



Impact Evaluation of RIRDC's Established Industries Program

An Overview of All Projects - Stage 1
(99/90)

**A report for the Rural Industries Research
and Development Corporation**

by Jenny Gordon and Lee Davis
Centre for International Economics

September 1999
RIRDC Publication No 99/90

© 1999 Rural Industries Research and Development Corporation.
All rights reserved.

ISBN 0 642 57910 5
ISSN 1440-6845

Impact Evaluation of RIRDC's Established Industries Program – An Overview of all Projects – Stage 1

Publication no. 99/99/90

The views expressed and the conclusions reached in this publication are those of the author and not necessarily those of persons consulted. RIRDC shall not be responsible in any way whatsoever to any person who relies in whole or in part on the contents of this report.

This publication is copyright. However, RIRDC encourages wide dissemination of its research, providing the Corporation is clearly acknowledged. For any other enquiries concerning reproduction, contact the Publications Manager on phone 02 6272 3186.

Researcher Contact Details

Centre for International Economics
Ian Potter House
Cnr Marcus Clarke St & Edinburgh Ave
GPO Box 2203
CANBERRA ACT 2601

Phone: 02 6248 6699
Fax: 02 6247 7484
Email: cie@intecon.com.au
Website: <http://www.intecon.com.au>

RIRDC Contact Details

Rural Industries Research and Development Corporation
Level 1, AMA House
42 Macquarie Street
BARTON ACT 2600
PO Box 4776
KINGSTON ACT 2604

Phone: 02 6272 4539
Fax: 02 6272 5877
Email: rirdc@rirdc.gov.au
Website: <http://www.rirdc.gov.au>

Published in September 1999
Printed on environmentally friendly paper by Canprint

Foreword

Good selection and management of R&D — at the project, program and portfolio level — requires good information. This report provides an overview of the Established Industry Program. It forms part of the overall evaluation program for RIRDC, and follows on from a similar report on the Emerging Industry Program undertaken in 1998. The second stage to this evaluation is eight detailed benefit–cost assessments of project sets selected from those identified in this report.

The report provides a brief history of the projects that have been completed in each program. As far as possible, the inputs and outputs of each project have been identified. The projects are presented as project sets, relating projects by common outcomes — as well as by direct links. In many cases there is a clear progression of projects — from identification of potential to undertaking the detailed development — and, in a few cases, extension to promote adoption.

An initial assessment of the likely outcomes of the project sets was also undertaken. The assessment drew on the knowledge of the program managers and advisory committee members. There were significant differences between programs on what constituted a high return, but the process was designed to be educating as well as provide guidance to the reader of the type of return that the project might deliver. Overall, the returns are expected to be good in all programs.

Apart from an indication of returns to the programs, the initial assessment highlighted some issues for future consideration. One issue is the project cycle and the impact of that cycle on the pay-off. Poor projects in the second development stage can be avoided with better identification in the first. Similarly, some first stage projects may not have proceeded if the second stage feasibility had been better assessed. It also highlighted the need to complete the cycle and the cost of changing direction when there were no intrinsic reasons for doing so. Another issue was the detailed knowledge of market structure required in order to assess the returns. Lack of knowledge of how R&D would impact on the market makes decisions about project selection difficult. This report is a part of building the knowledge base to improve such decision making.

This report (part one of a two part series), a new addition to RIRDCs diverse range of almost 400 research publications, forms part of our Global Competitiveness R&D program, which aims to identify important impediments to the development of a globally competitive Australian agricultural sector and support research that will lead to options and strategies that will remove these impediments.

Most of these 400 publications are available for viewing, downloading or purchasing online through our website:

- downloads at www.rirdc.gov.au/reports/Index.htm
- purchases at www.rirdc.gov.au/pub/cat/contents.html

Peter Core

Managing Director

Rural Industries Research and Development Corporation

Contents

Foreword	iii
Executive summary	vi
1. Introduction	1
Motivation for this study	1
Guidelines for initial assessment	2
Guidelines for assessing the impact	11
2. Chicken Meat Program	15
Overview	15
Project sets and initial evaluations	19
3. Egg Program	37
Overview	37
Project sets and initial evaluations	42
Evaluation	54
Recommendations for evaluation	58
4. Honeybee Program	60
Overview	60
Project sets and initial evaluations	65
5. Rice Industry Program	87
Overview	87
Project sets and initial evaluation	92
Evaluation	111
6. Horsemeat Industry Program	120
Overview	120
Project sets and initial evaluation	124
Evaluation	138
7. Fodder Industry Program	145
Overview	145
Project sets and initial evaluation	147
Evaluation	153
8. Pasture Seeds Program	156
Overview	156
List of projects	158
Project sets and initial evaluation	160
Evaluation	168

Executive summary

This report provides an overview of all completed projects in the established industry portfolio. The purpose is to:

- provide a reference source summarising the key outputs of each project and demonstrating the links between projects and the likely area — often a five year plan objective — to be effected; and
- make an initial assessment of the likely outcome of each project, or set of projects, to develop a sense of the type of projects and the areas of research with greatest potential for high returns.

A summary of projects in the Established Industry Programs

The review covered 431 projects in eight programs. Considerable effort was made to develop a complete list of projects and record the funding. However, in some cases very little information about the project was available. Projects in the chicken meat and egg program are only summarised from 1995 as this is when the R&D Councils became advisory committees. A summary of the number of projects in each program and funding information is provided in table 1.

Projects were mapped into logical sets for evaluation based on the impact they would be likely to have if successful in achieving their objectives. At the most aggregate level projects were categorised by whether their initial impact was in on-farm production, shipping and handling, processing or marketing. Projects focusing on industry development were assumed to have broad impacts across all elements in the industry. The vast majority of projects undertaken focused on on-farm production. The main exceptions are honeybees, where a number of projects concentrated on development of new products (processing), and fodder crops, where treatment prior to bailing hay was classed as processing. Table 2 demonstrates the division of projects into each level 1 category by volume and value.

1 Overview of portfolio

	<i>Number of projects identified</i>	<i>Total funding</i>	<i>RIRDC funding</i>	<i>Share RIRDC</i>
		\$million	\$	%
Chicken meat	57	8.74	3.92	45
Eggs	51	3.49	1.95	56
Honeybees	79	4.81	2.29	48
Rice	114	37.01	15.10	41
Horses	70	8.34	3.35	40
Fodder crops	24	3.92	1.08	27
Pasture seed	36	6.43	3.01	47

Note: Where total funding is not available, but RIRDC funding is, we have used RIRDC funding as an estimate of the total funding. This is the case for fodder crops and pasture seeds.

Source: RIRDC database.

2 Focus area of projects as share of RIRDC funding

	<i>Industry development</i>	<i>On-farm production</i>	<i>Processing</i>	<i>Shipping and handling</i>	<i>Marketing and distribution</i>
	%	%	%	%	%
Chicken meat	11	72	0	0	16
Eggs	17	66	0	0	16
Honeybee	1	70	20	0	9
Rice	10	86	1	3	0
Horses	11	85	4	0	0
Fodder crops	4	41	14	0	41
Pasture seed	1	77	0	0	23

Source: CIE and program managers assessments.

Projects were also defined by the stage of development in the research. Stage I projects are in the identification phase — and generally produce information, skills and/or techniques to be used as inputs into other projects. Often these projects can be considered basic research. Stage II projects are in the development (applied) phase. They aim to deliver a product — new or improved inputs, outputs and/or systems. Stage III projects are extension projects. They generally focus on getting information out to producers and/or consumers, getting adoption rates up and so on. The majority of RIRDC funds are concentrated in stage II projects. The main exception is the horse program (and, to a lesser extent, fodder crops), which can be expected as ‘newer’ industries. The share in total project numbers and RIRDC funding of projects in each stage are given in table 3.

Initial assessment

Assessments of the value of project outcomes to the relevant industry were provided by program managers — in some programs, committee members were also consulted. The assessments are not comparable across the programs, as in one program an implicit benefit–cost ratio of 3 might be considered to deliver a high net benefit, while in others ‘high’ relates to a benefit–cost ratio of 15. This problem stems partly from the way the questions were asked and partly from the lack of any standard benchmark. A range of values on well known projects to use as benchmarks should be developed to facilitate consistent comparisons across programs. As the database of evaluations improves, and understanding of the factors that determine benefits increases, better comparisons across programs will become possible.

Table 4 summarises the initial assessments by program. All programs appear to have a reasonable share of funds devoted to ‘medium’ and ‘high’ pay-off projects.

3 Share of projects in project cycle

<i>% of RIRDC funding</i>	<i>Share of RIRDC funding %</i>			<i>Share of projects %</i>		
	<i>Stage I</i>	<i>Stage II</i>	<i>Stage III</i>	<i>Stage I</i>	<i>Stage II</i>	<i>Stage III</i>
	%	%	%	%	%	%
Chicken meat	8	72	20	4	68	28
Eggs	8	74	18	10	63	27
Honeybee	6	69	25	9	65	26
Rice	26	65	8	43	50	6
Horses	44	43	13	53	36	11
Fodder crops	39	47	14	54	38	8
Pasture seed	9	86	5	22	72	6

Source: CIE and program manager assessments.

4 Initial assessment of projects returns

	<i>High</i>	<i>Medium</i>	<i>Low</i>	<i>No output</i>	<i>Too early</i>
	%	%	%	%	%
Chicken meat	3	62	4	7	24
Eggs	38	48	2	0	12
Honeybees	11	28	4	8	50
Rice	0	72	6	1	20
Horses	46	24	13	0	18
Fodder crops	7	65	26	0	2
Pasture seed	0	49	18	1	32

Note: Not known is included in no output, and no final output is included in the too early category.

Source: CIE and program manager assessments.

To a large extent, the assessment in table 4 can be considered as an assessment of project outputs, or ‘success’ in achieving their objectives, rather than project outcomes. In developing the assessments it became apparent that in some industries too little is known about the structure of the industry or the relationships along the value chain to be able to assess the likely impact of project outputs. There were not sufficient resources for each project set to be examined in as much depth as the initial assessment warranted. More emphasis on answering the set of guiding questions provided in chapter 1 of this report will improve this process in the future.

The other issue that became apparent in this review is the role of the project cycle. In some cases stage II projects appear misdirected and would have benefited from some previous exploration of the issues. A good example of potential savings is the workshop on rotavirus in the horse program. This stage I project identified that further research on vaccine development would be unlikely to produce a cost-effective vaccine, so no further projects with this objective were funded. The other side to this is the need to continue with certain projects if the earlier ones are to have any returns. For example, research on the biology of rice pests has no immediate payoff, but with additional resources may lead to new, more environmentally friendly approaches to pest management. The initial assessment also revealed that, in some cases, the lack of a stage III type project — either funded by RIRDC or the industry — resulted in low returns. This report should assist in identifying where in the project cycle the R&D is concentrated, and alert researchers and decision makers to the need to think through the full project cycle from the first ‘good idea’ to the final outcome

Introduction

Motivation for this study

Understanding the outcomes of past projects is an essential element in planning research programs and in selecting projects for funding. Too often RIRDC involvement ends with the project and assessment is limited to whether a particular project achieved its particular objectives. For decision making about project selection within programs, and even portfolio allocations across programs, assessment needs to look beyond individual project outputs to overall outcomes.

This report is one in a series of reports reviewing the performance of the portfolios. It undertakes an initial assessment of completed projects in the Established Industry Portfolio. The portfolio has programs in:

- chicken meat
- eggs
- honeybees
- rice
- equine industry
- fodder crops
- pasture seeds.

The purpose of this report is twofold. The first purpose is to improve understanding of research funded to date. The reports provide a historical overview of the projects conducted in each program in the portfolio. The objectives of the programs are described and a framework for understanding the likely impact of the projects developed. Projects are characterised within this framework by their potential impact.

The second purpose is to learn from the outcomes of past projects. A second stage of this study conducts detailed benefit–cost assessments on a number of completed projects. Such detailed assessments provide considerable information on industry and market structure as well as detailed descriptions of the factors that influence the outcomes of projects. However, even an initial assessment of the outcome of the project can be informative. In terms of project and program planning, there are two particular lessons that emerge from this report.

- Outcomes often are the result of a combination of projects rather than a single project. And in some cases relatively small additional funding will yield very large benefits as the results of a series of related projects are mobilised.
- A successful project, in terms of delivering its objectives, does not always deliver large benefits. Benefits depend on the speed with which results are disseminated, the adoption of the results (applicability and capacity to adopt), the leakage of the results to competitors and the market structure. Impacts on other industries and the community should also be factored into the assessment of benefits.

Ideally, program managers and committee members are able to incorporate these elements in making judgements about the outcomes of projects. In some cases, particularly where there is detailed knowledge of the industry, project objectives are developed with all of these elements in mind so a successful project is one that delivers large benefits. But, due to the complexity of the relationships that affect the benefits flowing from a project outputs, this is not always the case. In order to assist program managers and committees to incorporate these elements into decision-making, we develop a set of guidelines in making initial assessments of the outcomes of projects.

Guidelines for initial assessment

Initial assessment goes beyond the success of the project in delivering outputs and involves judging the actual or potential outcome. In many cases it is difficult to identify likely outcomes because of the early stage of research and development (R&D), or because market conditions and/or adoption rates are unknown. Initial assessment inevitably relies on the judgement of program managers. While, for the industry, the most important outcome is the impact on profitability, outcomes in terms of public benefits and impacts on other industries and the environment are also relevant.

The approach is to:

- group projects with a common targeted impact, or joint impacts, into sets for the purposes of evaluating that impact;
- provide information on outputs and other factors that affect the initial assessment of the overall likely net benefit of the project or set of projects;
- with the program manager, and in some cases with input from the R&D committees, assess the likely outcome; and
- assess the complexity of evaluating the impact to indicate the degree of uncertainty in the initial assessment and provide information for selecting project sets for formal evaluation.

Allocating projects to common outcomes

Projects that contribute to a common outcome need to be identified and represented as project sets. Identifying all contributing projects is an important part of initial assessment. Projects are allocated into project sets based on their likely or targeted outcome. Projects with similar outputs are likely to be grouped together. The R&D goals in the five year plans of the various programs provide groupings usually based on common areas of outcome, such as industry development, market development, animal health, nutrition, crop physiology and crop protection. Where feasible, we have used the same classifications, and added detail where appropriate.

Economic evaluation requires identifying what change (if any) is likely to result from applying the outputs of the R&D, and the product or products that experience change. These can be summarised as:

- stage of development — the likelihood of an initial impact;

- product description — what products and markets are impacted; and
- R&D description — the initial impact.

Further analysis of the impact of the change requires assessing how markets are likely to accommodate and adjust. This step of asking what is likely to happen as the R&D effects become assimilated into production and consumption decisions is not undertaken in this report except in a very informal way, basing initial assessments on an understanding of the markets likely to be affected by the change. Chart 1.1 outlines the classification system used in this report. It is described in more detail below.

Stage of development

The stage of development is a reflection of how close the output of the R&D is to actually impacting on prices, quantities, quality, costs and other factors that affect human welfare (producer and consumer surplus).

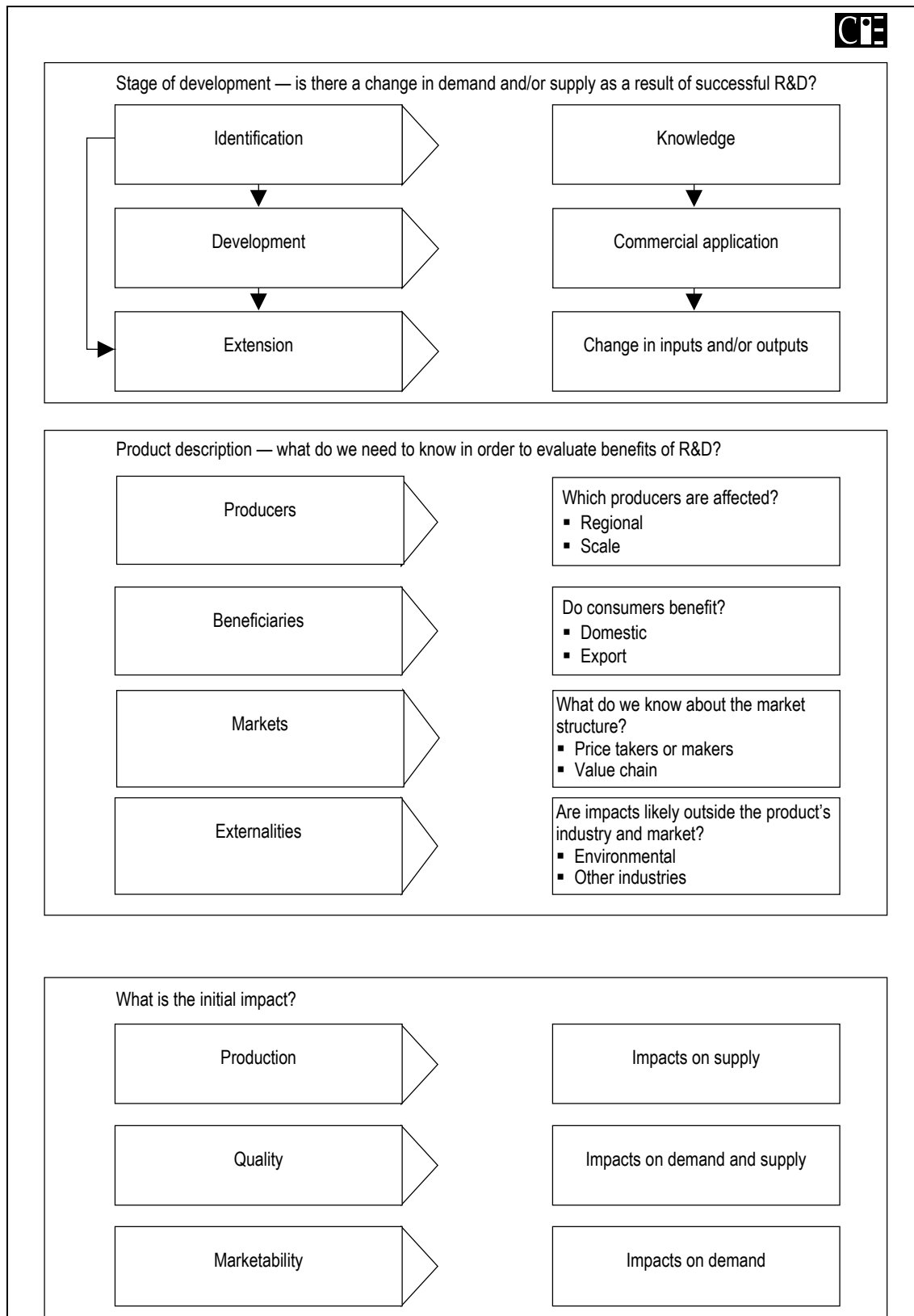
- Stage I is identification of a problem, possible solution, potential market opportunity, etc. It should deliver knowledge and understanding. This may be utilised immediately by the industry, drawn on in strategic development, or it may be an input into other projects. Stage I projects are usually difficult to evaluate except as part of a set.
- Stage II is development of a solution and testing it, accessing the opportunities and so on. The output of this stage can be adopted directly, although further trial may be required for commercial application.
- Stage III is extension that brings the R&D output into commercial use. In many cases extension is an industry activity and is not considered part of the R&D activity. However, the costs involved should still be included in the assessment of net benefit.

It is relatively straightforward to assess the stage of development although it is a matter of judgement. Some projects will encompass all stages, others only one or two. Related projects are identified as part of this process of classifying projects by their stage of development. Project sets often contain a stage I project, and several stage II projects. Where industry associations are active or there is commercial interest, stage III is usually not funded by RIRDC.

Product description

The product description allows the market or markets where the impact of the R&D would arise to be identified. It should also identify the producers who would be directly affected.

0.1 Outline of the classification system



Producers

The product may be a single product such as honey, or it may be products that are joint in production such as honey and pollination services. The effect of the R&D may impact on all products in an industry or even across several industries. Where many products and/or industries are affected by the R&D, it is a more complex task to evaluate the outcome of the R&D. This is particularly true when adjustment in one industry creates a chain of changes across other industries. In such situations the gain to one industry may be offset by losses in other industries. Similarly the benefit to domestic consumers may not be easy to assess, and impacts on the environment are almost by definition difficult to evaluate. Yet, it is important to consider these possible flow-on effects in assessing the impact of R&D.

Not all producers of a product need be impacted by the R&D output. For some, the output may not be relevant, such as with regional production issues.

Market beneficiaries

Products should also imply the potential beneficiaries. For example, it may be that the R&D output would impact on export markets rather than domestic markets so benefits of improved quality or lower prices accrue to foreign consumers. In a program such as the equine program, the diverse nature of the industry means that potential beneficiaries range from pony clubs to race track managers. The more diverse the potential beneficiaries, the more complex any evaluation of the impact of R&D is likely to be.

New and traditional products

The nature of the market for the product influences both the likely impact of any change in supply or demand and the ability to predict that impact. New products provide a particular challenge as often little is known about demand so the impact on price and sales is difficult to assess. In the established industries' portfolio, most of the products are traditional, but there are some new products such as royal jelly and package bees in the honeybee program.

Externalities

The spillovers and externalities that may arise from the R&D are rarely the principle objective, but can turn out to be very valuable outputs. There are three main areas of externalities.

