8800	Replacement	Nitrogen Fixation in Legumes	Plant Nutrition	S E Asia	2 Rice	Pulses,Beef/buff	1					201611	664066
8517	Replacement	Improvement of Urea use in Rice	Plant Nutrition	S E Asia	2 Rice		1					25000	689066
8804	Replacement	Sulfur and Phosphorus in Tropics	Plant Nutrition	S E Asia	2 Maize	Pulses,Rice	3					240000	929066
?	Replacement	Postharvest Tropical Fruit	Postharvest	S E Asia	2 Banana	Mango	3					80000	1009066
8810	Replacement	Feed Strategies Thailand	Animal Science	S E Asia	2 Beef/Buffalo		5					150000	1159066
?	New	Modelling	Food Legume	S E Asia	2 Pulses	Soybean	5					50000	1209066
8363	Replacement	Shrub Legumes for Infertile Soils	Forages	S E Asia	2 Beef/Buffalo	Sheep/Goat,Rice	5					116500	1325566
8527	Replacement	The S E Asia Forage R&D Program	Forages	S E Asia	2 Beef/Buffalo	Sheep/Goat,Rice	5					120000	1445566
?	New	Seed Technology	Food Legume	S E Asia	2 Soybeans	Groundnut	6					50000	1495566
8419	Replacement	Peanut Improvement	Food Legume	S E Asia	2 Groundnut		6					190000	1685566
?	New	Anthracnose - Thailand	Plant Protection	S E Asia	2 Soybeans		6					50000	1735566
8405	Replacement	Soy /Mungbean Improvement	Food Legume	S E Asia	2 Soybean	Pulses	6					100000	1835566
?	New	Integrated Pest Management	Plant Protection	S E Asia	2 Soybeans	Pulses	6					50000	1885566
8639	New	Survival	Fisheries	S E Asia	2 Fisheries		na					70000	1955566
8545	New	Stock Assessment	Fisheries	S E Asia	2 Fisheries		na					75000	2030566
8641	New	Baramundi Nutrition	Fisheries	S E Asia	2 Fisheries		na					70000	2100566
	New	Baramundi	Fisheries	S E Asia	2 Fisheries		na					170000	2270566
8643	New	Baramundi Diseases	Fisheries	S E Asia	2 Fisheries		na					70000	2340566
China													
8379	Replacement	Wheat Biotechnology	Cereals	China	3 Wheat		3					250966	250966
8451	Replacement	Nematodes - China	Plant Protection	China	3 Sugar	Horticulture	4					75000	325966
?	New	Hydatids in China	Animal Science	China	3 Wool		6					50000	375966
8811	New	Economics of Wool In China	Socieconomic	China	3 Wool		6					75000	450966
?	New	Citrus China	Horticultural	China	3 Oranges		6					60000	510966
8469	Replacement	Rapeseed Improvement	Food Legume	China	3 Rapeseed		8					45000	555966
South Pacific													
8824	New	Farming System in PNG	Farming Systems	S Pacific	4 Banana	Coconut,Sweet Pota	1					30000	30000
?	Replacement	South Pacific Biocontrol	Plant Protection	S Pacific	4 Coconut	Sweet Potato	1					250000	280000
8403	Replacement	Coconut Diseases	Horticultural	S E Asia/	4 Coconut		2					75000	355000
8433	Replacement	Sweet Potato	Horticultural	S Pacific	4 Sweet Potato		2					194212	549212
8429	New	Bees in S Pacific/Thailand	Animal Science	S Pacific	4 Bees/Honey		na					40000	589212
8823	New	Economics of Clams	Socieconomic	S Pacific	4 Clam		na					35000	624212
8820	New	Crocodile Diseases	Animal Science	S Pacific	4 Crocodile		na					60000	684212
8733	Replacement	Clams	Fisheries	S Pacific	4 Clams		na					300000	984212
8809	Replacement	?	Forestry		8 Forestry		8					137200	1121412
8808	Replacement	?	Forestry		8 Forestry		8					435000	1556412

na not analysed

profile, the Centre has decided from experience each Coordinator could be expected to manage 10-12% of ACIAR's research portfolio. This implies $1.2-1.5 million annually, or 9-12 projects.