- Environmental impacts of agricultural activities are coming under increasing scrutiny. The principle objective of the R&D may be to reduce the environmental costs of particular agricultural activities to the producer — such costs are onsite impacts. In other cases the impact may be offsite. There are three general categories of offsite impacts:
 - conservation impacts which affect nonuse values such as ecosystem and biodiversity preservation;
 - amenity impacts which affect the value of activities such as recreation, tourism and aesthetic values; and

- infrastructure impacts which affect the repairs, treatment and replacement frequency of infrastructure such as roads and water treatment facilities.
- Transferability of the R&D output to other industries forms an area of potential benefit. An example is the development of a pest control procedure for fennel that has been widely applicable to production in other leafy vegetable industries.
- The R&D activities themselves provide training for researchers and students. They increase knowledge of research methods as well as fundamental understanding. Involvement in R&D also enables access to a much greater pool of research.

While the impacts in these areas are generally difficult to assess, it is important to record whether the R&D outcome has or is likely to have a major impact in any of these areas.

Initial impact of the R&D

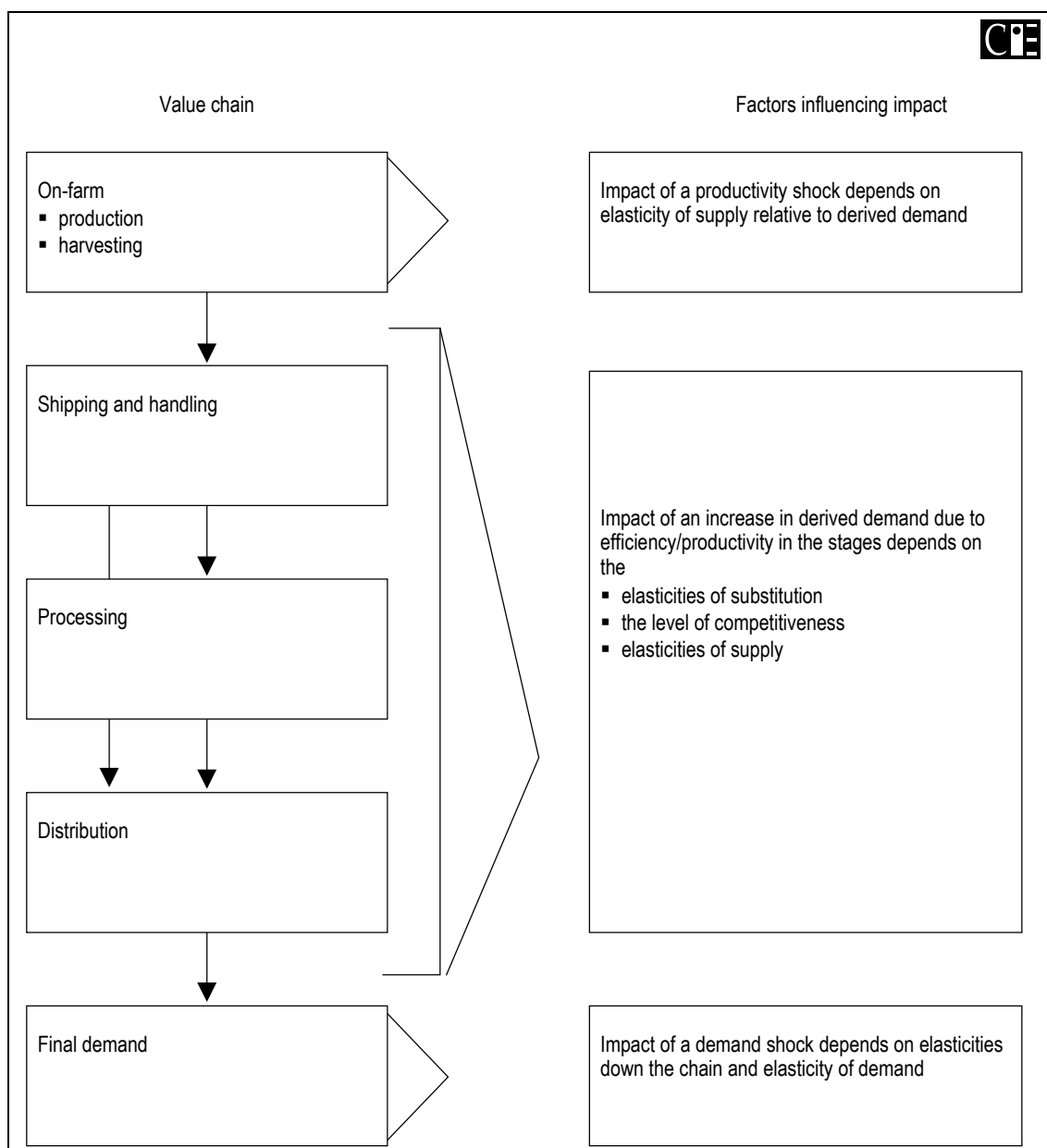
The purpose of the R&D description is to identify the type of shock that results from the R&D output. That is, where in the production, marketing or consumption chain do we expect the R&D to have an effect? For example, in the rice program a project that develops pest control strategies initially affects on-farm production, specifically pest control. The type of shock in this case is a production shock — reduced use of pesticides and a consequent saving in input costs. However, there may also be a shock on the demand side — increased demand arising from an improvement in quality due to reduced chemical residues. The initial impact or shock is felt on-farm, but also in final demand.

To understand the impact of this shock we need to evaluate both the effect of improved productivity on-farm and the impact on demand of the improvement in quality. The impact may be felt at other points in the value chain and may even be quantitatively greater at another point on the value chain. For example, on-farm productivity improvements may benefit processors more than farmers if processing capacity can only be increased at higher marginal costs, and processors are price takers.

The point on the value chain of the initial impact of the R&D for the projects in the established industry portfolio is summarised in the pies charts in the each of the chapters showing the sets of projects that should or could be evaluated together. Chart 1.2 summarises the value chain and the factors that influence the outcomes of the R&D for participants in the value chain, including final consumers. The main points on the value chain are:

- *on-farm production* — for example, a change in inputs into production such as change in water and fertiliser to optimal levels, a change in management system such as a pest management system, a change in genetic material to improve yields or lower production costs, and so on;

0.2 The value chain



- *shipping and handling*, which may occur at several points on the value chain. The most critical point is usually getting the fresh product to the processor or to the market. Quality control, improved treatment in storage, reduced travel time, the institution of delivery guarantees and lower handling costs through better management or new technology all impact on this point in the value chain;
- *processing* is used here to focus on the transformation technology — transforming the fresh product into a new product. Most RIRDC involvement will be at the basic processing end, such as making pellets and compressed bales of hay. For the established industries, RIRDC tends not to be involved in this area; and
- *distribution and marketing*, which is a catch-all to describe marketing from wholesale to retail. Developing a reputation, instilling brand loyalty through purchaser schemes and consumer education about quality are as much a part of distribution as establishing networks

of retail purchasers. RIRDC does not fund many projects in this area in the established industry portfolio, but it is a relevant area in new and emerging industries.

Table 1.3 maps the program five year plan objectives into these categories. Level 1 reflects the point of initial impact on the value chain and is based on the list above. An additional category of industry development is added as this is an area where R&D will tend to impact on all points on the value chain. Level 2 is based on the five year plan objectives. Further levels provide greater detail of the likely target of the R&D in terms of outputs and hence outcomes. Further levels for each program are described in each chapter, but often there is only one, or maybe two, projects at the next level. In the table only rice, the largest program, is defined to four levels. Projects can always be evaluated individually, but often this requires estimating the contribution of other projects to the measured outcome. The idea of the levels in table 1.3 is that we could evaluate sets at level 4, or group them up to level 3 or level 2. For evaluating the impact of projects targeting industry development, the most sensible grouping may be at level 1 as separately identifying the impacts of the projects may be impossible.

0.3 Mapping RIRDC objectives into areas of initial impact

<i>Level 1</i>	<i>Level 2</i>	<i>Level 3</i>	<i>Level 4</i>
Chicken meat			
Industry development	Technology transfer	Enhancing R&D capacity	
		Skills	
On-farm production	Production efficiency and flock health	Knowledge base	
		Physiological efficiency	
		Diseases	
		Nutrition	
	Husbandry		
Distribution and marketing	Community and consumer perceptions	Food safety	
		Environmental expectations	
Eggs			
Industry development	New market		
	Technology transfer		
	Economics		
On-farm production	Production efficiency	Diseases	
		Nutrition	
		Physiology	
	Husbandry and welfare		
Distribution and marketing	Community perceptions	Public health and quality assurance	
	Environmentally sustainable management		

Continued on next page

0.3 Mapping RIRDC objectives into areas of initial impact Continued

<i>Level 1</i>	<i>Level 2</i>	<i>Level 3</i>	<i>Level 4</i>
Honeybees			
On-farm production	Bee husbandry and management		
	Genetic stock		
	Nutrition		
	Disease and pest management		
	Income diversity		
	Resources	Access to flora and native flora	
	Pollination	Integrated pest management	
		Pollination services	
Distribution and marketing	Apiary products		
	Quality assurance		
Rice			
Industry development	Research and development		
	Technology transfer and communication		
On-farm production	Agronomy/crop physiology	Nitrogen-fixing bacteria	
		Crop physiology	
	Crop establishment		
	Crop nutrition	Optimal fertiliser	
	Crop protection - general	Ground-rig spraying	
	Weed control	Herbicide use	
		Biological control	
		Bird control	
	Pest control	Worms and snails	
		Main breeding program	
		Technical developments	
	Varieties	Special issues	Fragrance
			Colour
			Asian quality
			Cold tolerance
			Resistance
			Soyabeans
			Swagman
	Sustainability	Cropping systems	
		Ground water use	

Continued on next page

0.3 Mapping RIRDC objectives into areas of initial impact Continued

<i>Level 1</i>	<i>Level 2</i>	<i>Level 3</i>	<i>Level 4</i>
		Ground preparation	Site selection
			Puddling
		Other	Acidification
Processing	Harvesting		
	Storage		
	On-products		
Horses			
Industry development	R&D decisions and support		
	Communication		
On-farm production	Wastage		
	Exercise related		
	Laminitus		
	Respiratory diseases	Human health related	
		Rhodoccus	
		Strangles	
		Pulmonary haemorrhage	
		Identification of disease for vaccine development	
		Other	
	Other virus and diseases	Worm identification	
		Diseases affecting foals	
		Abortion in mares	
		Anti-inflammatory	
	Tissue and bone repair		
	Reproduction		
	Nutrition	Pasture feed	
		Nutrition requirements	
	Environment		
Processing	Racing		
	Horsemeat	Human health	
Fodder crops			
Industry development	Industry development		
On-farm production	Breeding		
	Other		

Continued on next page

0.3 Mapping RIRDC objectives into areas of initial impact Continued

Level 1	Level 2	Level 3	Level 4
Processing	Preharvest treatment		
Shipping and handling	Shipping		
Distribution	Quality	Health issues	
		Control	
	Marketing		
Pasture seeds			
Industry development		Broadening program	
On-farm production	Management systems	Lucerne	
		Clover and sub-clover	
		Other	
	Disease	Lucerne	
		Clover and sub-clover	
	Pest control	Lucerne	
	Weed control	Legumes	
		Other	
	New products (breeding)	Legumes	
		Cold tolerant medics	
Distribution and marketing	Marketing	Technical and communication	
		Production information to consumers	
	Quality assurance		

Source: Chapters 2 to 8.

Guidelines for assessing the impact

Tracing the initial impact — the shock — to a shift in demand and/or supply is the first step in evaluating the impact on the R&D. The second step is to go back to the product description to build a model of the market(s) likely to be impacted by the R&D.

The next steps in an evaluation are to quantify the initial impact or shock and then apply this shock in the market model to estimate the impact along the value chain. This is done only informally in this report and only where the information is easily available.

What is the initial impact?

Whether demand or supply or both will change with the R&D output depends on the specific output. However, there are a few general guidelines in making an assessment of the impact of the project.

- Changes in on-farm production inputs, systems and outputs shift supply. The change is usually summarised by changes in the unit cost of production. Raising yields, lowering fixed

costs and reducing inputs per unit of output are all aimed at improving production levels or reducing production costs.

- Changes in quality — increasing the average level and/or the consistency of product (and in meeting specified guidelines for quality) — raise the quality. Changes will impact on demand and, if production costs are affected, on supply.
- Changes in shipping and handling and/or processing influence the derived demand for farm product, affecting demand. From the perspective of suppliers of these services these changes will impact on their supply.
- Changes in marketability — raising consumer awareness of products and producer awareness of market opportunities, and R&D aimed at changing consumer attitudes and behaviour — will influence demand.

Additional information for initial assessment

Stage I in the GRDC and RIRDC *Guidelines for Economic Evaluation of R&D* sets out a process for identifying the likely impact of an R&D project based on a set of information about the market — demand and supply — structure.

To provide a flavour of the kind of information that is required to provide such initial assessments — and to assess the complexity of a full evaluation — a number of questions are listed below. In an initial assessment these questions are not answered formally, but they are for program managers and committee members to keep in mind when asked to make an assessment of the outcome of a project or project set.

Product description

These questions are designed to identify the market conditions that affect the impacts of the R&D output. In particular, it is important to understand whether the outputs of the R&D and their adoption will influence prices — of the product of other products, and of inputs. And, if so, how they will influence price.

- What are current prices and production levels?
- Does Australian production (or a region's production, if the R&D is only applicable to the region) influence price?
- If the R&D results in development of a new product or an expansion of existing activity — what did it replace?

R&D description

The main issue in the R&D description is to identify the initial impact or shock brought about by the R&D. There are two parts to this, the output of the R&D and where on the value chain this output is adopted.

The objective and the output of the R&D identify the desired initial impact of the R&D. For example, the initial impact of the R&D could be a new product, improvement in an existing product (which includes greater consistency of quality as well as better quality), lower

production costs through better management, and so on. However, the output may not have a physical representation — for example, in the case of market knowledge — or a strategy for development. These are intermediate outputs. For intermediate outputs to have an effect they have to lead to final outputs.

The types of questions that need to be answered depend in part on the initial impact of the R&D. But they have a similar theme.

- Is there a final output — does something physical (such as quality, quantity or cost) change?
- How does it change? This leads into what does it change — is the impact likely to be on the demand or supply side, or both?
- Is all production equally affected? Is the effect regional? Will different varieties or grades of product be affected in different ways?
- Will competing producers (including foreign producers) adopt the change?

These questions lead into the big question of how to follow through the impact of the change. The point in the value chain (or points) where change occurs will influence this answer if we know something about the structure of the industry. The following questions target this information. They are also important in assessing the distributional impacts of the change.

- How many steps are there in the value chain?
- What are the shares (of final price to the consumer) along the value chain?
- How do these shares adjust to changes along the chain?
- Are there outputs that are likely to impact on people outside the value chain? That is, are there any major externalities likely to be associated with the output?

Stage of R&D

The stage of R&D is very useful in identifying what needs to be included in an evaluation. All projects contributing to a particular initial impact should be included in a project set for evaluation. For example, if a project is at the extension stage, all the costs associated with bringing the output to commercial use — including private costs — should be included in the assessment. It is in this section that a rough judgement about likely adoption (or evidence on actual adoption) needs to be formed and the questions focus on this aspect.

- Are there plans to go to the next stage of R&D?
- Who is funding the next stage?
- How easy or widespread is commercial adoption likely to be or has been?

Another area of questions should seek to establish the counterfactual — that is, the ‘without’ scenario. This has several elements as can be seen by the types of questions to be addressed.

- Would funding for the activity have been forthcoming from another (private) source if not funded by RIRDC?
- Would a lower level of funding have resulted in the same output?
- What would have been the improvement in output for a slightly higher level of funding?

- What activities might have been undertaken if the project had not?

The final area of questions is aimed at providing information about the risk associated with the project. There are several sources of risk.

- Was the project undertaken as a way of dealing with or as insurance against a possible future event? Did such an event arise? Is such an event still expected to arise?
- Did any major changes in market conditions, technology or other factors impacting on the value of the R&D output arise that were not foreseen at the commencement of the project? What was their impact on the value of the R&D output?
- Was the project considered 'high risk' — having a low probability of success — at its commencement? Note that high risk projects, even if they fail to produce an output, are not necessarily bad projects. Identification of 'dry hole' could save considerable resources from being committed in the future. Furthermore, by their nature, very high return projects are often high risk and any portfolio should contain some high risk – high return projects.

Initial assessments

Although this report does not answer any of these questions explicitly, they provide the information that goes into the judgements made in the initial assessments. As far as possible, the expected outcomes of the projects are assessed. In some cases it will be too early to make any judgement as the success of the output is still uncertain. In most cases where the projects are completed, and no other project follows on, the success is known, but there are a few old projects for which no information is readily available.

Given the lack of formal process in making the initial assessment, the assessments of the outcomes of successful projects are limited to low, medium and high. Direct comparisons cannot be made between the programs as the assessments were based on different perceptions on what a good pay-off is. They reflect, however, considerable effort by the program managers to utilise their knowledge of the industry to assess the actual or potential value of the R&D outputs to the industry and, for some projects, the broader community.

1.Chicken Meat Program

Overview

Background

The Australian chicken meat industry today rivals the traditional livestock industries of sheep meat, beef and veal, and pig meat in terms of domestic per capita consumption. Annual production is approximately 560 000 tonnes, with an estimated retail value of A\$2 billion. The industry is anticipated to grow by around 4 per cent per annum over the next few years.

The Australian chicken meat industry is orientated towards the domestic market, with less than 2 per cent of production exported. The majority of product is sold fresh, with 15 per cent of production being sold frozen. Raw product accounts for 50 per cent of the market, raw value added products such as chicken fillets account for 30 per cent, and cooked or further processed products account for 20 per cent. Opportunities for increased exports are believed to lie in the further processed products area (higher value added). The value added segments of the market are growing at between 10 and 20 per cent per annum.

Two large, vertically integrated national companies that have ownership over most stages of the production process dominate the industry. These two companies supply approximately 75 per cent of day old broiler chickens hatched and process about 65 per cent of broilers. There are nine other major meat processors (each accounting for 2 per cent of production) and a number of smaller processors and hatcheries. Market concentration may occur due to economies of scale existing in the chicken growing and processing sectors. Such concentration means that often there is no need for R&D projects to progress beyond stage II. The major companies (Steggles and Ingham) undertake much of the testing and along with smaller companies, the commercialisation of the R&D outputs. R&D on value added products is the responsibility of the industry.

Research and development activities

Joint and/or singular industry – commonwealth government funded research schemes have been in place since 1969. Chicken meat came under the RIRDC portfolio in July 1995, when activities of the Chicken Meat Research and Development Council (CMRDC) were assumed by RIRDC. Prior to 1995, chicken meat research activities were coordinated and administered by the CMRDC.

Previous CMRDCs have focused primarily on the ‘on-farm’ area — in particular, flock health and nutrition. On industry advice, R&D councils and/or committees have stayed out of the areas of new product development, processing and distribution technologies. Industry participants believed that they were best positioned to undertake this type of R&D and capture the commercial benefits.

The current five year R&D plan (1998–2003) addresses eight key areas — flock health, bird nutrition and feed supply, consumer and community preferences, food safety, environmental

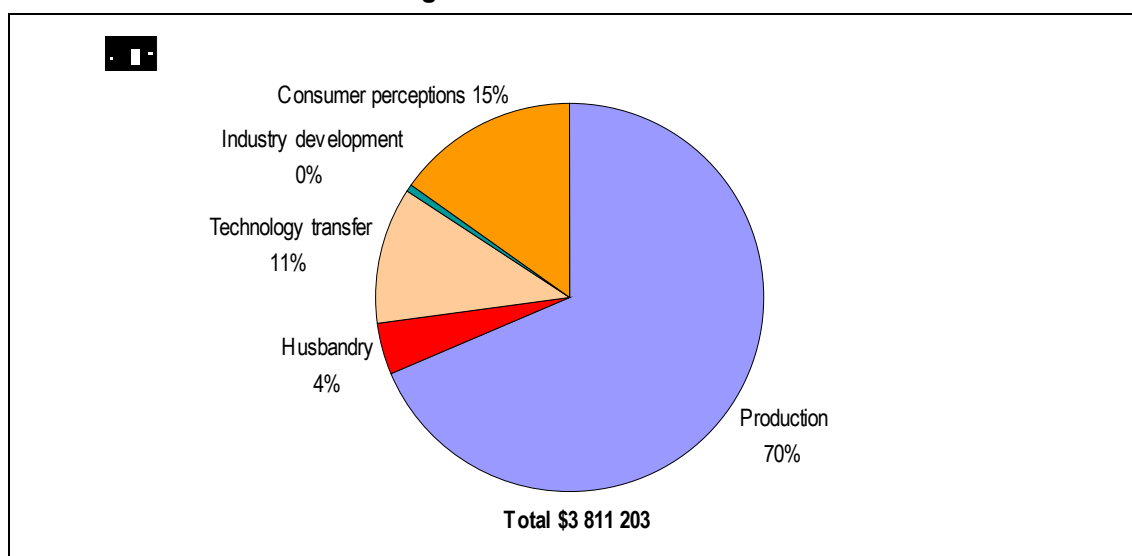
management, animal welfare, industry competitiveness and technology transfer. Due to close similarities between some of these areas (for example, flock health and bird nutrition) five key R&D areas have been identified, which are further disaggregated into 13 research areas. Chicken meat R&D projects have been classified as addressing one or more of the following.

- Production efficiency and flock health:
 - disease diagnosis (DD), treatment and resistance (DTR), and epidemiology (DE);
 - genetic stock (GS);
 - nutrition and utilisation of feed supply (N); and
 - physiological efficiency (P).
- Husbandry:
 - animal welfare (AW); and
 - housing (H).
- Technology transfer:
 - skills (S);
 - knowledge base (KB); and
 - enhancing R&D capability (R&D).
- Industry development:
 - competitiveness (C); and
 - new markets (NM).
- Community and consumer perceptions:
 - food safety (FS); and
 - environmental expectations and management (E).

Expenditure on the chicken meat program during the 1998-99 financial year will be approximately \$1.9 million.

Chart 2.1 summarises the main areas of RIRDC funding by five year RIRDC chicken meat

1.1 Main areas of RIRDC funding



Data source: RIRDC database and program compendiums.

program R&D plan categories. The main area of funding for projects completed since 1995-96 has been production, accounting for 69 per cent of project funding. Within the research area of production, approximately 56 per cent of funding has gone towards projects addressing the area of poultry diseases and 26 per cent to nutrition related projects.

List of projects

Table 2.2 lists the projects that have been identified as being completed during or after 1995-96. This cut off date reflects when the chicken meat program came under the RIRDC portfolio. Projects completed prior to 1995-96 but which provide input(s) to projects completed after 1995-96 are included. Starting and finishing dates are provided where available. The total cost of the project as reported by RIRDC has been included (sum of annual dollar amounts, not discounted) to give an approximation of the relative size of projects. The total project cost includes contributions from industry, research institutions and RIRDC.

1.2 Completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
ANU-1CM	Undergraduate research scholarship: Ms Alleva (immune response to coccidia)		1992-93	5 000	2 500
ANU-2CM	Junior research fellowship: Ms Kerr (immune response to coccidial infections)	1992-93	1995-96	56 475	56 475
ARLF-1CM	Australian Rural Leadership Program	1993-94	1995-96	12 000	12 000
CSJ-2A	Control of ovarian development and function in meat chicken females	1995-96	1997-98	904 050	239 050
CSK-2CM	Growth pattern and reproduction in meat chicken female lines	1991-92	1995-96	698 288	305 266
CSK-3A	Infectious Bursal Disease Virus (IBDV): To determine if current vaccination strategies prevent the emergence of very virulent IBDV	1995-96	1996-97	264 789	124 789
CST-27A	Australian mycotoxin data centre (continued)	1995-96	1997-98	24 000	3 000
CST-2CM	Australian mycotoxin data centre	1991-92	1993-94	3 000	1 500
CSU-14CM	An improved assay for chicken anaemia virus		1995-96	118 758	47 758
DAN-129A	Distant learning materials		1995-96	87 827	37 827
DAN-142A	Production of distant learning materials for the poultry industry – stage III continued	1996-97	1997-98	200 450	82 450
DAN-39CM	Production of trial distant learning materials for the poultry industry	1993-94		55 390	27 695
DAQ-200A	Rapid and specific detection of avian bacterial pathogens	1995-96	1997-98	402 461	120 000
DAQ-212A	Marek's Disease challenge trial 4		1996-97	30 048	28 200
DAQ-226A	Sabbatical studies — Dr Mazhar Khan		1996-97	2 500	2 500
DAQ-28CM	Improved control strategies for Marek's Disease	1993-94	1995-96	82 036	82 036
DAQ-29CM	Characterisation and attenuation of Eimeria spp for use in a living vaccine for Avian coccidiosis	1994-95	1995-96	79 996	79 996
DAQ-30CM	Testing and improving the nutritional value of grain legumes for layers and broilers	1994-95	1996-97	287 461	86 327
DAQ-31CM	Marek's Disease challenge trials	1994-95	1995-96	40 295	12 380
DAS-10CM	Factors influencing the nutritive value of lupins	1994-95	1996-97	256 760	151 769
DAV-115A	Marek's Disease Challenge Virus pathogenicity trial		1995-96	6 150	6 150

Continued on next page

1.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
DAV-125A	Marek's Disease vaccine seed attenuation and challenge trial		1996-97	15 125	15 125
DAV-145A	Three vaccine trials on Marek's Disease	1996-97	1997-98	41 056	41 056
DAV-37CM	Human factors and the productivity and welfare of commercial broiler chickens	1992-93	1995-96	160 284	160 284
DAV-41CM	Assessment of Attenuation of Marek's Disease Vaccine Seeds	1992-93	1994-95		
DAW-66A	Studies into the control of big liver and spleen disease of chickens	1995-96	1996-97	109 173	50 173
DAW-7CM	Investigations into the control of big liver and spleen disease in poultry in Australia	1992-93	1994-95	253 888	126 944
HAS-2A	Chicken meat research and development committee — strategic plan	1996-97	1997-98	15 000	15 000
IMVS-4CM	Epidemiological studies of Salmonella using serotyping, phage typing and plasmid analysis and chromosomal fingerprinting	1991-92	1993-94	337 708	168 854
IMVS-6cm	Epidemiological studies of Salmonella using serotyping, plasmid analysis, chromosomal and PCR analysis	1994-95	1996-97	1165 075	152 075
MS967-01	Commissioned Marek's Disease research		1996-97	4 648	4 648
MS978-11	Support for establishment of the Animal Welfare Research and Training Centre		1997-98	5 000	5 000
MS978-17	Marek's Disease subcommittee		1997-98	250	250
RMIT-1CM	The characterisation of Campylobacter jejuni isolates from chickens and comparison of colonisation and potential pathogenicity	1992-93	1993-94	282 785	143 385
RMIT-3CM	Postgraduate studentship award: Ms Cunningham (chicken anaemia agent)	1993-94	1995-96	35 810	35 810
RMIT-4CM	Development of Marek's Disease Type 1 vaccine				
RMIT-5CM	Differentiation of virulent and avirulent Campylobacter jejuni and Campylobacter coli strains isolated from humans and chickens	1993-94	1996-97	245 000	165 000
TA956-38	Testing Australian IBVD strains for cross reaction with Snyder's monoclonal antibodies and Australian MAb's for cross reaction with classical and very virulent IBVD strains, Holland		1995-96	1 460	1 460
UCS-11A	Postgraduate scholarship award: Ms Coombs	1995-96	1997-98	21 717	21 717
UM-18CM	Avian Colibacillosis in Australia: Improvement in understanding and control	1992-93	1993-94	260 000	130 000
UM-19CM	Junior research fellowship: Ms Ginns (colibacillous in broilers)	1992-93	1995-96	133 200	66 600
UM-20CM	Avian Colibacillosis in Australia: Further improvement in understanding and control		1995-96	112 654	52 654
UMO-10CM	Junior research fellowship: Ms Ruffolo (antigenic studies of the organism causing fowl cholera)	1991-92	1994-95	52 032	26 016
UMO-11CM	Improvement of chicken disease resistance by cytokines	1992-93	1994-95	275 448	137 724
UMO-12CM	Identification of in vivo expressed antigens of Pasteurella multocida	1994-95	1997-98	409 607	259 607
UMO-17A	Improvement of chicken disease resistance by cytokines	1995-96	1997-98	179 934	90 000
UMO-9CM	Towards the Development of an Effective Live Attenuated Vaccine Against Fowl Cholera	1990-91	1993-94		80 000
UNE-54A	Increasing the efficiency of lean tissue deposition in broiler chickens		1996-97	124 966	30 000
UQ-20CM	Postgraduate award: bacterial poultry pathogens	1991-92	1992-93	57 198	28 788
UQ-22CM	A study of ovarian regression in the domestic hen and its effect on performance in layer and broiler flocks	1994-95	1995-96	60 936	9 668
UQ-52A	A comparison of total and digestible amino acids in diets for broilers and layers	1995-96	1997-98	248 162	48 162

Continued on next page

1.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
UQ-64A	The metabolisable energy of 'viscous' and problem grains measured at two sites and methods of prediction of grain samples likely to respond to enzyme additions	1996-97	1997-98	125 651	16 000
US-60CM	Amino acid analysis of Australian feedstuffs	1992-93	1994-95	64 174	32 087
US-62CM	Novel strategies for improved mucosal immunity in chickens: Application to control of Salmonellosis	1991-92	1994-95	56 664	28 332
US-64CM	Junior research fellowship: Ms Muir (improving mucosal immunity)	1992-93	1995-96	33 300	33 300
US-67CM	Determination of true amino acid digestibility of feedstuffs	1994-95	1996-97	230 458	230 458
WS978-21	Broiler modelling workshop		1997-98	768	768

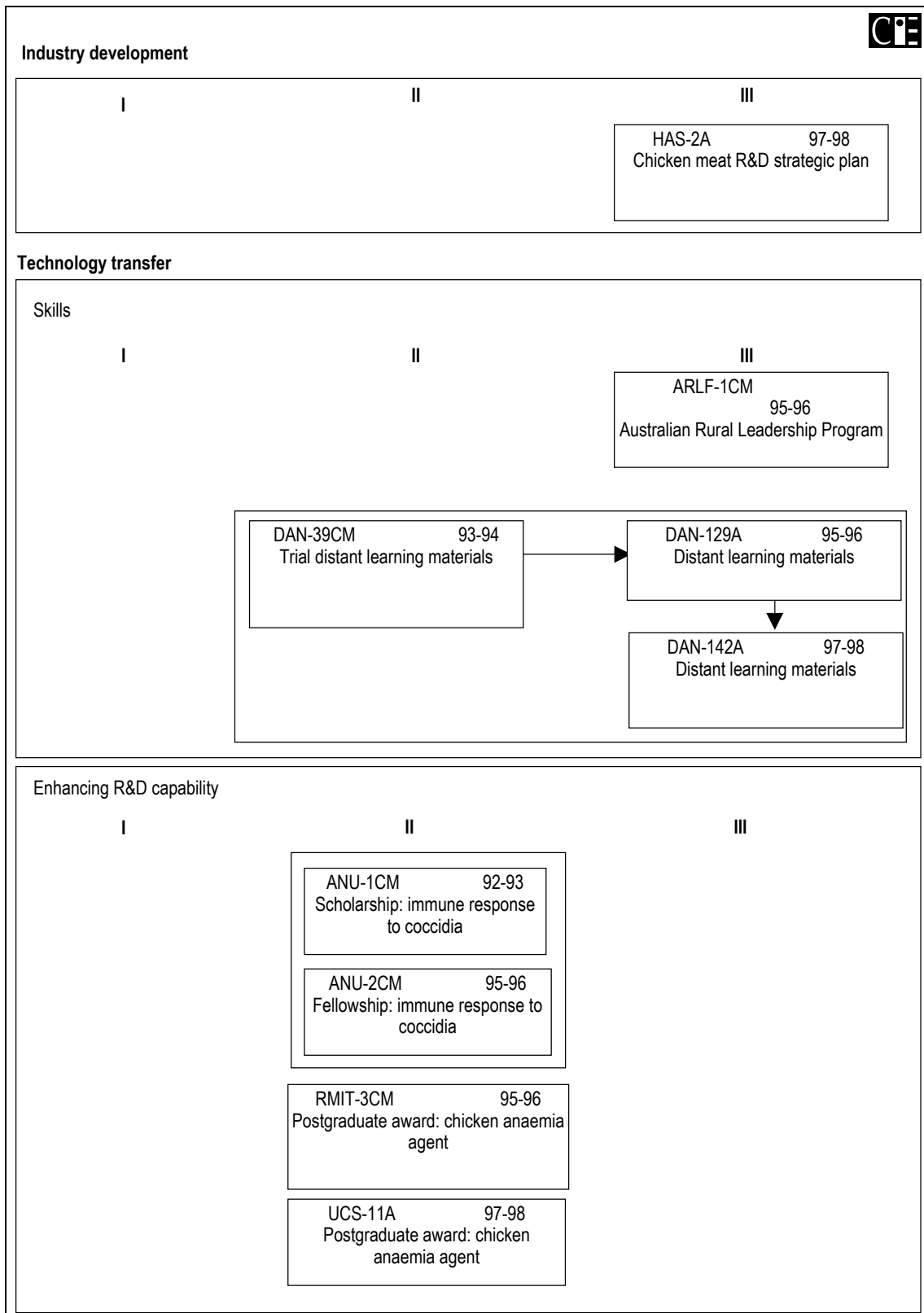
Source: RIRDC database, compendiums.

Project sets and initial evaluations

Chart 2.3 sets out the project sets that contribute to similar outcomes. Projects can be evaluated individually or in small or large sets. Where projects are joined by an arrow it means that the output of one project directly leads into another project. Such projects need to be evaluated together. Where a box encloses projects it means that the projects all share a common theme and/or are related in some way. These projects should also be evaluated together. However, as the projects are separate entities, only part of the cost of the preceding project(s) should be allocated against the benefit flows from the following project(s). The program manager will be required to adjudicate on the share of costs of the earlier program attributed to the following program.

The close relationship between the chicken meat and egg industries means that R&D into areas such as chicken diseases, fowl nutrition and husbandry may have a discernible effect on the egg industry. Hence, in the majority of projects which address these areas, effects may impact on both the chicken meat and egg markets.

1.3 Classification of projects for evaluation



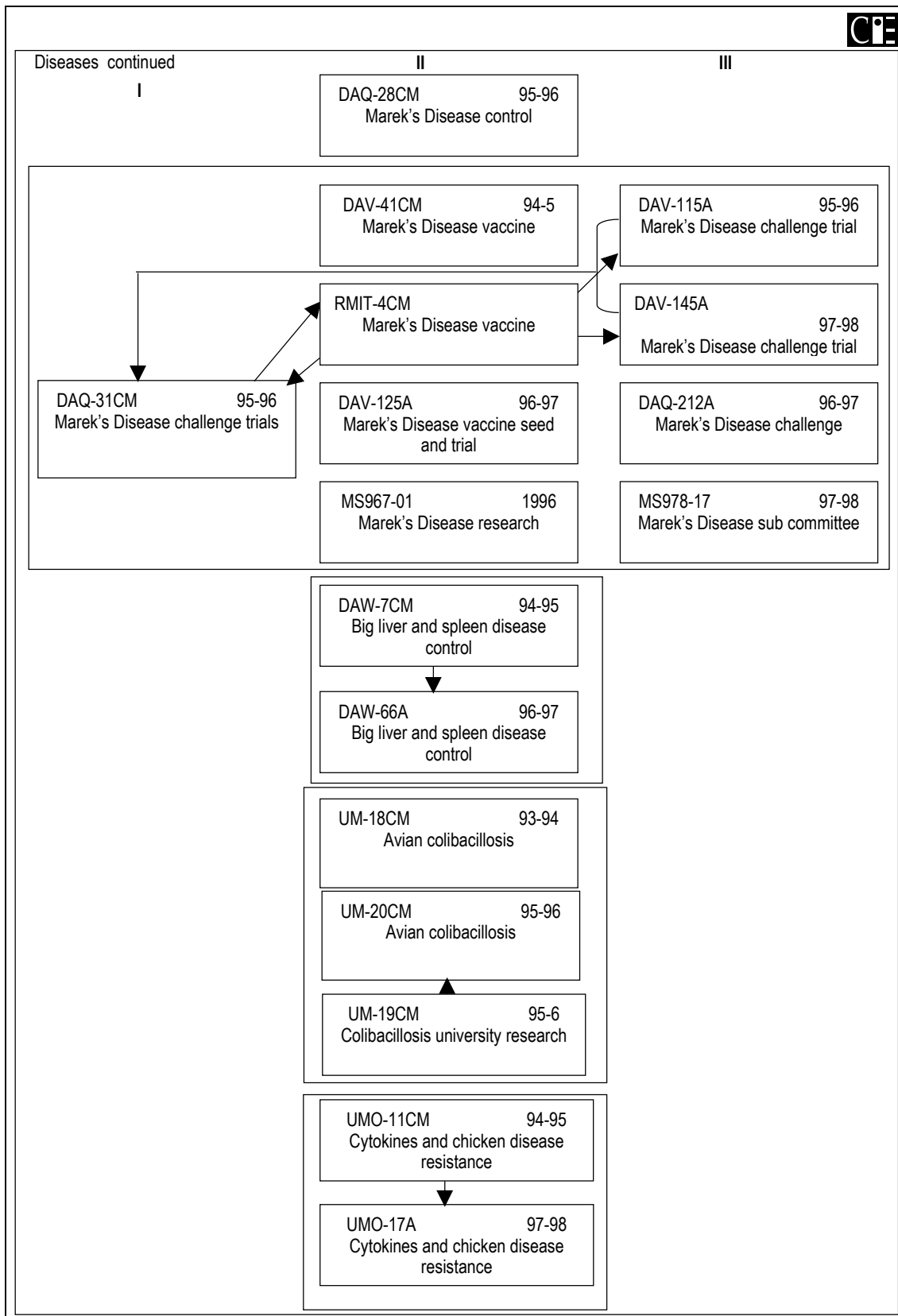
Continued on next page

1.3 Classification of projects for evaluation Continued

Industry development Continued			CIE
Knowledge base	I	II	III
			WS978-21 97-98 Broiler modelling workshop
Production efficiency of flock health			
Physiological efficiency	I	II	III
	CSK-2CM 95-96 Growth patterns and reproduction in female meat chickens	CSJ-2A 97-98 Control of ovarian function in female meat chickens	
		UQ-22CM 95-96 Ovarian regression in the domestic hen	
Disease			
	II	III	
	CSK-3A 96-97 Preventing emergence of very virulent IBDV	CST-2CM 93-94 Mycotoxin data centre	
	TA-956 95-96 Testing Australian IBVD strains for cross reaction	CST-27A 97-98 Mycotoxin data centre	
	CSU-14CM 95-96 Chicken anaemia virus array		
	DAQ-29CM 95-96 Vaccine for Avian coccidiosis		
	DAQ-226A 96-97 Sabbatical studies	DAQ-200A 97-98 Avian bacterial pathogens	
	UQ-20CM 92-93 Postgraduate award: bacterial poultry pathogens		

Continued on next page

1.3 Classification of projects for evaluation Continued



Continued on next page

1.3 Classification of projects for evaluation Continued

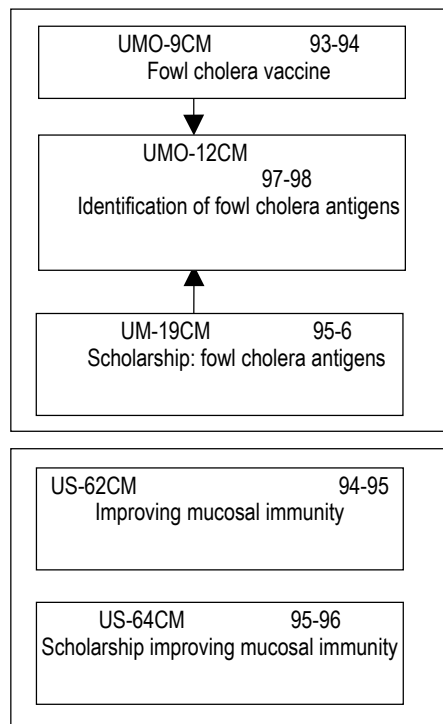


Diseases Continued

I

II

III

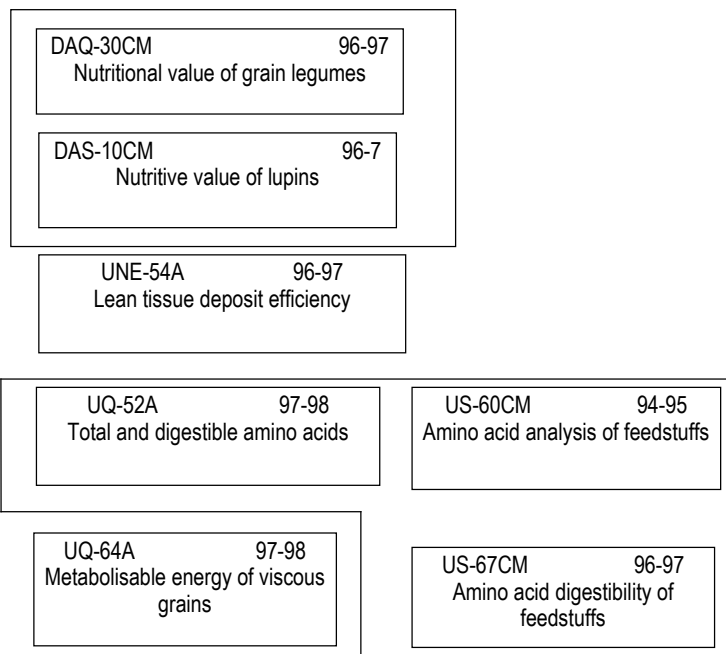


Nutrition

I

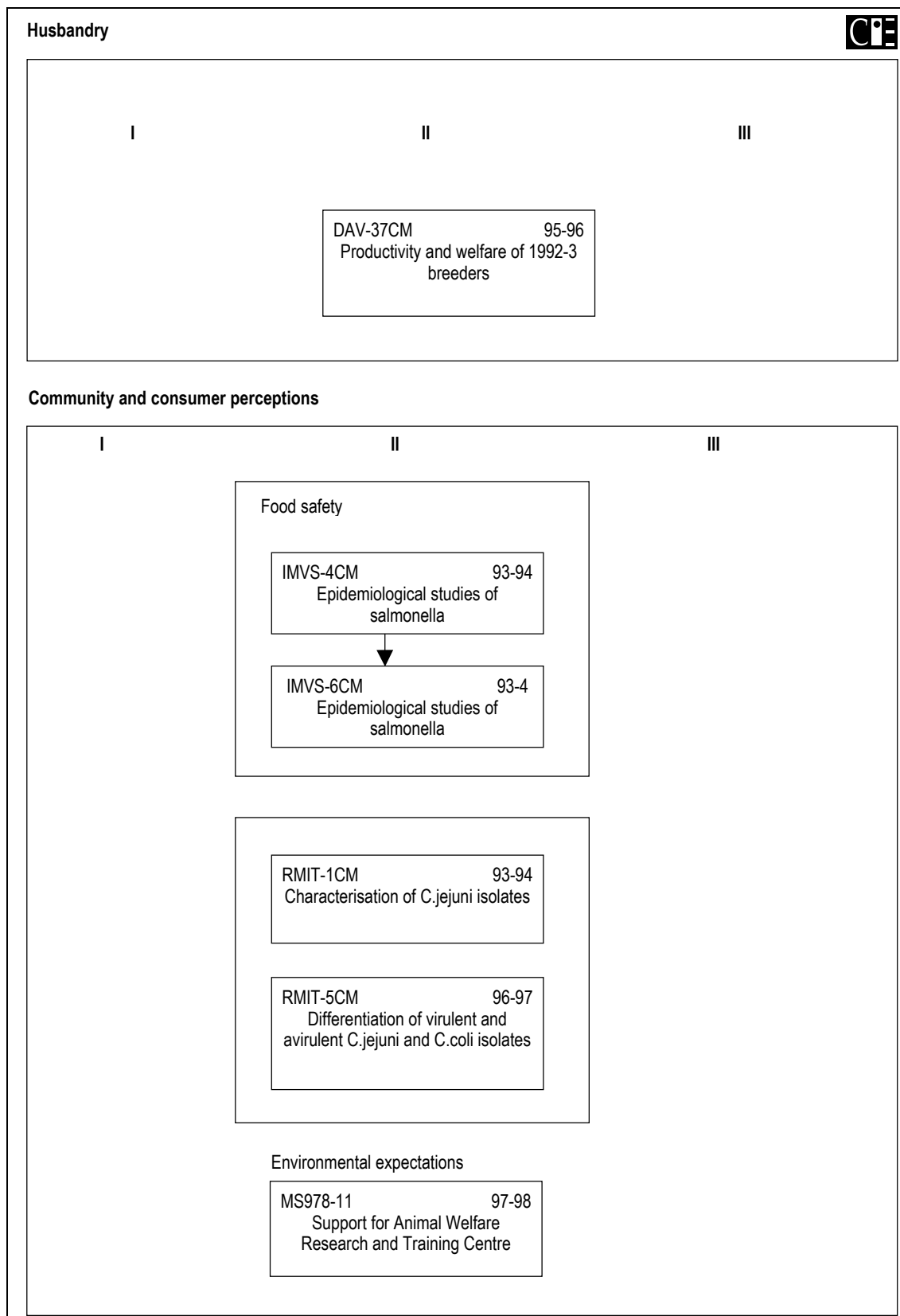
II

III



Continued on next page

1.3 Classification of projects for evaluation Continued



RMIT-1CM

93-94

Characterisation of C.jejuni isolates

RMIT-5CM

96-97

Differentiation of virulent and avirulent C.jejuni and C.coli isolates

Environmental expectations

MS978-11

97-98

Support for Animal Welfare Research and Training Centre

Data source: Program managers and CIE assessment.