The final criteria in column 12 explicitly recognizes that ultimately the decisions on project funding rest with the ACIAR executive and Board. Information in this column would indicate whether a project has some special features which make it important to fund, even if not satisfying ACIAR's economic objectives or other decision-making criteria.

The particular advantages of having an assessment of the potential relative economic benefits of research on different commodities available when making final judgements on project priorities are that decision-makers:

(i) can if they choose, utilise one consistent criteria to rank projects or, if they prefer to use other criteria on an ad hoc basis, they

(ii) are required to clearly specify the rationale for the particular portfolio selected which, if different from one based upon estimated economic impact, enables an assessment of the likely opportunity cost of the alternatives, and

(iii) makes clear on what basis each project ought to be evaluated and reviewed when they have been completed.

Columns 13 and 14 contain the first year's budget for each project and the cumulative total, starting with the highest priority commodity projects to the lowest.

Within Table 14 projects are assembled into several sections. The first is by geographical regions - these are provided by the PAC guidelines. For each regional grouping, projects are listed according to the priority of the primary commodity influenced by the project. Where applicable, sub-groups of high (I to III) and low (IV to VI) priority projects are separated. At this stage not all commodities receiving ACIAR research support have been included in the priority assessment. Projects involving these commodities are grouped separately and marked 'na' (not analysed) under the priority grouping.

The May 1988 budget meeting was the first time the information in the form of Table 14 was provided to assist decision-making. At this time the priority grouping measures had been quantified and information regarding existing regional funding balances was available. Determination of the regional balance impact of prospective new projects proved to be more complex than expected so time did not enable quantification of this aspect. For this and the remaining criteria, subjective assessments were made when each project was discussed. As the information system evolves, more detailed quantification of these measures will be provided.

The basic procedure used to select the projects to be recommended to the BOM for funding was as follows: Projects in the highest three priority groupings were discussed briefly (BOM had already approved them in principle). They were recommended for funding for 1988/89 unless timing or other problems required reconsideration. Projects in the lower priority

groups required more detailed discussion of the case for funding; that is, an indication of whether there was some underlying feature which would

indicate a potentially much larger impact than the higher priority projects. Ultimately the projects selected to be recommended to the BOM for funding came from the high priority group, plus some from the 'na' group, which were discussed on a case-by-case basis.

It quickly became apparent that this type of information was required well before this advanced stage of decision-making. It was thus decided to produce a similar analysis as a basis for in-house-review meetings. This would avoid the situation of developing projects to the final proposal stage before it was evident that they did not satisfy ACIAR objectives very well in the first place. It was also felt that information regarding criteria included in columns 9 to 13 could best be generated during these early stages. Table 15 contains the information provided during the June 1988 in-house-review meetings.

As should be clear from the discussion, this information system is still evolving and the most appropriate type and form of information to include is still to be determined. This will hopefully occur as we continue to gain experience in the various review and planning discussions.

10. CONCLUSIONS

In this paper the following issues have been addressed and conclusions drawn:

(i) A methodology has been developed which provides a consistent means of measuring the potential economic impact of alternative research strategies.

(ii) The methodology has been applied to a set of 24 important agricultural commodities. Estimates of the potential impact of research on these commodities have been used to suggest research priority rankings for them.

(iii) It has been emphasised that the research priorities so determined are critically dependent on ACIAR's research objectives. For this analysis ACIAR's objective was assumed to be maximisation of international economic gains from research, where improved welfare of one group was not considered to be more important than any other.

(iv) The cumulative and current research expenditure by ACIAR was categorised on a commodity and country basis and expenditure patterns compared with the suggested regional and commodity research priority rankings.

(v) The preliminary information generated by the above analysis indicated a major emphasis on high priority commodity research by ACIAR. However, a significant share has been devoted to lower priority commodity research. Patterns within program areas were also shown to differ significantly.

This paper represents only the first stage in the development of an information system to assist in research resource allocation decision-making within ACIAR. It is crucial therefore that decision-makers at all levels provide reactions to the information generated. These should cover two main areas:

(i) The appropriateness of some of the assumptions and data used. Of primary importance is agreement on and clear articulation of ACIAR's objectives. While maximisation of international economic benefits from research has been used in this paper, recent discussion suggests benefits to each of the seven geographic regions of primary interest to ACIAR considered separately would be more appropriate. The mutual benefits accruing to Australia are also looming larger as an explicit objective.