Industry development

HAS-2A was a series of workshops used to provide input into the chicken meat R&D strategic plan. The series of workshops facilitated development of the program's R&D plan.

Technology transfer

Skills

In project ARLF-1CM funding was granted to the Australian Rural Leadership Program, which is a multi-industry collaborative program. This project has had minimal, if any, impact on the chicken meat industry.

The project set of DAN-39CM, DAN-129A and DAN-142A attempted to develop some learning/information sets suitable for distant learning. Only several sets have been completed — the projects are running considerably behind schedule. As a result, output from these projects is considered to be low, but expected to be good when all information sets are completed.

Knowledge base

WS978-21 investigated whether the two most advanced international broiler models were suitable for use in Australia. The models were found to be suitable, removing the need to build Australian models.

Enhancing R&D capability

In this area, research findings are of secondary importance. Of prime importance is enhancing R&D capability and developing a pool of well trained researchers from which to draw in the future. Hence, funding is often given to projects with little scientific or commercial value. In such instances funding is granted simply to improve the skills of a researcher. In the area of enhancing R&D capability, six projects received funding — ANU-1CM, ANU-2CM, RMIT-3CM, UCS-11A, UM-19CM and US-64CM.

Production efficiency and flock health

Thirty-seven programs have been identified that address the key research area of production efficiency and flock health. The egg and chicken meat committees jointly funded 15 of these programs. Either the egg or chicken meat program manager oversees programs jointly funded — they are not jointly overseen. The chicken meat program manager administers jointly funded programs addressing the area of poultry disease, while projects addressing the area of poultry nutrition are administered by the egg program manager.

Twelve project sets and six stand-alone projects were identified. Nine of the project sets (encompassing 28 projects) addressed the research area of poultry diseases.

Diseases

- The project set of CST-2CM and CST-27A sought to provide a mycotoxin identification and notification (via publications) service. Mycotoxins are a tropical problem and therefore the output(s) of this project is limited to poultry farmers in Queensland. The RIRDC egg committee also contributed funding to the data centre (through project CST-3E) — but did not contribute funding to either of these projects.
- CSU-14CM investigated chicken anaemia virus (CAV). CAV is an immunosuppressive disease that exacerbates infection by other micro-organisms (secondary infections). CAV is believed to result in lower body weights and higher mortality. This project attempted to develop a test for CAV that is more specific and less costly. Problems were identified which prevented the development of an improved test–assay for CAV. As a satisfactory assay could not be developed, this project was unsuccessful. The industry currently uses imported diagnostic tests.
- DAQ-28CM is a stand-alone project investigating control strategies for Marek’s Disease.
- The project set of DAW-7CM and DAW-66A investigates big liver and spleen disease. These projects feed into DAW-74A, which seeks to develop appropriate diagnostic and control measures. DAW-74A is expected to finish in June 1999. The disease also causes immunosuppression and reduced egg production in broiler breeders. Both projects were rated as having output of good value. However, as the disease is a problem in broiler breeders only, the impact on industry likely to be small. In addition, due to the limited market for a prevention and/or control strategy, it may be difficult to find a company willing to commercialise the findings.
- The set of projects comprising UM-18CM, UM-19CM and UM-20CM investigate avian colibacillosis. The projects identified genetics factors in *E.coli* associated with virulence, and hence provided a better understanding of whether *E.coli* might be pathogenic. The output of these projects may be used in other research projects.
- The project set of UMO-11CM and UMO-17A investigated the use of cytokines in enhancing chicken disease resistance. Technical problems meant that there was no output from these projects. The work has now been taken up by another research group who is making progress. A benefit flowing from the UMO projects was that they stimulated interest in using cytokines to improve disease resistance.
- The set of projects comprising UMO-9CM, UMO-10CM and UMO-12CM investigated a vaccine against fowl cholera. A commercial enterprise has since funded the research group to explore a different route in developing a fowl cholera vaccine.
- Projects US-62CM and US-64CM investigate improving mucosal immunity in poultry. The output of these projects feeds into two projects currently in progress (US-34A and US-72A). The RIRDC egg committee jointly funds US-64CM (and US-34A). This work has potential to significantly impact on the industry by improving disease resistance.

Diseases – jointly funded projects

- The project set of CSK-3A and TA956-38 investigate whether very virulent IBVD strains are present in Australia and whether existing vaccination strategies provide protection. The research showed that, as in other countries, IBVD strains in Australia are changing. High

antibody titres in breeders are recommended to minimise the risk of virulent challenge to young broilers. Project CSK-3A was rated as having output of good value. The output feeds into project CSA-2A, which is expected to be completed in June 2000.

- DAQ-29CM was a stand-alone project aiming to develop a vaccine that could be used as an alternative to drug treatment. Such vaccines have already been developed in the UK — DAQ-29CM aimed to develop an Australian version of the vaccine. Resistance by coccidiosis (an intestinal parasite) to available drugs is becoming a problem for the industry. The candidate vaccine strains developed in this project will be incorporated in a coccidiosis vaccine to become commercially available in the future. The techniques developed by this project are being used elsewhere (for example, in the current DAQ-215A). This project was rated as having output of excellent value.
- DAQ-200A, DAQ-226A and UQ-20CM is a project set investigating the rapid and specific detection of avian bacterial pathogens. DAQ-226A — which enabled sabbatical studies — attempted to develop alternative techniques for the typing of *H.paragallinarum* (fowl cholera). These techniques could not be developed to a satisfactory level and are thus of limited value. DAQ-200A, however, realised an accurate, rapid and validated technique for diagnosis of *H.paragallinarum*. This project set is expected to have a small impact on industry as there are already other means of diagnosing infection.
- The project set comprising DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, MS967-01, MS978-17 and RMIT-4CM is associated with researching a vaccine for Marek's Disease. The RIRDC egg committee jointly funded six of these projects (DAQ-212A, DAV-115A, DAV-125A, DAV-145A, MS967-01 and MS978-17). Despite imported vaccines being effective in controlling the disease, mutations might result in the current (imported) vaccine becoming ineffective. Research has been maintained so as to provide (potential) vaccines to treat Marek's Disease should it become resistant to existing vaccines. The disease has the potential to cause significant losses, particularly in the layer industry. All projects were rated as having output of at least good value.

Nutrition and utilisation of feed supply

- Projects DAQ-30CM and DAS-10CM investigate the use of lupins in feed. The findings of these projects has lead to the development of more cost-effective feed formulae — as a greater quantity of lupins can be included in the diet, at certain times (when lupins are cheap) it is possible to formulate a cheaper diet. Approximately 60 per cent of the cost of a live bird is attributable to feed. These projects therefore have potential to significantly impact on the poultry industry. Both projects were rated as having output of good value. Outputs can be readily adopted by nutritionist and used in feed formulae.
- UNE-54A investigated using nutritional manipulation of protein degradation (via the insulin axis) to increase the efficiency of lean meat growth in broilers. Findings suggest supplementing feed with polyunsaturated fatty acids to take advantage of their effects on energy utilisation and carcass fat content. The findings of this project may feed into other projects that have potential for significant industry impacts.
- UQ-64A investigated how to determine the energy value of grains, therefore leading to better diet formulation. The findings of this project may be used in other projects to improve feed conversion efficiency and lower feed costs.

- The project set comprising UQ-52A, US-60CM and US-67CM investigated diets formulated on a total and digestible amino acid basis. The outputs of the projects may enhance the efficiency of feed intake, optimise bird growth and allow the finetuning of feed conversion. Improved feed formulation may enable lower cost diets. All projects were rated as having output of good value. The RIRDC egg committee jointly funded project UQ-52A. Two projects currently underway (US-38A and US-51A) are related to the project set. These projects are expected to finish in March and June 1999 respectively, and need to be included in the project set.

Physiological efficiency

- The project set of CSJ-2A and CSK-2CM investigates reproductive efficiency in meat hens. These projects sought to improve ovarian function in broiler breeders, which had declined due to long term selection for meat production. CSK-2CM identified strategies to prevent reproductive failure, while CSJ-2A investigated possible means of overcoming reproductive failure. If a successful intervention strategy is developed, the impacts on industry may be large. However, this line of research may be dropped due to difficulties associated with modifying the activity of the follicle growth axis.
- UQ-22CM is a stand-alone project investigating techniques to differentiate between true ovarian disease and ovarian regression. Surveys revealed that birds culled for ‘going out of lay’ were most likely going through normal ovarian regression and not having ovarian disease. The findings of UQ-22CM may help in the correct diagnosis of ovarian regression. The RIRDC egg and chicken meat committees jointly funded UQ-22CM. The output of this project was rated as good — however, the impact on industry is expected to be minimal as broiler breeders are not a large industry segment.

Husbandry

- Project DAV-37CM investigated the relationship between human behaviour and bird response (fear and production efficiency) to those behaviours. The project found that there was little correlation between human behaviour and bird mannerisms.

Community and consumer perceptions

Food safety

- The project set comprising IMVS-4CM and IMVS-6CM is associated with providing serotyping services to the chicken meat industry to eliminate chicken meat as a source of contamination in human borne salmonella cases. These projects effectively provide a salmonella monitoring program used by industry to substantiate and maintain its food safety record. The serotyping service that these projects provide is valued in excess of the project funding. These projects are inputs to IMVS-1A, which is expected to be completed in July 2000. Both IMVS-4CM and IMVS-6CM are rated as having output of good value.
- The project set of RMIT-1CM and RMIT-5CM carries out a role similar to that of the IMVS set, but for a different micro-organism. These projects are not as advanced as the IMVSs as less is known about the micro-organism. Both projects were rated as having output of good value, which is used by a project currently underway (RMIT-7A) investigating a bio-replacement strategy as a means of controlling the micro-organism.

Environmental expectations and management

- MS978-11 provided support for the Animal Welfare Research and Training Centre. Funding was granted to communicate that the chicken meat industry is concerned about poultry welfare and to maintain expertise in the area of poultry welfare.

Evaluation

Table 2.4 summarises the expected outputs and outcomes from the projects.

Approximately 69 per cent of projects are type II R&D, 27 per cent type III and 4 per cent type I. Sixty per cent of the type III projects occur in the key research area of production.

1.4 Initial assessment of completed and continuing projects

Project	Project title	Stage	Product	Classification	Related projects	Initial assessment
ANU-1CM	Undergraduate research scholarship: Ms Alleva (immune response to coccidia)	II	Not applicable	R&D	ANU-2CM	No final output
ANU-2CM	Junior research fellowship: Ms Kerr (immune response to coccidial infections)	II	Not applicable	R&D	ANU-1CM	No final output
CSJ-2A	Control of ovarian development and function in meat chicken females	II	Multi-industry effect, traditional products, all markets	P	CSK-2CM	Medium
CSK-2CM	Growth pattern and reproduction in meat chicken female lines	I	Multi-industry effect, traditional products, all markets	P	CSJ-2A	Medium
CSK-3A	Infectious Bursal Disease Virus (IBDV): To determine if current vaccination strategies prevent the emergence of very virulent IBDV	II	Multi-industry effect, traditional products, all markets	DE, DTR	TA956-38	Medium
CST-27A	Australian mycotoxin data centre (continued)	III	Multi-industry effect, traditional products, all markets	DE	CST-2CM	Low
CST-2CM	Australian mycotoxin data centre	III	Multi-industry effect, traditional products, all markets	DE	CST-27A	Low

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
CSU-14CM	An improved assay for chicken anaemia virus	II	Multi-industry effect, traditional products, all markets	DD	Stand-alone	No output
DAN-129A	Distant learning materials	III	Industry level effect, traditional products, all markets	S	DAN-39CM, DAN-142A	Low (expected medium)
DAN-142A	Production of distant learning materials for the poultry industry – stage III continued	III	Industry level effect, traditional products, all markets	S	DAN-39CM, DAN-129A	Low (expected medium)
DAN-39CM	Production of trial distant learning materials for the poultry industry	II	Industry level effect, traditional products, all markets	S	DAN-129A, DAN-142A	Low (expected medium)
DAQ-200A	Rapid and specific detection of avian bacterial pathogens	III	Multi-industry effect, traditional products, all markets	DD	DAQ-226A	Medium
DAQ-212A	Marek's Disease challenge trial 4	III	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, RMIT-4CM, MS967-01, MS978-17	High
DAQ-226A	Sabbatical studies — Dr Mazhar Khan	II	Multi-industry effect, traditional products, all markets	DD	DAQ-200A	No output
DAQ-28CM	Improved control strategies for Marek's Disease	II	Multi-industry effect, traditional products, all markets	DD, DE	Stand-alone	No final output
DAQ-29CM	Characterisation and attenuation of Eimeria spp for use in a living vaccine for Avian coccidiosis	II	Multi-industry effect, traditional products, all markets	DTR	Stand-alone	High
DAQ-30CM	Testing and improving the nutritional value of grain legumes for layers and broilers	II	Multi-industry effect, traditional products, all markets	N	DAS-10CM	Medium
DAQ-31CM	Marek's Disease challenge trials	I	Multi-industry effect, traditional products, all markets	DTR	DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, RMIT-4CM, MS967-01, MS978-17	Medium

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
DAS-10CM	Factors influencing the nutritive value of lupins	II	Multi-industry effect, traditional products, all markets	N	DAQ-30CM	Medium
DAV-115A	Marek's Disease Challenge Virus pathogenicity trial	III	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-125A, DAV-145A, RMIT-4CM, MS967-01, MS978-17	Medium
DAV-125A	Marek's Disease vaccine seed attenuation and challenge trial	II	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-145A, RMIT-4CM, MS967-01, MS978-17	Medium
DAV-145A	Three vaccine trials on Marek's Disease	III	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, RMIT-4CM, MS967-01, MS978-17	Medium
DAV-37CM	Human factors and the productivity and welfare of commercial broiler chickens	III	Industry level effect, traditional products, all markets	AW	Stand-alone	Medium

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
DAV-41CM	Assessment of Attenuation of Marek's Disease Vaccine Seeds	II	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAQ-212A, DAV-115A, DAV-125A, DAV-145A, RMIT-4CM, MS967-01, MS978-17	Medium
DAW-66A	Studies into the control of big liver and spleen disease of chickens	II	Multi-industry effect, traditional products, all markets	DTR	DAW-7CM	Medium
DAW-7CM	Investigations into the control of big liver and spleen disease in poultry in Australia	II	Multi-industry effect, traditional products, all markets	DTR, DD, DE	DAW-66A	Medium
HAS-2A	Chicken meat research and development committee — strategic plan	III		C	Stand-alone	Medium
IMVS-4CM	Epidemiological studies of Salmonella using serotyping, phage typing and plasmid analysis and chromosomal fingerprinting	II	Industry level effect, traditional products, all markets	FS	IMVS-6CM	Medium
IMVS-6cm	Epidemiological studies of Salmonella using serotyping, plasmid analysis, chromosomal and PCR analysis	II	Industry level effect, traditional products, all markets	FS	IMVS-4CM	Medium
MS967-01	Commissioned Marek's Disease research	II		DD	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, RMIT-4CM, MS978-17	Medium
MS978-11	Support for establishment of the Animal Welfare Research and Training Centre			E	Stand-alone	No final output

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
MS978-17	Marek's Disease subcommittee	III		DD	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, RMIT-4CM, MS967-01,	Medium
RMIT-1CM	The characterisation of <i>Campylobacter jejuni</i> isolates from chickens and comparison of colonisation and potential pathogenicity	II	Industry level effect, traditional products, all markets	FS	RMIT-5MC	Medium
RMIT-3CM	Postgraduate studentship award: Ms Cunningham (chicken anaemia agent)	II		R&D	Stand-alone	No final output
RMIT-4CM	Development of Marek's Disease Type 1 vaccine	II	Multi-industry effect, traditional products, all markets	DTR	DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, MS967-01, MS978-17	Medium
RMIT-5CM	Differentiation of virulent and avirulent <i>Campylobacter jejuni</i> and <i>Campylobacter coli</i> strains isolated from humans and chickens	II	Industry level effect, traditional products, all markets	FS	RMIT-1CM	Medium
TA956-38	Testing Australian IBVD strains for cross reaction with Snyder's monoclonal antibodies and Australian MAb's for cross reaction with classical and very virulent IBVD strains, Holland	II		DTR	CSK-3A	Medium
UCS-11A	Postgraduate scholarship award: Ms Coombs	II	Not applicable	R&D	Stand-alone	No final output
UM-18CM	Avian Colibacillosis in Australia: Improvement in understanding and control	II	Multi-industry effect, traditional products, all markets	DD, DTR	UM-19CM, UM-20CM	No final output

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
UM-19CM	Junior research fellowship: Ms Ginns (colibacillosis in broilers)	II	Not applicable	R&D	UM-18CM, UM-20CM	No final output
UM-20CM	Avian Colibacillosis in Australia: Further improvement in understanding and control	II	Multi-industry effect, traditional products, all markets	DD, DTR	UM-18CM, UM-19CM	No final output
UMO-10CM	Junior research fellowship: Ms Ruffolo (antigenic studies of the organism causing fowl cholera)	II	Not applicable	R&D	UMO-9CM, UMO-12CM	No final output
UMO-11CM	Improvement of chicken disease resistance by cytokines	II	Multi-industry effect, traditional products, all markets	DTR	UMO-17A	No output
UMO-12CM	Identification of in vivo expressed antigens of <i>Pasteurella multocida</i>	II	Multi-industry effect, traditional products, all markets	DTR	UMO-9CM, UMO-10CM	No final output
UMO-17A	Improvement of chicken disease resistance by cytokines	II	Multi-industry effect, traditional products, all markets	DTR	UMO-11CM	No output
UMO-9CM	Towards the Development of an Effective Live Attenuated Vaccine Against Fowl Cholera	II	Multi-industry effect, traditional products, all markets	DTR	UMO-10CM, UMO-12CM	No final output
UNE-54A	Increasing the efficiency of lean tissue deposition in broiler chickens	II	Industry level effect, traditional products, all markets	N	Stand-alone	No final output
UQ-20CM	Postgraduate award: bacterial poultry pathogens	II	Not applicable	R&D	DAQ-200A, DAQ-226A	No final output
UQ-22CM	A study of ovarian regression in the domestic hen and its effect on performance in layer and broiler flocks	II	Multi-industry effect, traditional products, all markets	P	Stand-alone	Medium
UQ-52A	A comparison of total and digestible amino acids in diets for broilers and layers	II	Multi-industry effect, traditional products, all markets	N	US-60CM, US-67CM	Medium
UQ-64A	The metabolisable energy of 'viscous' and problem grains measured at two sites and methods of prediction of grain samples likely to respond to enzyme additions	II	Industry level effect, traditional products, all markets	N	Stand-alone	No final output
US-60CM	Amino acid analysis of Australian feedstuffs	III	Multi-industry effect, traditional products, all markets	N	UQ-52A, US-67CM	Medium
US-62CM	Novel strategies for improved mucosal immunity in chickens: Application to control of Salmonellosis	II	Industry level effect, traditional products, all markets	DTR	US-64CM	Medium
US-64CM	Junior research fellowship: Ms Muir (improving mucosal immunity)	II	Not applicable	R&D	Stand-alone	No final output

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
US-67CM	Determination of true amino acid digestibility of feedstuffs	III	Multi-industry effect, traditional products, all markets	N	UQ-52A, US-60CM	Medium
WS978-21	Broiler modelling workshop	III	Industry level effect, traditional products, all markets	KB	Stand-alone	Medium

Source: Program managers and CIE assessment.

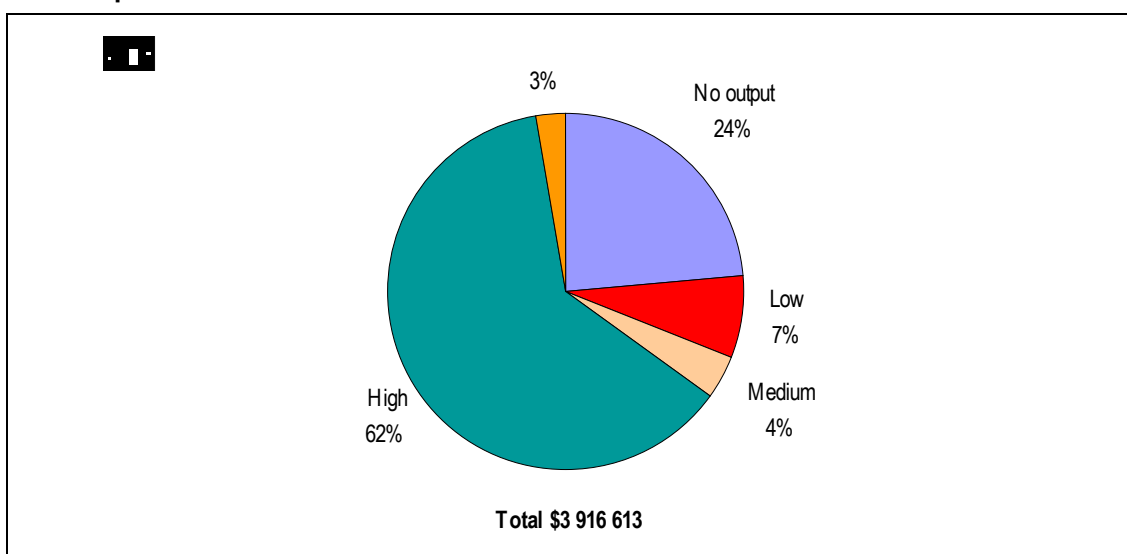
Chart 2.5 summarises the likely outcomes by budget allocation. The outcomes are indicative only. From the chart we can see that approximately 61 per cent of RIRDC funding went to projects which delivered an output of at least good value.

Recommendations for evaluation

Four project sets and one stand-alone project have been identified for possible evaluation.

- CSK-3A and TA956-38 investigate IBVD. Internationally, this disease is a significant problem. Australia remaining IBVD free, or being in a position to control the disease, is of significant importance to the industry. Evaluation of this set would be relatively straight forward and would address questions such as ‘if a very virulent strain of IBVD infected Australian poultry, what would the losses be and would the research conducted avert these losses?’ Joint funding of these projects would not complicate that analysis.
- The Marek’s Disease project set (DAQ-31CM, DAQ-212A, DAV-41CM, DAV-115A, DAV-125A, DAV-145A, MS967-01, MS978-17 and RMIT-4CM) would be difficult to evaluate. This is because of the large number of projects involved and uncertainty surrounding whether Australian vaccines will prove successful in providing immunity to the disease should the imported vaccines become ineffective. The uncertainty would require several ‘what if’ scenarios to be developed.
- DAQ-30CM and DAS-10CM would be a relatively straightforward project set to evaluate.

1.5 Output assessment



Data source: Chicken meat program manager and CIE assessment.

As these projects have significant potential to lower feed costs, and as feed costs account for approximately 60 per cent of live bird cost, a high benefit–cost ratio is expected.

- IMVS-4CM and IMVS-6CM would be slightly more difficult to evaluate. Consumer responses to adverse publicity surrounding the safety of chicken meat products would need to be known. An estimate of the magnitude to which these projects contribute to food safety would also be required. A range of ‘what if’ scenarios would need to be undertaken. As these projects provide services (serotyping) of value greater than the funding allocated to the projects, a high benefit–cost ratio is expected.
- DAQ-29CM would be a relatively easy project to evaluate. All that would be required is knowledge of the losses caused by coccidiosis and the likelihood of the parasite developing resistance to currently available drugs. As the techniques developed in DAQ-29CM are now being used to develop vaccines to other diseases (the benefits from which would be in part attributed to DAQ-29CM), this project is expected to have a high benefit–cost ratio.

1.Egg Program

Overview

Background

The Australian egg industry is undergoing a period of adjustment following the deregulation of marketing, which began in New South Wales in 1989. Deregulation has made entry and exit to the industry easier and there has been a significant increase in vertical integration and market concentration. Since deregulation there has only been limited formal data collection.

Available statistics suggest that there are approximately 950 commercial establishments producing eggs in Australia. Annual output is around 210 million dozen eggs with a gross production value of \$300 million. The layer flock size in Australia is estimated at 11.5 million birds, of which approximately 14 per cent are 'backyard' noncommercial flock. The commercial flock is estimated at 9.9 million birds, of which 9.1 million are kept in cages. Between 90 and 95 per cent of Australian eggs are produced by layers housed in cages. Other production to suit specific market needs is accomplished in barn, deep litter and free-range systems.

Consumption of eggs in Australia is relatively constant at around 156 eggs per capita per annum. This is low relative to other western countries. Approximately 15 per cent of Australian egg production go to further manufacturing and processing. Exports account for about 1 per cent of production. The dismantling of some quarantine barriers in recent years has resulted in a significant increase in imports of egg products.

Research and development activities

The RIRDC program commenced in 1995. Prior to this R&D was funded by the Egg Industry Research and Development Corporation (EIRDC). The RIRDC Egg Program is funded by two sources. The Research and Development Fund is the major source of funding for the program. Funds are raised via a compulsory levy on chicks supplied by hatcheries. These funds are matched dollar-for-dollar by the Commonwealth government. The second source of funds available to the program is the Egg Industry Development Fund. This is a trust fund containing money sourced from a Commonwealth levy scheme terminated in 1987.

The RIRDC Egg Program has close links in collaborative research with the RIRDC Chicken Meat Program, with a number of jointly funded projects. Cooperative research projects have also involved the grains, dairy and pig research and development corporations and the Meat and Livestock Australia (formerly the Meat Research Corporation).

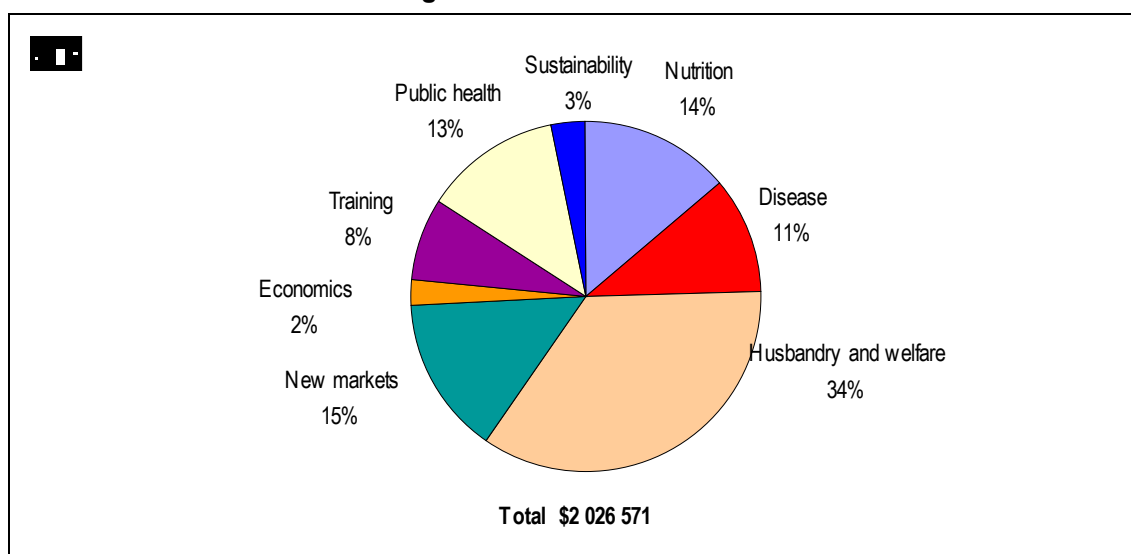
The current five year RIRDC Egg Program R&D plan (1998–2003) addresses eight key areas — implications of the changing economic environment, new and existing markets, public health, flock health and disease management, feed availability and nutrition, husbandry and welfare, environmentally sustainable development, and training, information and technology transfer.

Due to the close relationship between some of these areas — for example, flock health and bird nutrition — five key R&D areas have been identified, which can be further disaggregated into 11 research areas. Egg R&D projects have been classified as addressing one or more of the following.

- Industry development:
 - new and existing markets (NM); and
 - implications of the changing economic environment (E).
- Training and information transfer.
 - skill (S);
 - knowledge base (KB); and
 - R&D capability (R&D).
- Production efficiency and flock health:
 - disease diagnosis (DD), treatment and resistance (DTR), and epidemiology (DE);
 - feed availability and nutrition (N); and
 - physiology (P).
- Husbandry and welfare (HW).
- Community perceptions:
 - public health and quality assurance(QA); and
 - environmentally sustainable management (ESM).

Flock health and disease management, feed availability and nutrition, and training, information and technology transfer are the highest priority areas, accounting for between 60 and 75 per cent of the research budget. Public health and husbandry and welfare are anticipated to account for between 20 and 30 per cent of research expenditure. Of lowest priority are the areas of new and existing markets, environmentally sustainable management and implications of the changing economic environment. These areas are expected to account for between 15 and 30 per cent of

1.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

the research budget. The total budget for the program in 1998-99 is \$1.65 million.

Chart 3.1 summarises the main areas of RIRDC project funding by the five year plan categories. The main areas of RIRDC funding since 1995-96 are bird husbandry and welfare, identification of new markets for egg products, bird nutrition and egg product quality assurance.

List of projects

Table 3.2 lists the projects that have been identified in the Egg program as being completed during or after 1995-96. This date reflects when the Egg Program came under the RIRDC portfolio. Starting and finishing dates are provided where available. The total cost of the project as reported by RIRDC has been included (sum of annual dollar amounts, not discounted) to give an approximation of the relative size of projects. The total project cost includes contributions from industry, research institutions and RIRDC.

3.2 Completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
AEI-1E	National industry databases	1994-95	1996-97	22 325	22 325
AFS-1A	Investigation and development of egg yolk products to match local and export market opportunities	1995	1996	32 845	32 845
CSK-3A	Infectious Bursal Disease Virus (IBDV): To determine if current vaccination strategies prevent the emergence of very virulent IBDV	1995-96	1996-97	264 789	124 789
CST-3E	Australian mycotoxin data centre	1994-95	1996-97	3 000	3 000
DAQ-195A	Selection criteria for a high rate of lay in poultry	1995	1996	15 000	15 000
DAQ-197A	A computer program for the formulation of economically optimal layer diets	Jul-95	Jun-98	140 023	40 023
DAQ-200A	Rapid and specific detection of avian bacterial pathogens	Jul-95	Jun-98	402 461	120 000
DAQ-226A	Sabbatical studies — Dr Mazhar Khan	1996	1997	2 500	2 500
DAQ-25E	Characterisation and attenuation of Eimeria spp for use in a living vaccine for Avian coccidiosis	1993-94	1995-96	27 617	27 617
DAQ-28E	Testing and improving the nutritional value of grain legumes for layers and broilers	1994-95	1996-97	326 854	57 427
DAS-23E	Demonstrating techniques of beak trimming and vaccination in poultry	Jul-93	Jun-95	97 928	40 464
DAS-24E	Ideal drinking water temperature for layers	1993-94	1995-96	55 725	55 725
DAS-44A	Nutritive value of lupins	Jun-05	Jun-05	15 450	15 450
DAV-111A	A study of the metabolism of the laying hen during weight loss and sub-optimal growth during early egg production	1995-96	1996-97	45 906	45 906
DAV-115A	MD Challenge Virus pathogenicity trial	1995	1996	6 150	6 150
DAW- 68A	Controlling vent trauma and resultant mortality with stock wound sprays	1995	1996	5 978	5 978
DAW-67A	Molecular typing to trace contamination of egg products by bacteria	1995-96	1996-97	9 985	9 985
INS-4A	Interdependence and integration of the egg, processed food and food service industries: Future trends and strategies	1996	1997	71 000	71 000
KTR-1A	Egg based repellents	1995	1996	38 300	38 300

Continued on next page

3.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
MS967-01	Commissioned Marek's Disease research	1996	1997	4 648	4 648

MS967-25	RIRDC contribution to GRDC rodent research program	1996	1997	10 000	10 000
MS978-11	Support for establishment of the Animal Welfare Research and Training Centre	Sep-97	Jun-98	2 500	2 500
MS978-17	Marek's disease subcommittee			250	250
NEP-1A	Computer software for performance analysis and benchmarking of egg laying flocks	Nov-96	Jul-98	70 880	37 730
REM-1A	Review of 'Disease need not be a sentence'	1995	1996	4 500	4 500
RSA-1A	Development of strategies and economic models to seek stability in the production and marketing of eggs in Australia	1995	1996	55 400	55 400
SAR-3A	Prevent chronic pain developing in layers subject to beak trimming and retrimming	Jul-96	Jun-98	168 042	92 242
SAR-6A	Productivity, efficiency and profitability of caged layers with poor feather cover	Mar-97	Jun-98	19 860	8 436
TA956-38	Testing Australian IBVD strains for cross reaction with Snyder's monoclonal antibodies and Australian MAb's for cross reaction with classical and very virulent IBVD strains, Holland	1995	1996	1 460	1 460
TA967-32	Mr McMaster travel to address egg producer groups in mainland states on the economic outlook for the Australian egg industry	1996	1997	2 000	2 000
UCS-17A	Modeling the determinants of domestic egg demand	Sep-97	Jun-98	23 624	13 549
				\$	\$
UF-1A	Eggs as a source of essential docosahexanoic acid in the diets of weaning infants	1995-96	1996-97	127 624	127 624
UF-3E	Prevention of beak regrowth and chronic pain following trimming	Jul-91	Jul-95	75 890	75 890
UF-4E	Effects of foot lesions and feather loss on the welfare of caged layers using anatomical and behavioural approaches	1994-95	1996-97	50 168	50 168
UMU-3E	Genetic relationships and pathogenicity of intestinal spirochaetes infection in Australian poultry	1994-95	1995-96	35 156	35 156
UNC-2A	Visibility of eggs and egg products in the print media	1996	1997	12 323	12 323
UNC-3A	Egg and fat consumption patterns of slimmers compared to that of other foods	1996	1997	17 987	17 987
UNE-43A	The effect of extraneous factors on egg and eggshell quality in laying hens	Jul-95	Jun-98	366 718	126 718
UNE-50A	Commercial implications of source and form of dietary calcium and comparative evaluation of three imported and two Australian layer strains	1995	1996	28 755	28 755
UNE-55E	Eggshell ultrastructure and eggshell quality: Conveying the information to the egg industry	1995	1996	6 545	6 545
UNE-61A	Educational materials: Egg shell quality problems	Jul-97	Jun-98	59 743	31 539
UQ-19E	The significance of salmonella, particularly <i>Salomella infantis</i> , in the Australian egg industry, with respect to public health	1993-94	1995-96	57 082	57 082
UQ-21E	New vegetable protein sources for layers	1993-94	1995-96	30 443	30 443
UQ-23E	Production and welfare of layers housed at high and low stocking density in modified existing cage units	Jul-94	Dec-97	88 492	88 492
UQ-25E	A study of ovarian regression in the domestic hen and its effect on performance in layer and broiler flocks	1994-95	1995-96	9 668	9 668
UQ-26E	Production and welfare of layers housed in Edinburgh modified cages in Australia	Jul-94	Dec-97	120 692	100 692
UQ-52A	A comparison of total and digestible amino acids in diets for broilers and layers	Jan-96	Dec-97	248 162	48 162

Continued on next page

3.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
UQ-60A	Strategic review of environmental, land use and sustainability issues in the Australian egg industry	1996	1997	48 310	48 310
US-43A	Improvement in egg shell quality at high temperatures	1996	1997	37 679	37 679

VCA-4A	Evaluation of the performance of moulted hens fed high nutrient density diets post moult	May-96	Nov-97	113 060	43 610
VFI-1A	Strategy development of a strong feed grains industry in Victoria well integrated with livestock industries	1996	1997	5 000	5 000
Projects not included in assessment					
ACM-1A	10th Australian Poultry and Feed Convention – 'Winners or losers in the global market'	1995	1996		6 000
DAN-128A	National egg industry seminars	1995	1996		5 430
MS978-25	Printing of Ausvetplan	?			
QPR-1A	Capital improvements for QPRDC (EIDF)	Jul-97	Jun-98		45 000
TA956-101	5th International Congress on Marek's Disease	?			1 755
TA956-12	1995 National Egg Industry Seminar, North Queensland	Sep-95			5 430
TA956-14	Australian Poultry Science Symposium	Feb-96			600
TA956-15	VI European Symposium on the Quality of Egg and Egg Products, Spain	Sep-95			1 500
TA956-16	Investigate New American Poultry Business Methods, USA	Oct-95			2 000
TA956-20	1995 National Egg Industry Seminar, North Queensland	Nov-95			3 293
TA956-23	1996 Poultry Symposium, Sydney	Feb-96			600
TA956-32	Poultry Welfare Symposium, Canada	Aug-95			2 000
TA956-40	Australian Poultry Science Symposium, 4th Australian Feed Enzyme and WPSA AGM, Holland	Feb-96			320
TA956-43	5th International Symposium on Marek's Disease, Michigan	Sep-96			1 750
TA956-49	1997 Australian Poultry Science Symposium	1997			3 000
TA956-62	Poultry Information Exchange Conference, Surfers Paradise	Apr-96			592
TA956-63	XX World Poultry Science Congress and Exhibition, New Delhi	Sep-96			1 990
TA956-70	International Union of Microbial Societies Eight International Congress of Bacteriology and Applied Microbiology, Jerusalem	Aug-96			2 000
TA967-12	Dr Lunam travel to Australian Poultry Science Symposium	1996	1997		600
TA967-13	Mr McErlane travel to Israel and Europe to study the poultry industry	1996	1997		2 500
TA967-14	Dr Barnett travel to 5th European Symposium of Poultry Welfare	1996	1997		2 000
TA967-18	Mr Glatz travel to 1997 Poultry Science Symposium in Sydney	1996	1997		600
TA967-19	Ass. Prof. Hampson travel to 1997 Poultry Science Symposium in Sydney	1996	1997		1 000
TA967-20	Dr Hunton travel to 1997 Poultry Science Symposium in Sydney	1996	1997		1 000
TA-967-3	11th International Congress of the International Organisation for Mycoplasmaology	1996	1997		1 000
TA967-38	Dr Lunam — European symposium on poultry welfare	1996	1997		2 804
TA967-4	Pig and Poultry Fair — Roseworthy 1996	1996			538
TA967-41	Mr McMaster travel to XX World Poultry Science Association Congress, New Delhi	1996	1997		2 926
TA978-03	Dr Mike Gentle — Australian Poultry Science Symposium	Feb-98	May-98		2 000

Continued on next page

3.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC contribution</i>
				\$	\$
TA978-06	Dr Sandra Sapats — Recombinant Antibody Technology Conference, San Francisco	Sep-97			3 500
TA978-07	1997 South Australian Pig and Poultry Fair, Roseworthy Campus (8-9 October 1997)	Oct-97			432

TA978-10	Dr Phil Glatz — Poultry Science Symposium, Sydney (February 1998)	Feb-98		600
TA978-11	VII European Symposium on the Quality of Eggs and Egg Products, Poznan, Poland (1997)	Sep-97	Oct-97	1 500
TA978-17	Associate Professor D Balnave — attendance and scientific presentation at the 1998 Australian Poultry Science Symposium in Sydney	Feb-98		3 000
TA978-20	Poultry Science Symposium 1998 — J Barnett	Feb-98		500
TA978-21	Poultry Science Symposium 1998 — E Jongman	Feb-98		500
TA978-22	Australian Poultry Science Symposium — Mr Bob Hughes, February 1998	Feb-98		1 024
TA978-23	6th World Congress on Genetics Applied to Livestock Production (6WCGALP), Armidale 1998 — W Fairfull	Jan-98		1 000
TA978-32	David Farrell — Newly Emerging Ovo-biotechnologies, Banff, Canada (April 1998)	Apr-98		1 000
TA978-40	6th Asian Pacific Poultry Congress, Nagoya, Japan (June 1998) — Dr J Roberts	Jun-98		1 000
TA978-49	XII International Organisation of Mycoplasma Conference, Sydney — July 1998	Jul-98		907
TA978-51	1998 SA Pig and Poultry Fair, Adelaide (July 1998)	Jul-98		352
TA978-57	IEC meeting, Toronto, 6-11 September 1997 — Malcolm Peacock	Sep-97		4 397
US-44E	EIRDC — Junior research fellowship — Ms Muir	1992-93	1995-96	11 100
US-45E	EIRDC — Postgraduate studentship — Ms Kriketas	1994-95	1995-96	23 500

Source: RIRDC database, compendiums.