(ii) Is the type and form of the summary information generated to this point appropriate?

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ATTACHMENT A

CRITERIA AND CONSIDERATIONS IN FORMULATING ACIAR PROJECTS AND PROGRAMS

CRITERIA	CONSIDERATIONS (WITH SOME EXAMPLES)
Developing country priorities	- Government policies . National welfare gains (eg. choose sectors where economic payoff is likely to be greatest) . Rural employment . Import substitution . Equity . Focus on particular regions eg. Eastern Indonesia . Institutional/manpower focus eg. focus on an institution which has been neglected by other agencies . Crop diversification - Capacity of research institution to participate and availability of resources
Australian comparative advantage and priority	- Research capability in Australia (equipment/human capital) - Priority to Australian agriculture and likely benefits - Capacity of Australian scientists/institutions eg. Australian institution may be overcommitted on domestically oriented research - Commodity and trade policy e.g. institute may research a commodity (e.g. sugar) for which trade and competition may preclude Australian involvement

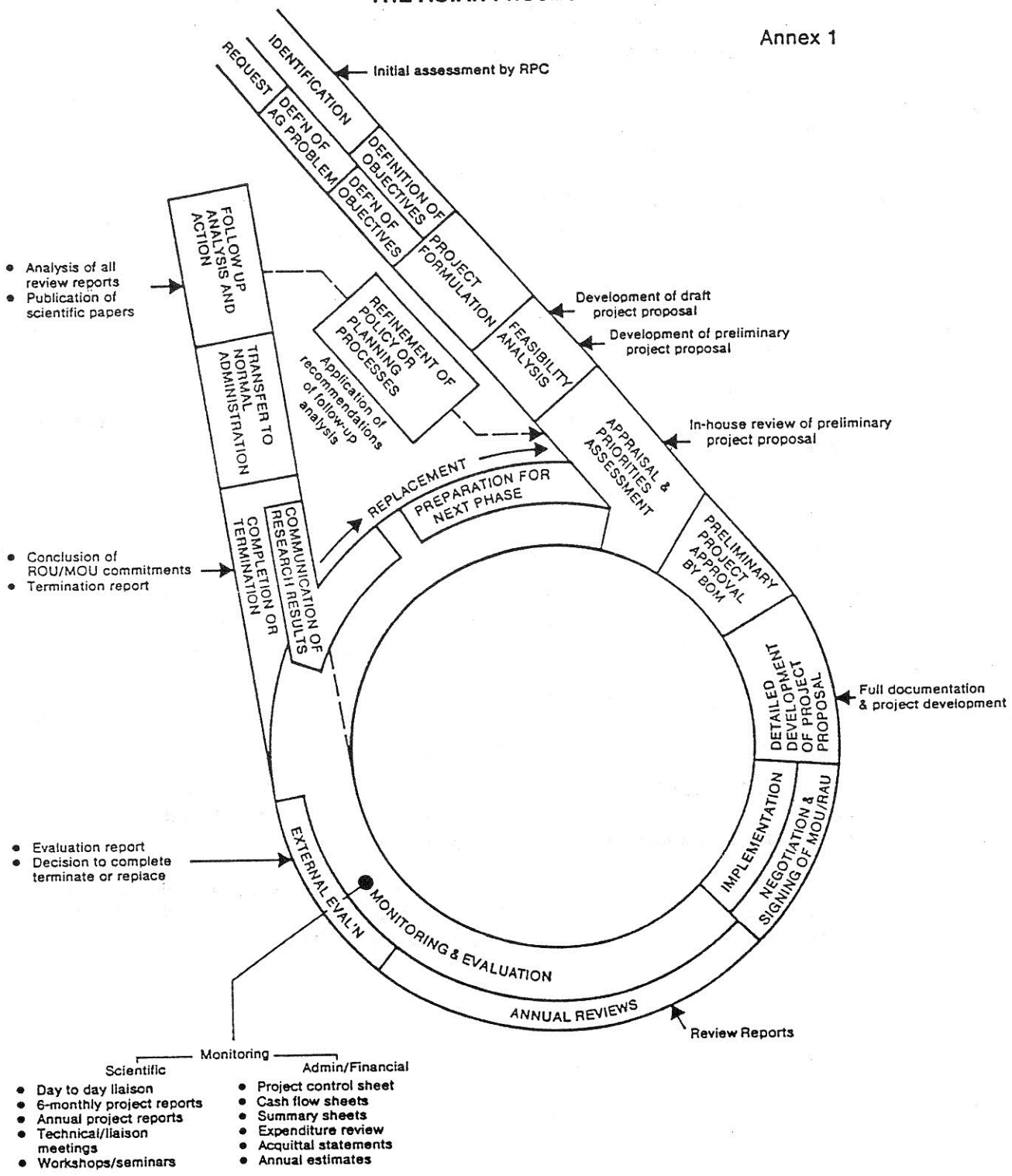
CRITERIA	CONSIDERATIONS (WITH SOME EXAMPLES)
Australian foreign policy (Strategic Humanitarian Commercial)	- Strategic importance - Policy may preclude involvement with particular countries eg. Indochinese countries - Regional focus on neighbouring countries - Possibility of enhancing trade opportunities - Adequacy of Australian representation - Aid focus on basic human needs - Enhancing support of disadvantaged groups eg. focus on role of women in agriculture and agricultural science
Resource/Environmental	- Emphasis on sustainability of agricultural development/technologies eg. role of multipurpose trees in soil stabilisation - Reducing pollution of the agricultural environment eg. biological control of crop pests
Public vs private sector	- Emphasize research which maximizes public good and does not compete with private sector research
Time frame	- Balance between projects with long term research requirements vs those having shorter time horizons eg. need for some short term payoffs to enhance ACIAR's public relations/support
Chance of success	- Minimize risk of project failure through over ambitious goal-setting - Undertake a few risky projects with high potential payoffs and spillovers