Project sets and initial evaluations

Chart 3.3 sets out the project sets for potential evaluation. Projects can be evaluated individually, or in small or large sets. Where projects are joined by an arrow it means that the output of one project directly leads into another project. Such projects need to be evaluated together. Where a box encloses projects it means that the projects all share a common theme and/or are related in some way. These projects may be evaluated as a set or as separate entities. The program manager will be required to adjudicate on the share of costs of the earlier projects that should be attributed to the project being evaluated.

Industry development

Two project sets and six stand-alone projects addressing the research area of industry development were identified.

New and existing markets

- AFS-1A investigated and attempted to develop egg yolk products to match local and export market opportunities. This project was not successful and had no final output.
- INS-4A looked into the interdependence and integration of the egg, processed food and food service industries. This project, while completed, has not been made public due to concerns about the possibility of some information being commercially sensitive. Its output is expected to be of low to good value, subject to release.
- KTR-1A tested the suitability of egg based repellents for use in the horticultural industry. Browsing of new seedlings by rabbits and wallabies can result in significant damage to plantations. As a result of this project two egg-based repellents were identified. Commercial agreements for sale of the product have been reached and further field testing is currently under way. This project is classified as having output of excellent value.

- UF-1A investigated the use of eggs as a source of docosahexanoic acid in the diets of weaning infants. This project was classified as having output of excellent value. Project evaluation would require surveying nutritionists to establish rates of adoption of the findings.
- Projects UNC-2A and UNC-3A established the marketing profile of eggs and egg products. This project set would be difficult to evaluate at this point in time as it is not known who will use the marketing profile or how it will be used. The output of these projects was rated as being of low value.

Implications of the changing economic environment

- AEI-1A and TA967-32 address the economic outlook for the Australian egg industry. AEI-1A is a database containing national information and statistics of relevance to the egg industry. TA967-32 provides funding for egg producer groups to be addressed about economic issues and information contained in the database. The extension project (TA967-32) was classified as having output of excellent value.
- Project UCS-17A modelled the determinants of domestic egg demand. The output of this project was a tool that could be incorporated into other economic related projects. The project was considered to have no final output.

Training and information transfer

A large number (46) of projects were identified which address the areas of training and information transfer. Most of these were extension projects, such as the sponsoring of a symposium or conference, or a travel allowance enabling a researcher to attend such a conference. Individual training and information transfer projects will not be addressed. The program manager will be consulted to establish whether any of the training and information transfer projects are associated with the projects chosen for evaluation. If a relationship is established, the relevant training and information transfer project will be included in the project set being evaluated.

Production efficiency and flock health

Twenty projects have been completed since 1995-96 that address the key research area of production efficiency and flock health. Just under half of these programs were jointly funded.

The close relationship between the chicken meat and egg industries means that R&D into areas such as chicken diseases, fowl nutrition and husbandry may impact on both chicken meat and egg markets. Most projects of this nature are jointly funded. The Chicken Meat Program manager administers jointly funded programs addressing the area of poultry disease, while projects addressing the area of poultry nutrition are administered by the Egg Program manager.

Two project sets (encompassing two disease related and three nutrition related projects) and 15 stand-alone projects were identified.

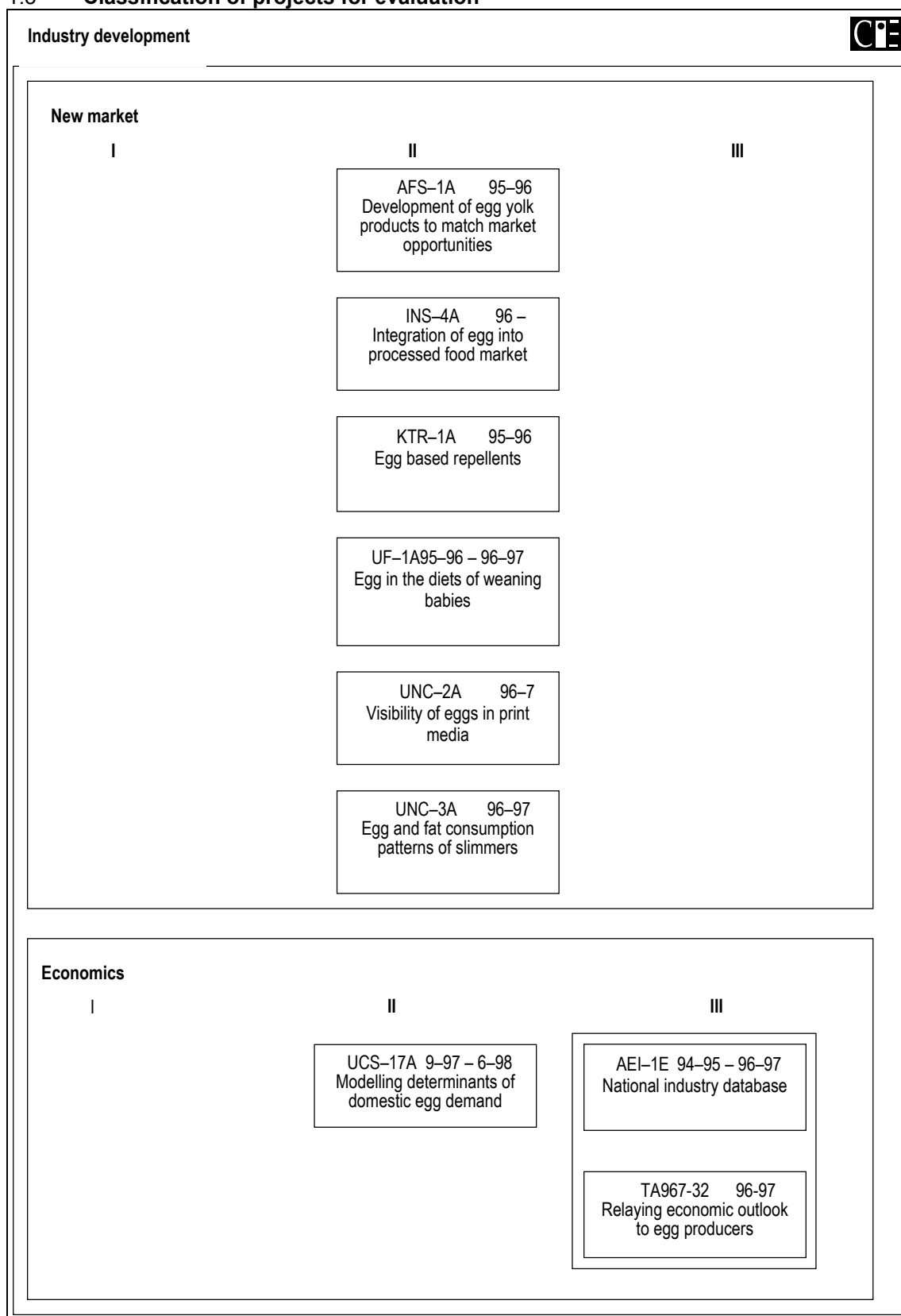
Diseases

- CST-3E sought to provide a mycotoxin identification and notification (via publications) service. Mycotoxins are a tropical problem and therefore the output(s) of this project are

limited to poultry farmers in Queensland. This project was classified as having a low output as the service was not widely used.

- REM-1A is a review of a book manuscript. The book — *Disease Need Not be a Sentence* — discusses poultry diseases and is written in layperson terms. As yet, the book has not been reviewed and, as it was written some time ago, it may be dated.
- UMU-3E was an epidemiological study identifying intestinal spirochaete infection of Australian poultry and determining the occurrence of such infection. This project feeds directly into project UMU-21A (in progress), which is surveying the prevalence of the disease in the eastern seaboard states. Project UMU-3E was classified as having no final output.

1.3 Classification of projects for evaluation



Economics

I

II

III

UCS-17A 9-97 - 6-98

Modelling determinants of domestic egg demand

AEI-1E 94-95 - 96-97

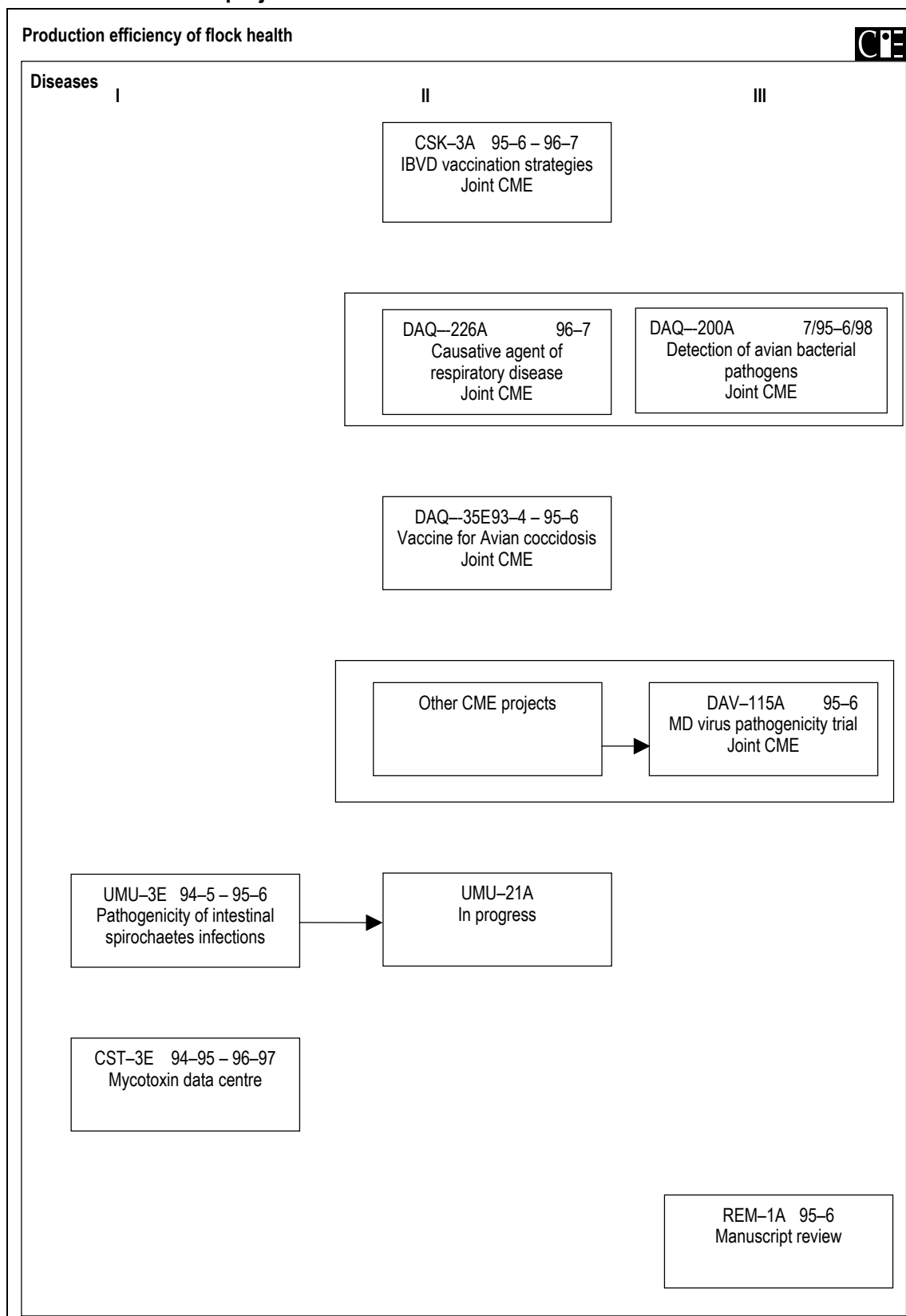
National industry database

TA967-32 96-97

Relaying economic outlook to egg producers

Continued on next page

1.3 Classification of projects for evaluation Continued



Continued on next page

1.3 Classification of projects for evaluation Continued



Nutrition

I

II

III

DAQ-28E 94-95 – 96-97
Improving nutritional value of
grain legumes

DAS-44A 95-96
Nutritive value of lupins

UQ-21E93-94 – 95-96
Vegetable protein sources for
layers

DAV-111A95-96 – 96-97
Laying hen metabolism

UNE-50A 95-96
Dietary calcium source and
form implications

UQ-52A 1-96 – 12-97
Total and digestible amino acid
comparison
Joint CME

VCA-4A 5-96 – 11-97
Moulted hens and high nutrient
density diets

VFI-1A 96-97
Strategy development of a feed
growing industry in Victoria

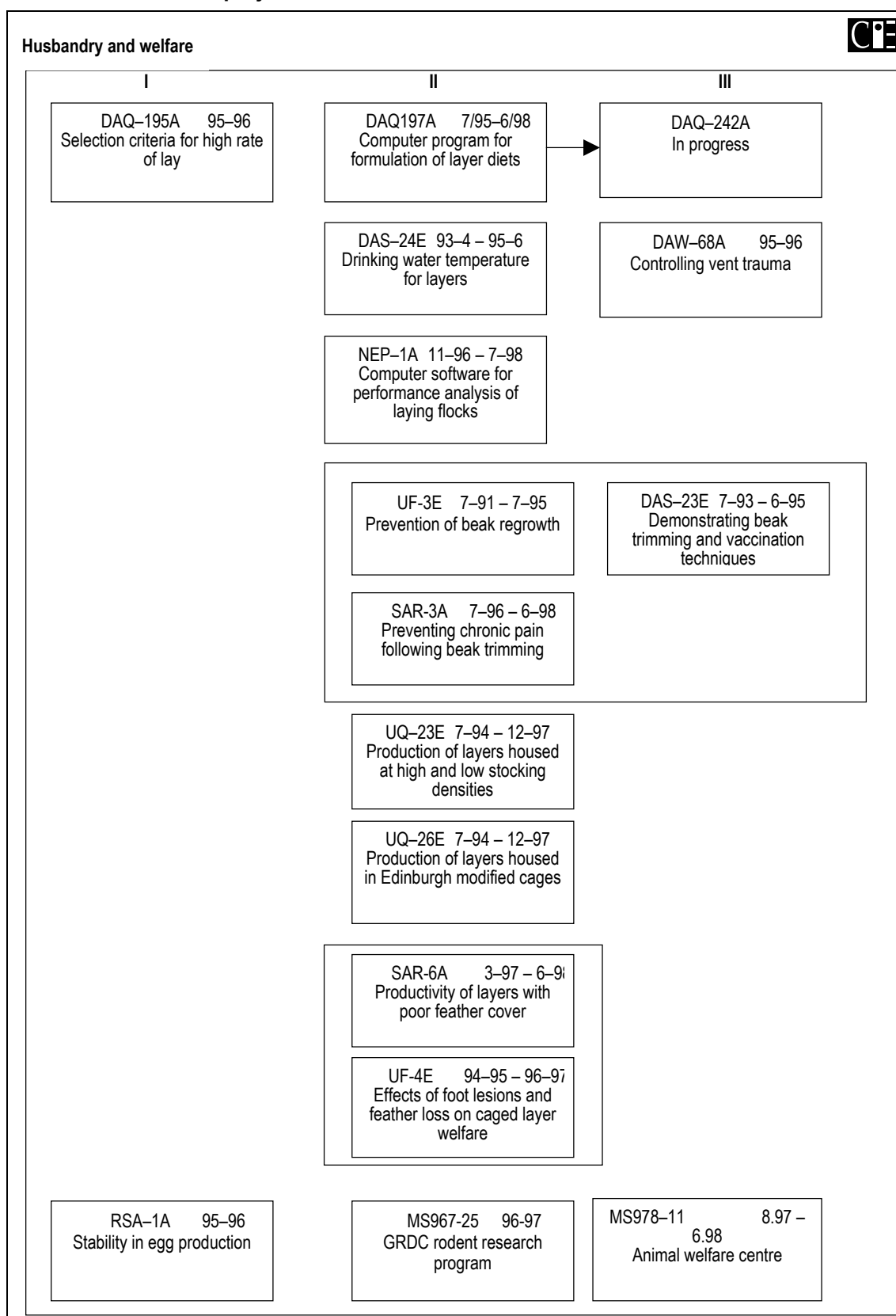
Continued on next page

1.3 Classification of projects for evaluation Continued

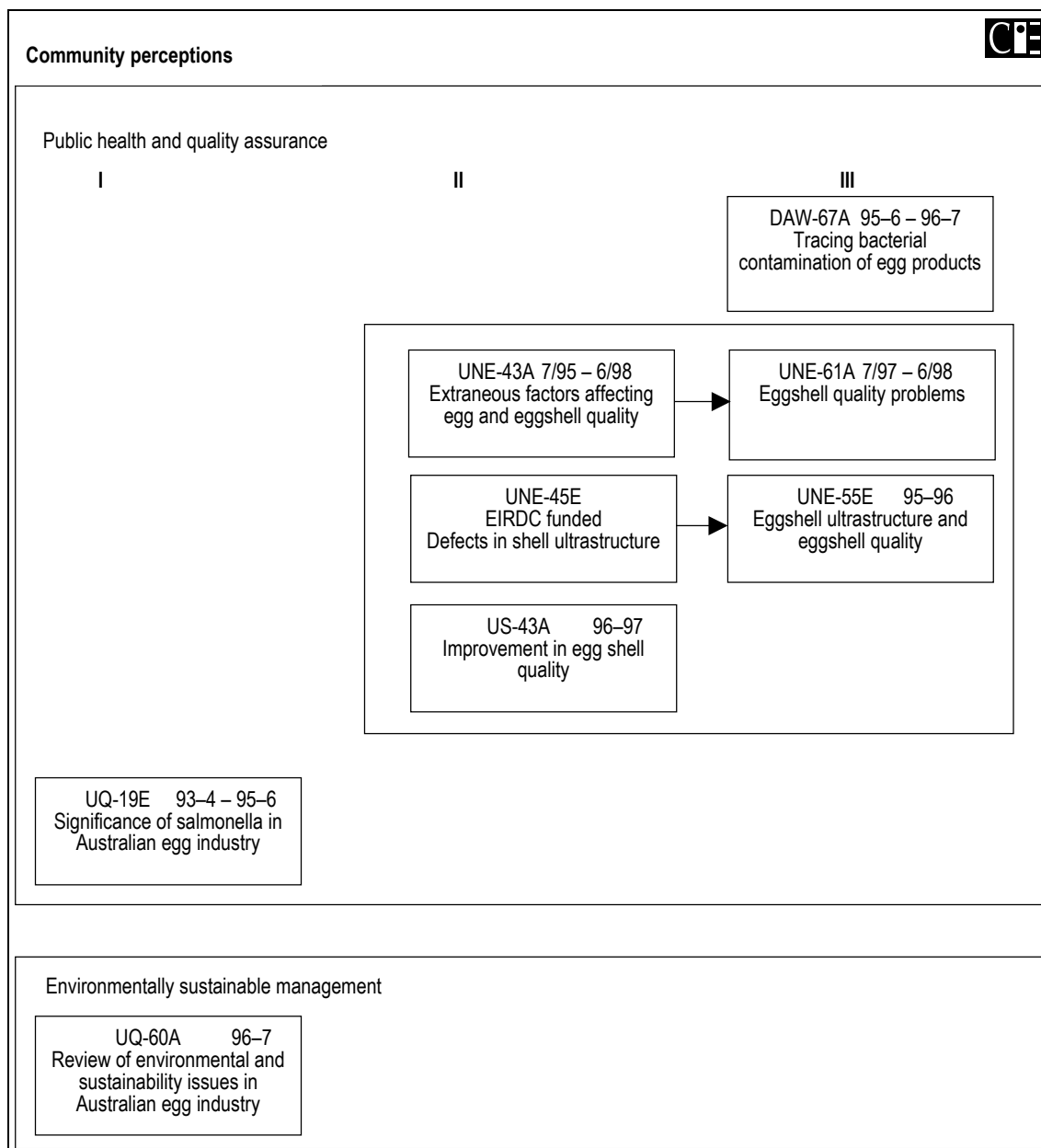
Physiology		
I	II	III
Other CME (CSK-2CM)	UQ-25E 94-5 – 95-6 Ovarian regression in domestic hen Joint CME	

Continued on next page

1.3 Classification of projects for evaluation Continued



1.3 Classification of projects for evaluation Continued



Data source: Program managers and CIE assessment.

Disease – jointly funded projects

The joint projects are listed below. Full details of these projects are provided in chapter 2.

- CSK-3A.
- DAQ-200A and DAQ-226A.
- DAQ-25E.
- DAV-115A, MS967-01 and MS978-17.
- TA956-38.

Feed availability and nutrition

- DAQ-28E, DAS-44A and UQ-21E is a set of projects addressing the issue of bird diet cost. Through providing greater certainty about the nutritional value of legumes, it is hoped that less costly feed alternatives can be identified. Each of these projects had a good output.
- DAV-111A is a stand-alone project investigating low growth rates and low appetite in laying flocks housed in controlled environment shedding. This project was considered to have a good output. Assessment of this project would require knowledge of adoption rates. As usage of controlled environment shedding is growing, assessment of this project in the future would yield a greater pay-off.
- UNE-50A is a stand-alone project that was classified as having output of good value. This project evaluated the performance and profitability of new layer strains introduced to Australia. The information generated will assist producers in assessing which strain of bird and type of calcium supplement are most likely to suit their needs.
- UQ-52A sought to minimise feed costs per bird by reducing any unnecessary feed expenditure arising due to poor nutritional information. The egg and chicken meat committees jointly funded this project and it was considered to have output of good value.
- VCA-4A evaluated the performance of moulted hens fed a high nutrient density diet. While the output of this project was rated as good, the findings are only relevant to a small segment of the egg industry (farmers with birds in second cycle production).
- VFI-3A is a consultant report that established a strategy for development of a grains industry in Victoria to assure supply of grains to poultry farmers. This project received funding from numerous sources and will impact on all intensive livestock industries. This project, which has elements of all three stages of R&D, was classified as having output of good value.

Physiology

- The egg and chicken meat programs jointly funded project UQ-25E. This project investigated ovarian regression in broiler breeder and layer flocks, and sought to differentiate between true ovarian disease and normal ovarian regression. This project was rated as having output of excellent value.

Husbandry and welfare

Ten stand-alone projects and two projects sets addressing the key research area of flock husbandry and welfare were identified.

- Project DAQ-195A is responsible for maintaining an Australian line of genetic stock with high rate of lay characteristics. Following the importation of new genetic lines of stock, it was no longer necessary to select Australian stock for high lay characteristics. DAQ-195A maintained the line of Australian stock for future use.
- DAQ-197A developed a computer program for the formulation of cost minimising optimal layer diets. The output of this is a direct input to project DAQ-242A, which is trailing the program. DAQ-197A is expected to have output of good value.
- DAS-24E sought to demonstrate long known anecdotal information as being scientifically correct. The project demonstrated that insulation of water lines was of benefit in terms of reducing bird mortalities and raising production. The output of this project is of benefit only in those regions where heat is a problem. Evaluation of this project would require a survey of farmers to assess their uptake rate and consideration of exogenous factors likely to influence uptake. This project was classified as having output of good value.
- DAW-68A is similar to DAS-24E in that it attempted to demonstrate that anecdotal information concerning vent trauma and stock wound sprays was scientifically correct. Despite having output of good value, the findings of this project have not been widely adopted.
- MS967-25 was a RIRDC contribution to a GRDC rodent research program. An information chart was produced showing how to control rodents in feed and poultry sheds. The impacts of this project are felt in all grain intensive feed industries. This project would be difficult to evaluate because of the public good nature of rodent control.
- Project MS978-11 provided funding for the Animal Welfare and Training Centre. While not strictly an environmentally sustainable management project, it does address the area of community perceptions. This project has a public relations focus rather than delivering scientific benefits and was considered to have output of good value.
- NEP-1A was a project attempting to develop computer software for the analysis and benchmarking of egg laying flocks. The developed software is now obsolete and hence the project has no final output.
- Project RSA-1A sought to develop strategies and economic models to assess the (economic) impact of flock replacement and management strategies. The project attempted to develop a management tool with which farmers could optimise their flock replacement plans. This project had no final output.
- SAR-3A, UF-3E and DAS-23E are a set of projects establishing that beak trimming is a credible practice and prevents cannibalism amongst layers. Allowing beak trimming to continue is estimated to avert losses of \$17.5 million from cannibalism mortalities. Medical agents can be used to prevent acute pain and to reduce beak regrowth. SAR-3A was rated as having output of excellent value and UF-3E as having output of good value. Project DAS-23E produced and distributed videos demonstrating the techniques of beak trimming and vaccination in poultry. DAS-23E was considered to have output of excellent value.

Evaluation of these projects would be difficult, as it would require attaching a monetary value to bird welfare.

- SAR-6A and UF-4E share a common theme in that they assess the welfare and productivity of caged layers. Both of these projects had output of good value.
- UQ-23E investigated the effect on production and bird welfare of possible lower cage stocking densities prescribed in the Code of Practice — Domestic Poultry (1992). This project found that current stocking levels were optimal and that no change in current practices was required. The findings of this project were classified as excellent value.
- UQ-26E assessed the suitability of modified Edinburgh cages in Australia. The project found that such cages were not appropriate in Australian conditions. This project was rated as having output of excellent value as it avoided costs associated with installing cages that welfare groups cite as being preferred.

Community perceptions

One project set of four projects and four stand-alone projects have been identified.

Public health and quality assurance

- The project set containing UNE-43A, UNE-55E, UNE-61A and US-43A addresses the relationship between shell quality and public health. Egg shells of poor quality increase susceptibility to bacterial contamination, thereby reducing quality assurance. UNE-43A and UNE-61A were rated as having excellent output while UNE-55E and US-43A were rated as having good output. The EIRDC funded project UNE-45E was a direct input into project UNE-55E, which published the findings of UNE-45E.
- Project DAW-67A was rated as having an output of low value. The project developed a molecular typing technique to test processed egg products for bacterial contamination, thereby improving the quality assurance program.
- UQ-19E was an epidemiological study attempting to identify whether or not the Australian egg industry was free of the Salmonella responsible for the main type of food poisoning. Having found that this was the case, public health reasons could be used as justification for raising quarantine barriers. This project was classified as having output of good value.

Environmentally sustainable management

- UQ-60A was the first and only project so far conducted for the egg industry in the area of environmentally sustainable development. The project provided recommendations and good information on sustainable development. This project was classified as having excellent output — however, measurable outputs are not expected for ten years.

Evaluation

Table 3.4 summarises the expected outputs and outcomes from the projects. It also describes the stage of the research and which industries and products are likely to be affected. Multi-industry indicates that both chicken and egg industries are affected, whereas industry means the impacts

are on the egg industry. The majority of projects (approximately 63 per cent) are stage II. Approximately 17 per cent of projects are stage III and 10 per cent stage I. Just under half of the stage III projects address the key research area of production efficiency and flock health. For a number of projects it is too early to be able to identify explicit outcomes flowing from the project. In such instances evaluation would largely be *ex ante* in the sense of predicting the benefit flows.

Overall, the assessment is that most projects have delivered outputs of at least good value (75 per cent of projects classified as having output of medium or high value). Dissemination of research findings, applicability and practicality of research findings and adoption rates will impact on the outcomes of the projects and project sets.

1.4 Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
AEI-1E	National industry databases	III	Industry level effect, traditional products, all markets	KB	TA967-32	Medium
AFS-1A	Investigation and development of egg yolk products to match local and export market opportunities	II	Industry level effect, new products, all markets	NM	Stand-alone	No final output
CSK-3A	Infectious Bursal Disease Virus (IBDV): To determine if current vaccination strategies prevent the emergence of very virulent IBDV	II	Multi-industry effect, traditional products, all markets	DE, DTR	Joint CME	Medium
CST-3E	Australian Mycotoxin Data Centre	I	Multi-industry effect, traditional products, all markets	DE	Stand-alone	Low
DAN-38A	Producing trial distant learning materials for the poultry industry	III	Industry level effect, traditional products, all markets	S, KB	Stand-alone	Too early
DAQ-195A	Selection criteria for a high rate of lay in poultry	I	Industry level effect, traditional products, all markets	HW	Stand-alone	No final output
DAQ-197A	A computer program for the formulation of economically optimal layer diets	II	Industry level effect, traditional products, all markets	HW	DAQ-242A (in progress)	No final output (expected good)
DAQ-200A	Rapid and specific detection of avian bacterial pathogens	III	Multi-industry effect, traditional products, all markets	DD	Joint CME, DAQ-226A	Medium
DAQ-226A	Sabbatical studies — Dr Mazhar Khan	II	Multi-industry effect, traditional products, all markets	DD	Joint CME, DAQ-200A	No output

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

Project no.	Project title	Stage	Product	Classification	Related projects	Initial assessment
DAQ-28E	Testing and improving the nutritional value of grain legumes for layers and broilers	II	Multi-industry effect, traditional products, all markets	N	Joint CME, UQ-21E, DAS-44A	Medium
DAS-23E	Demonstrating techniques of beak trimming and vaccination in poultry	III	Multi-industry effect, traditional products, all markets	HW	SAR-3A, UF-3E	High
DAQ-25E	Characterisation and attenuation of Eimeria spp for use in a living vaccine for Avian coccidiosis	II	Multi-industry effect, traditional products, all markets	DTR	Joint CME – DAQ-29CM	High
DAS-24E	Ideal drinking water temperature for layers	II	Industry level effect, traditional products, all markets	HW	Stand-alone	Medium
DAS-44A	Nutritive value of lupins	II	Industry level effect, traditional products, all markets	N	UQ-21E, DAQ-28E	Medium
DAV-111A	A study of the metabolism of the laying hen during weight loss and sub-optimal growth during early egg production	II	Industry level effect, traditional products, all markets	N	Stand-alone	Medium
DAV-115A	MD Challenge Virus pathogenicity trial	III	Multi-industry effect, traditional products, all markets	DTR	Joint CME	Medium
DAW- 68A	Controlling vent trauma and resultant mortality with stock wound sprays	III	Multi-industry effect, traditional products, all markets	HW	Stand-alone	Medium
DAW-67A	Molecular typing to trace contamination of egg products by bacteria	III	Industry level effect, traditional products, processed export market	QA	Stand-alone	Low
INS-4A	Interdependence and integration of the egg, processed food and food service industries: Future trends and strategies	II	Multi-industry effect, traditional products, all markets	NM	Stand-alone	Medium
KTR-1A	Egg based repellents	II	Industry level effect, new products, all markets	NM	Stand-alone	High
MS967-01	Commissioned Marek's Disease research		Multi-industry effect, traditional products, all markets	DD	Stand-alone	Medium
MS967-25	RIRDC contribution to GRDC rodent research program	II	Multi-industry effect, traditional products, all markets	HW	Stand-alone	Medium
MS978-11	Support for establishment of the Animal Welfare Research and Training Centre	II	Multi-industry effect, traditional products, all markets	ESM	Stand-alone	Medium
MS978-17	Marek's disease subcommittee		Multi-industry effect, traditional products, all markets	DD	Stand-alone	Medium

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

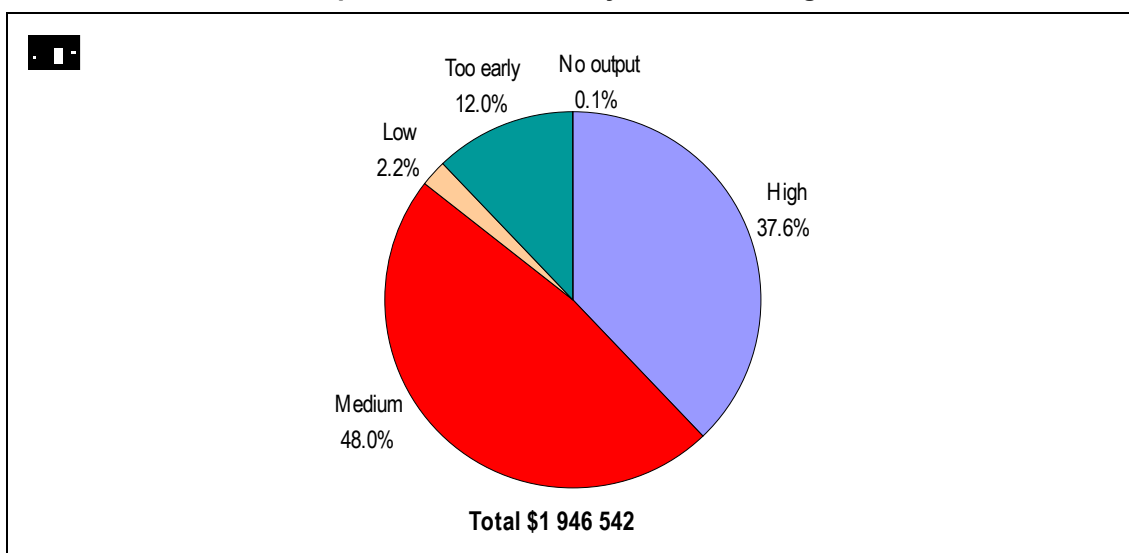
Project no.	Project title	Stage	Product	Classification	Related projects	Initial assessment
NEP-1A	Computer software for performance analysis and benchmarking of egg laying flocks	II	Industry level effect, traditional products, all markets	HW	Stand-alone	No final output
REM-1A	Review of <i>Disease Need Not be a Sentence</i>	III	Multi-industry effect, traditional products, all markets	DD, DTR	Stand-alone	No final output (too early)
RSA-1A	Development of strategies and economic models to seek stability in the production and marketing of eggs in Australia	II	Industry level effect, traditional products, all markets	HW	Stand-alone	No final output
SAR-3A	Prevent chronic pain developing in layers subject to beak trimming and retrimming	II	Multi-industry effect, traditional products, all markets	HW	DAS-232E, UF-3E	High
SAR-6A	Productivity, efficiency and profitability of caged layers with poor feather cover	II	Industry level effect, traditional products, all markets	HW	UF-4E	Medium
TA956-38	Testing Australian IBVD strains for cross reaction with Snyder's monoclonal antibodies and Australian MAb's for cross reaction with classical and very virulent IBVD strains, Holland		Multi-industry effect, traditional products, all markets	DTR	Stand-alone	Medium
TA967-32	Mr McMaster travel to address egg producer groups in mainland states on the economic outlook for the Australian egg industry	III	Industry level effect, traditional products, all markets	E	AEI-1E	High
UCS-17A	Modelling the determinants of domestic egg demand	II	Industry level effect, traditional products, all markets	E	Stand-alone	No final output
UF-1A	Eggs as a source of essential docosahexanoic acid in the diets of weaning infants	II	Industry level effect, new products, all markets	NM	Stand-alone	High
UF-3E	Prevention of beak regrowth and chronic pain following trimming	II	Industry level effect, traditional products, all markets	HW	DAS-23E, SAR-3A	Medium
UF-4E	Effects of foot lesions and feather loss on the welfare of caged layers using anatomical and behavioural approaches	II	Industry level effect, traditional products, all markets	HW	SAR-6A	Medium
UMU-3E	Genetic relationships and pathogenicity of intestinal spirochaetes infection in Australian poultry	I	Multi-industry effect, traditional products, all markets	DE	UMU-21A (in progress)	No final output
UNC-2A	Visibility of eggs and egg products in the print media	II	Industry level effect, traditional products, all markets	NM	Stand-alone	Low
UNC-3A	Egg and fat consumption patterns of slimmers compared to that of other foods	II	Industry level effect, traditional products, all markets	NM	Stand-alone	Low

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

Project no.	Project title	Stage	Product	Classification	Related projects	Initial assessment
UNE-43A	The effect of extraneous factors on egg and eggshell quality in laying hens	II	Industry level effect, traditional products, all markets	QA	US-43A, UNE-55E, UNE-61A	High
UNE-50A	Commercial implications of source and form of dietary calcium and comparative evaluation of three imported and two Australian layer strains	II	Multi-industry effect, traditional products, all markets	N	Stand-alone	Medium
UNE-55E	Eggshell ultrastructure and eggshell quality: Conveying the information to the egg industry	III	Industry level effect, traditional products, all markets	QA	US-43A, UNE-43A, UNE-61A	Medium
UNE-61A	Educational materials: Egg shell quality problems	III	Industry level effect, traditional products, all markets	QA	US-43A, UNE-55E, UNE-43A	High
UQ-19E	The significance of salmonella, particularly <i>Salmonella infantis</i> , in the Australian egg industry, with respect to public health	I	Industry level effect, traditional products, all markets	QA	Stand-alone	Medium
UQ-21E	New vegetable protein sources for layers	II	Multi-industry effect, traditional products, all markets	N	DAQ-28E, DAS-44A	Medium
UQ-23E	Production and welfare of layers housed at high and low stocking density in modified existing cage units	II	Industry level effect, traditional products, all markets	HW	Stand-alone	High
UQ-25E	A study of ovarian regression in the domestic hen and its effect on performance in layer and broiler flocks	III	Multi-industry effect, traditional products, all markets	P	Joint CME, CSK-2CM	High
UQ-26E	Production and welfare of layers housed in Edinburgh modified cages in Australia	II	Industry level effect, traditional products, all markets	HW	Stand-alone	High
UQ-52A	A comparison of total and digestible amino acids in diets for broilers and layers	II	Multi-industry effect, traditional products, all markets	N	Joint CME	Medium
UQ-60A	Strategic review of environmental, land use and sustainability issues in the Australian egg industry	I	Industry level effect, traditional products, all markets	ESM	Stand-alone	High
US-43A	Improvement in egg shell quality at high temperatures	II	Multi-industry effect, traditional products, all markets	QA	UNE-43A, UNE-55E, UNE-61A	Medium
VCA-4A	Evaluation of the performance of moulted hens fed high nutrient density diets post moult	III	Multi-industry effect, traditional products, all markets	N	Stand-alone	Medium
VFI-1A	Strategy development of a strong feed grains industry in Victoria well integrated with livestock industries	I–III	Multi-industry effect, traditional products, grains market	N	Stand-alone	Medium

1.5 Initial assessment of potential outcomes by RIRDC funding^a



^a Excluding projects addressing the areas of training and information transfer.

Data source: Program manager and CIE assessment.

Chart 3.5 summarises the likely outcomes by budget allocation. The outcomes are indicative only. From the chart we can see that approximately 85 per cent of RIRDC–EIRDC funding went to projects which delivered an output of at least good value.

Recommendations for evaluation

One project set and five stand-alone projects are recommended for evaluation, reflecting a mix of easy to evaluate projects for accountability and interesting issues for management. The key research areas of community perceptions, husbandry and welfare nutrition, and industry development are addressed by these projects.

- The project set of UNE-43A, UNE-55E, UNE-61A and US-43A addressed the issue of poor shell quality and public health concerns. Poor shell quality increases the opportunity for bacterial contamination of eggs, an obvious quality assurance and public health concern. Poor shell quality also sees eggs being downgraded, at a cost to the industry of approximately \$10 to 15 million per year. If this project set were chosen for an evaluation project, the EIRDC funded UNE-45E would need to be included in the set. Evaluation of the set would require knowledge of adoption rates, rates of bacterial contamination due to poor shell quality pre and post findings, and the change in costs associated with the downgrading of eggs. The cost of bacterial contamination — in terms of bad publicity, recalls and human sickness — would also be needed. This set would be difficult to evaluate.
- UQ-23E established that the possible lower stocking densities might result in negative bird welfare effects and lower net returns per unit of cage space. Evaluating the cost savings flowing from this project would be relatively easy — all that would be required is knowledge of current cage space, the number of birds caged and the cost of building additional cages. This data is obtainable from industry and industry organisations.
- UQ-26E established that European developed ‘resource enriched’ Edinburgh modified cages are not directly applicable to Australian open shed conditions. This project has averted costs

associated with installing Edinburgh cages. Evaluating the cost savings flowing from this project would be straightforward — all that is needed is the cost of the Edinburgh cage, stocking densities and ongoing operational costs.

- KTR-1A developed a commercial egg based repellent for use in horticulture. Benefits flowing from this program include reduced horticulture losses attributable to browsing animals and environmental benefits associated with using non-lethal animal control techniques. Evaluation of this program would be ex ante as it would require estimating the potential savings flowing to the horticulture sector. This program would be hard to evaluate.
- UF-1A looked at including egg products in the diets of weaning infants. Evaluation of this program would require knowledge of adoption rates. This information should be obtainable via a survey of nutritionists and by extrapolating from the number of information pamphlets disseminated. This project may be difficult to assess as it would require knowledge of the substitutability between egg products and other sources of docosahexanoic acid in infant diets.
- VC-4A evaluated the performance of moulted hens fed a high nutrient density diet. This was found to have a significant impact on bird survival and performance, and is expected to have a good pay-off for the industry.

1.Honeybee Program

Overview

Background

The Australian honeybee industry recorded production of 31 000 tonnes of honey in 1998, worth an estimated \$49 million at the farm gate. Due to under reporting of production and poor statistical information about the industry, actual production and value of production are likely to be significantly higher. Domestic consumption is approximately 15 000 tonnes, with the remaining 16 000 tonnes being exported in pre-pack and bulk form. The European Union is the largest export market for Australian apiary products. Australia is the world's fourth largest exporter of honey.

Honey is only one output of the honeybee industry. In 1994-95 the value of production by the honeybee industry — including honey, queen and package bees, beeswax, pollen and pollination — was estimated to be between \$60 and \$65 million. In addition, pollination carried out by honeybees is estimated to benefit the Australian economy between some \$604 million and \$1.2 billion annually.

There are approximately 800 commercial apiarists in Australia and several thousand part-time and hobby apiarists, operating some 673 000 (registered) hives. The majority (70 to 80 per cent) of honey is produced from native flora, especially eucalypts growing on public, crown leasehold and freehold land. The main production time is between October and March. Honey production is concentrated in New South Wales, accounting for nearly 45 per cent of total honey production. Managed honeybees are found in all Australian states and territories, although little honey is produced in the Northern Territory or the Australian Capital Territory.

Research and development activities

Honeybee research and development effort has been formally supported and coordinated since 1962. Industry supported honeybee research was administered by the Australian Honey Board until 1980. The *Honey Research Act 1980* established the Honey Research Committee and introduced a statutory levy to raise funds for research and development activities in the beekeeping industry. The *Primary Industries and Energy Research and Development Act 1989* established the Honeybee Research and Development Council to further improve research administration. Further streamlining of honeybee research and development in 1995 resulted in the formulation of the Honeybee Research and Development Committee (HBRDC) within RIRDC.

The current research and development (R&D) levy is 0.75 cents per kilogram of honey, although this may increase to 1.5 cents per kilogram in the near future. Producers only pay the levy if their annual production is in excess of 600 kilograms. Annual R&D budgets were typically in the order of \$200 000 to \$250 000. However, in the last two years the R&D budget has been raised considerably — \$480 000 was allowed for in 1998-99. If the R&D levy does increase, annual R&D expenditure may be in the region of \$600 000.

Honeybee research has been developed progressively over three five year research and development (R&D) plans. The first (1986–91) emphasised field production. The second (1991–96) addressed the areas of resource access, quality assurance and market opportunities. The current plan (1996–01) seeks to improve industry productivity, address market related issues and industry diversification.