CRITERIA	CONSIDERATIONS (WITH SOME EXAMPLES)
International coordination	- Avoid overlap with other funding agencies eg. avoid overcommitting "popular" developing country scientists - Identify gaps in programs of IARCs e.g. consult with IRRI to find gaps in very extensive NARS/IRRI rice research program in Asia
ACIAR coordination	- Develop project groupings around major thrusts to create critical mass eg. post-harvest grains, food legumes, biological nitrogen fixation - Spread coordination workload across programs - Avoid isolated one-off projects
Small input large outputs ("catalytic effect")	- Prospects for generalising and extrapolation to other regions

Attachment B

THE ACIAR PROJECT MANAGEMENT CYCLE

Annex 1



PAPERS IN ACIAR/ISNAR PROJECT PAPER SERIES.

Davis J. S. and J.G. Ryan, "Priority Assessment in Agricultural Research: International and National Perspectives" ACIAR/ISNAR **Project Paper No 1**, January 1987.

Davis Jeff, "Evaluation of Research and Priority Setting: A Preliminary Application to Philippines Agriculture" ACIAR/ISNAR **Project Paper No 2**, January 1987.

Davis Jeff, "Evaluation of Research and Priority Setting: A Preliminary Application to Papua New Guinea Agriculture", ACIAR/ISNAR **Project Paper No 3**, March 1987.

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Davis J. S. and J.G. Ryan, "Institutionalisation of Agricultural Research Priority Assessment: An Application", ACIAR/ISNAR **Project Paper No 5**, June 1987.

Norton George W., "Priority Setting Methods for Agricultural Research: Research Experience in the Dominican Republic Ecuador and Uruguay", ACIAR/ISNAR **Project Paper No 6**, June 1987.

Davis Jeff, "Evaluation of Research and Priority Setting: A Preliminary Application to Agriculture in Thailand", ACIAR/ISNAR **Project Paper No 7**, July 1987.

Davis J.S. and J.G. Ryan, "Evaluation of and Priority Setting for Agricultural Research: Methodology and a Preliminary Application for China", ACIAR/ISNAR **Project Paper No 8**, October 1987.

Antony, G.,G.Y. Kauzi, D.W. Loh and J.R. Anderson, "Returns to Cocoa Research 1965 to 1980 in Papua New Guinea", ACIAR/ISNAR **Project Paper No 9**, September 1988. **PNG Country Study**.

Antony, G.,G.Y. Kauzi, and R.N.B. Pryor, "Returns to Research on Insect Pollination of Oil Palm in Papua New Guinea", ACIAR/ISNAR **Project Paper No 10**, September 1988. **PNG Country Study**.