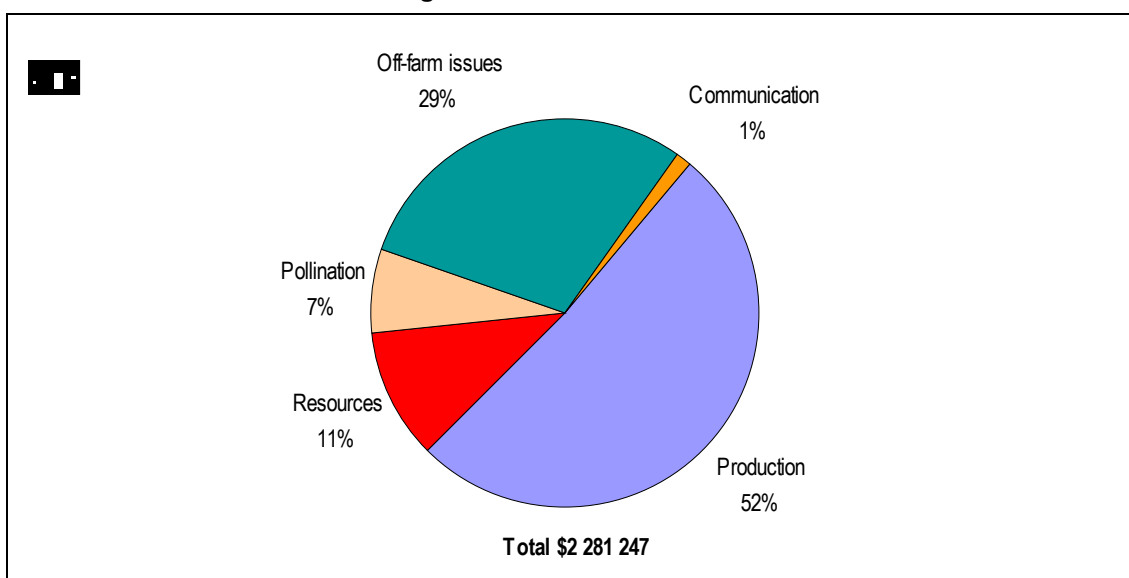
The current five year R&D plan covers five key areas. Key research areas can be further broken down into specific research programs. R&D projects can be classified as falling into one (and sometimes more) of the following.

- Production:
 - bee husbandry and management (BHM);
 - disease and pest management (DPM);
 - nutrition (N)
 - genetic stock (GS); and
 - income diversity (ID).
- Resources:
 - access to (native) flora (ANF).
- Pollination:

- pollination services (PS); and
- integrated pesticide management (IPM).
- Off-farm issues:
 - development of apicultural products (AP);
 - marketing (M); and
 - quality assurance (QA).
- Communication and extension (C).

Chart 4.1 summarises the main areas of HBRDC–RIRDC funding by five year RIRDC Honeybee Program R&D plan categories. The main area of funding since 1990-91 has been production, accounting for over half of the available funding. Within the research area of production, approximately 51 per cent of funding goes towards projects addressing the area of disease and pest management, and 30 per cent to genetic stock related projects.

1.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

List of projects

Table 4.2 lists the projects that have been identified in the Honeybee Program. Projects that are currently under way or have been approved are included in the listing (these projects are italicised). Starting and finishing dates are provided where available. The total cost of the project as reported by RIRDC has been included (sum of annual dollar amounts, not discounted) to give an approximation of the relative size of projects. The total project cost includes contributions from industry, research institutions and HBRDC–RIRDC.

4.2 Completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
AHB-3H	Codes of practice for assuring the quality of Australian honey		1991-92	30 334	15 167
AHB-4H	Consumer market research into attitudes to and uses for Australian honey	1992	1993	50 000	25 000

AHB-5H	Codes of practice for assuring the quality of Australian honey	1992-93	1993-94	16 000	8 000
AQB-1B	Introduction and performance of queen bees — survey of queen bee breeders' apiaries	Sep-97	Jun-98	2 000	2 000
CSE-2H	Diseases and disorders of the queen honeybee (<i>Apis mellifera</i>)	1991	1992	94 595	32 000
CSE-3H	Molecular taxonomy of nosema apis	1993-94	1997-98	78 000	52 000
CSE-4H	A pilot study of disappearing disease of honeybee colonies	1993-94	1996-97	20 000	10 000
CSE-5H	A study to isolate, identify and apply the Nasonov pheromone of the Asian honeybee <i>Apis cerana</i>	1993	1994		
CSE-6H	Disappearing disorder	1994-95		32 813	32 813
CSE-74A	Identification and application of the aggregating pheromone of <i>Apis cerana</i>	Jul-96	Jun-98	239 444	118 348
CSE-81A	Development of a specific aggregation lure for <i>Apis cerana javana</i>	1997-98	1999-2000	126 285	62 660
CSF-1H	Production of de-flavoured honey and honey flavours using the spinning cone column flavour recovery system	1992	1993	19 300	9 650

Continued on next page

4.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
CUT-4A	Testing an electronic device that emits queen piping sounds to find a queen bee in a colony	1995	1996	18 254	8 250
DAN-10H	The development of techniques for the prevention and control of American Foulbrood	Jul-88	Jun-91	57 460	28 730
DAN-11H	The production of bee diseases, parasites and pests video	Jul-90	Jun-91	10 576	5 291
DAN-12H	Government mission to USSR	Jul-90	Aug-90	4 220	2 360
DAN-134A	Crude protein and amino acid levels of pollens collected by honeybees in southern NSW	Mar-95	Dec-98	137 736	46 506
DAN-135A	Development of remote sensing, beehive production status monitoring system	1995-96	1997-98	27 894	17 711
DAN-136A	Oxytetracycline sensitivity, diversity and study of <i>Melissococcus pluton</i> (European Foulbrood)	Jul-95	Jun-98	350 096	103 133
DAN-14H	Safeguarding honey quality through pesticide monitoring in high risk areas		1992-93		
DAN-153A	Natural resources database for the NSW apiary industry	1996	1997	2 138	2 138
DAN-155A	Floral resource database for the NSW apiary industry	Feb-96	Dec-98	167 526	19 800
DAN-15H	Amino acid profiles and crude protein levels of pollens	1991-92	1992-93	6 800	3 400
DAN-164A	Introduction and performance of queen bees — introduction apiary status and post introduction results	Sep-97	Jun-98	55 504	7 100
DAN-16H	Disease producing mechanisms of American Foulbrood	1992-93	1993-94	59 875	59 875
DAN-17H	Educational videotape on package bees	1992-93	1994-95	17 004	8 502
DAN-18H	Palatability and nutritional value of six commonly available non floral feed stuffs available to honeybees	1993	1994	29 032	14 516
DAN-19H	Pollination of faba beans	1996	1997	21 422	10 400
DAN-4H	Amino acid profiles and crude protein levels of pollens for maximising honey production and crop pollination	Jul-87	Jun-91	5 800	2 900
DAN-21H	Production of a video on chalkbrood disease	1994-95	1996-97	11 721	3 751
DAN-22H/DAN-139A	Production of a video on external exotic honeybee parasites	1994-95	1997-98	11 770	11 770
DAN-93T1	Travel to Korea to study the package bee industry and exotic diseases	1993	1994	2 400	2 400
DAQ-199A	The development of a natural resource database for the Queensland apiary industry	Feb-95	Jun-97	112 562	21 337

DAQ-202A	Quality survey of introduced honeys	1995-96	1996-97	10 000	10 000
DAQ-203A	Promotion of native bees in the Torres Strait		97-98	35 039	9 811
DAQ-204A	Antimicrobial properties of Australian honeys	1995-96	1996-97	68 590	31 980
DAQ-205A	Investigations into Disappearing Disorder — a problem of honeybees in south east Queensland	Sep-95	Apr-97	46 662	17 029
DAQ-231A	A quality survey of Australian honeys	Jul-97	Sep-98	52 250	18 150
DAQ-232A	The use of Australian honey in moist wound management	Jul-97	Jun-2000	480 000	180 000
DAQ-5H	Promotion of native bees in the Torres Strait	1994-95	1995-96		
DAT-2H	Introduction and evaluation of replacement species for blackberry in Tasmania	1992-93	1996-97	72 372	39 037
DAV-109A	A comprehensive study of beekeepers' use of honey and pollen flora resource in Victoria	Jul-95	Jun-99	89 309	26 204
DAV-10H	Oxytetracycline hydrochloride in Australian honey	1990-91	1991-92	30 490	17 941
DAV-119A	Developing a communications and marketing strategy for honeybee crop pollination	Jul-96	Nov-98	104 342	30 000
DAV-11H	A survey of pollination services in Victoria	1992-93	1993-94	37 320	24 730

Continued on next page

4.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
DAV-12H	The storage of oxytetracycline hydrochloride in beehives	1993	1994	14 909	8 657
DAV-13H	Metallic residues in honey stored in bulk containers	1993	1994		
DAV-157A	Best practice use of oxytetracycline hydrochloride (OTC) in beehives	1998	1999	68 327	37 725
DAV-8H	Control of American Brood Disease with oxytetracycline	Jul-89	Jun-92	27 132	19 295
DAW-2H	Genetic improvement of queen bee breeding stock in Australia	1985-86	1991-92	107 071	107 071
DAW-3H	A natural resource questionnaire for beekeepers	1990	1991	13 920	6 460
DAW-4H	Survey of the cost of production and income of WA honey farmers	Mar-91	Jun-91	9 100	3 000
DAW-69A	Using swarming acoustics of honeybees to clear honey supers of honeybees	1994-95	1996-97	18 515	7 300
DAW-75A	Export package bees — evaluating a lupin flour based feed for increased live bee production	Jan-97	Apr-2001	82 716	39 858
DAW-91A	Pollen analysis of Eucalyptus patens (Blackbutt), E. accedens (Powderbark) and E. wandoo (Winter Wandoo variety) in Western Australia	1998-99	1999-2000	26 682	10 500
FIC-1H	Leatherwood nectar resource management plan	Jan-92	Jun-93	20 000	10 000
GK-1A	Bulk honey containers	1993-94	1997-98	56 580	42 080
GK-2A	Strategic planning and action meeting for honeybee nutrition	?	1997-98	15 000	15 000
HAW-5H	Eastern bee breeding scheme	1992	1993	55 420	23 960
QAC-5H	The effects of farming practices on honeybee foraging behaviour and resultant yields in Entomophilous crops	1990-91	1992-93	94 762	69 378
QAC-6H	Developing opportunities for Australian honey		1992-93	48 534	38 372
QBA-2A	Laboratory and field trials relating to heat treatment of AFB infected bee equipment	Jul-97	Jun-98	2 780	2 780
TAR-1A	Non-fungicidal and biological control of core rots in pome fruit	Jul-97	Jul-2000	87 137	38 727
UA-1H	Impact of commercially managed honeybees Apis mellifera on the flora and fauna of Banksia Heathland in Ngarkat conservation park		1996-97	181 376	111 376
ULA-1H	Mitochondrial DNA characteristics of Australian honeybee strains	?	1993-94	60 196	47 098
ULA-2H	Evaluation of honeybees for hygienic behaviour	1994-95	1996-97	40 595	31 095
UNE-2H	The promotion and strategic development of the Australian pollination services market	1992	1993	9 312	9 312
UNE-46A	Benefits of secure access to public lands and their melliferous resources		1996-97	17 110	3 110

UNE-4H	The benefits to the beekeeping industry and society from secure access to public lands and their melliferous resources	1994-95	1995-96	7 944	7 944
UNE-5H	Verification of honey protein activities	1994	1995	1 500	1 500
UQ-1H	Australian honey in dried food mixes	1994	1995	7 453	7 453
UQ-50A	Australian liquid honey in commercial bakery products	Jul-95	Oct-98	130 956	65 598
UQ-54A	Australian honey in dried food mixes		1997-98	21 377	3 977
UQ-65A	The use of honeybees to deliver biocontrol agents to Geraldton waxflower	Jun-97	Jun-98	34 586	5 700
UQ-67A	Flavour quality assurance of Australian floral honeys by chemical fingerprinting	Aug-97	Oct-2000	185 545	85 594
UQ-84A	Improving the movement/use of liquid Australian honey within manufacturing processes	1998-99	2000-01	256 170	127 701
US-39A	Breeding hygienic disease resistant bees	Jul-96	Jun-2000	222 490	125 623
UWS-1H	Evaluation of imported honeybee stock in Australia	Jun-90	Sep-91	31 226	15 613

Source: RIRDC database, compendiums.

Project sets and initial evaluation

Chart 4.3 sets out the project sets for potential evaluation. Projects can be evaluated individually, or in small or large sets. Where projects are joined by an arrow it means that the output of one project directly leads into another project. Such projects need to be evaluated together. Where a box encloses projects it means that the projects all share a common theme and/or are related in some way. These projects should also be evaluated together — however, as the projects are separate entities, only part of the cost of the preceding project(s) should be allocated against the benefit flows from the following project(s). The program manager will be required to adjudicate on the share of costs of the earlier project attributed to the following project should a set be chosen for detailed evaluation.

Production

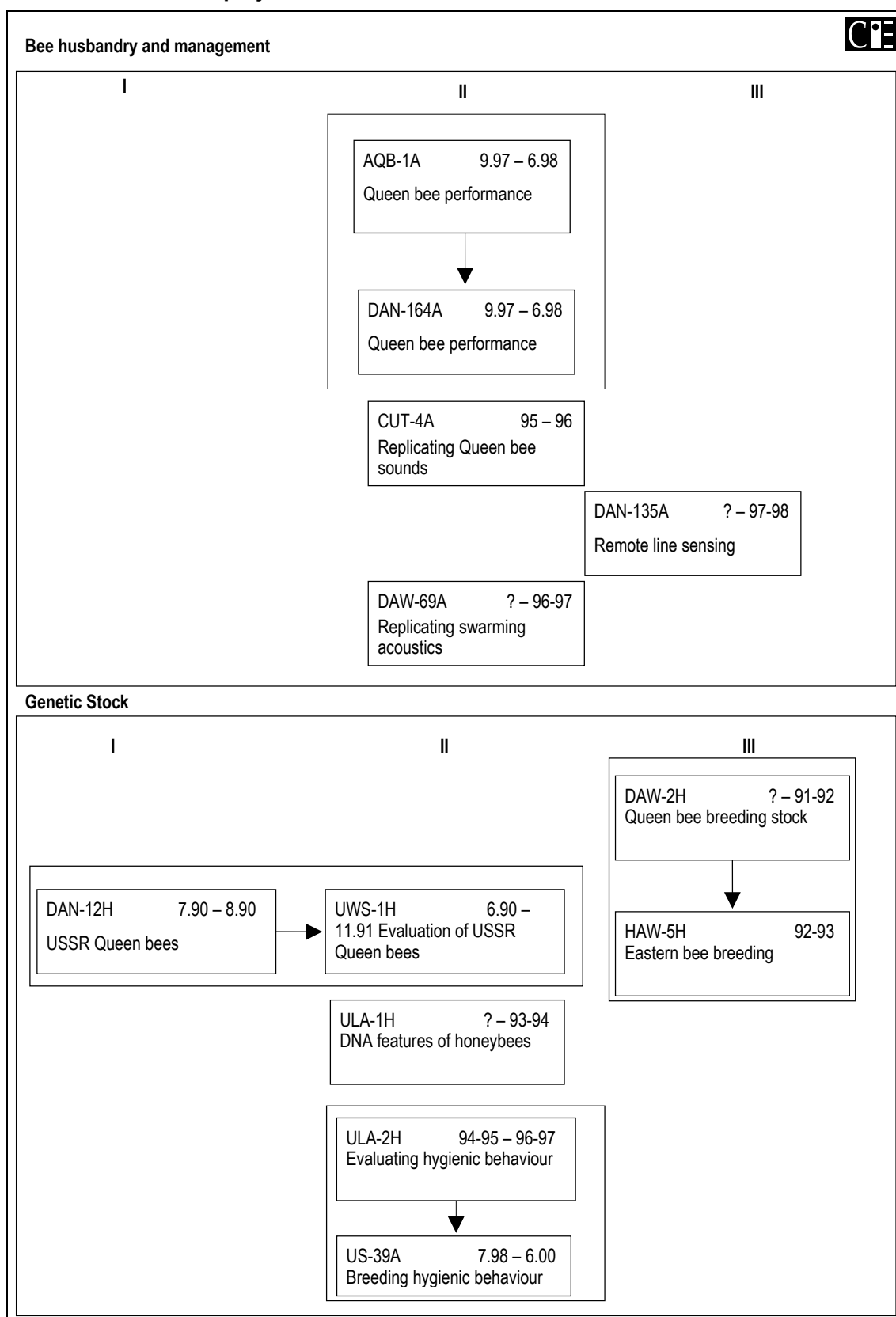
Bee husbandry and management

There is one project set and three stand-alone projects that address the research area of bee husbandry and management.

- ▣ AQB-1A and DAN-164A both examine queen bee introduction and performance. Both of these projects are currently in progress, with AQB-1A being a direct input into DAN-164A. The projects attempt to identify critical areas during queen bee production, which influence introduction and early performance levels.
- ▣ CUT-4A sought to develop an electronic tool that could mimic the sounds of queen bees to attract the queens to the source of the sound. It was hoped that this device would lower the time taken to locate a queen when re-queening a honeybee colony, but the project was not successful.
- ▣ DAW-69A attempted to develop an electronic device that could be used to mimic the swarming acoustics of honeybees to clear honeybees from honey supers. This project was unsuccessful.
- ▣ DAN-135A developed a technique by which honeybee farmers could monitor their hives remotely. The development of remote sensing systems means that apiarists no longer have to

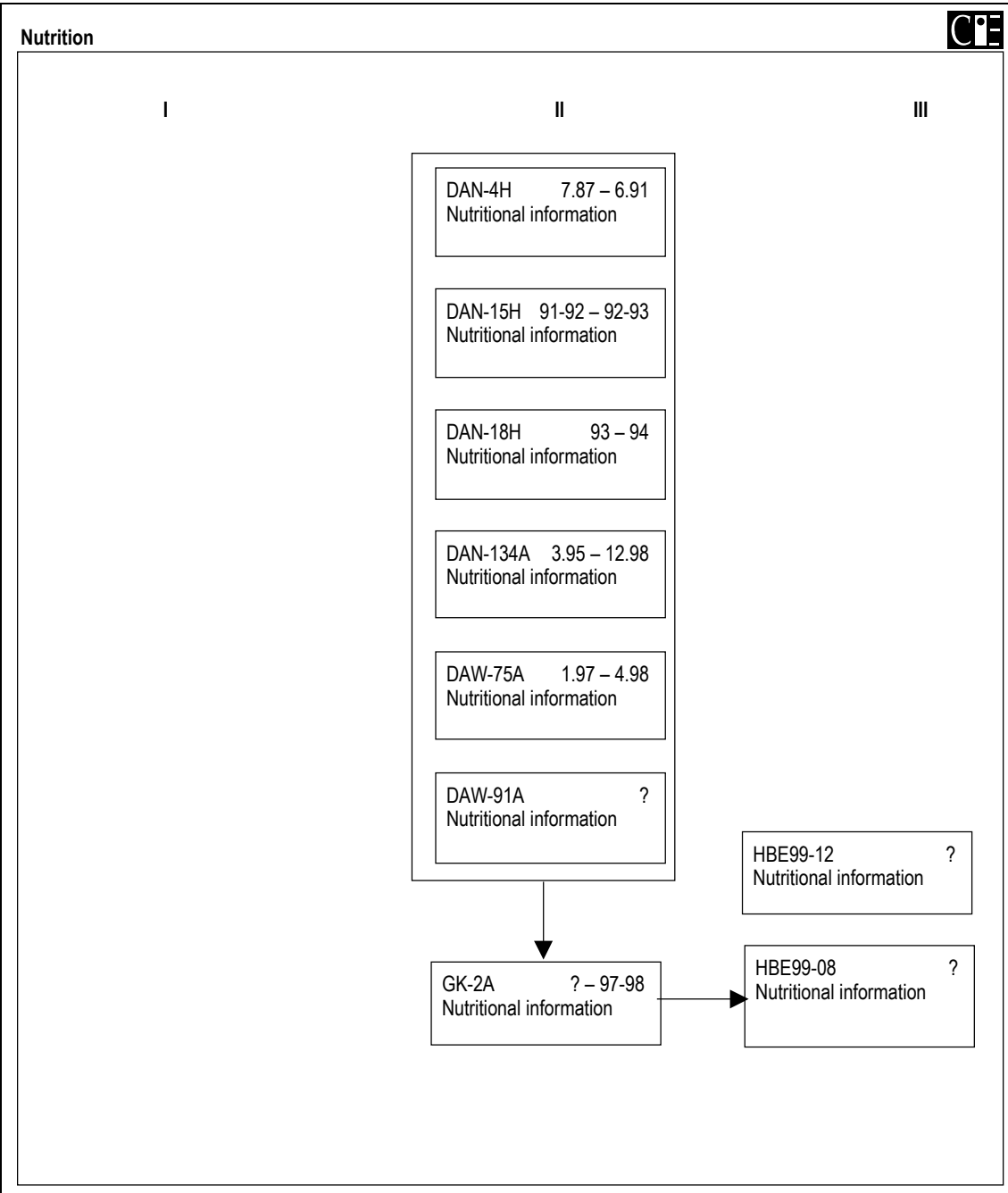
visit hives in order to assess hive status, allowing more time and resources for production tasks. This project is rated as having a good pay-off. It should be easy to evaluate if adoption rates are known.

1.3 Classification of projects for evaluation



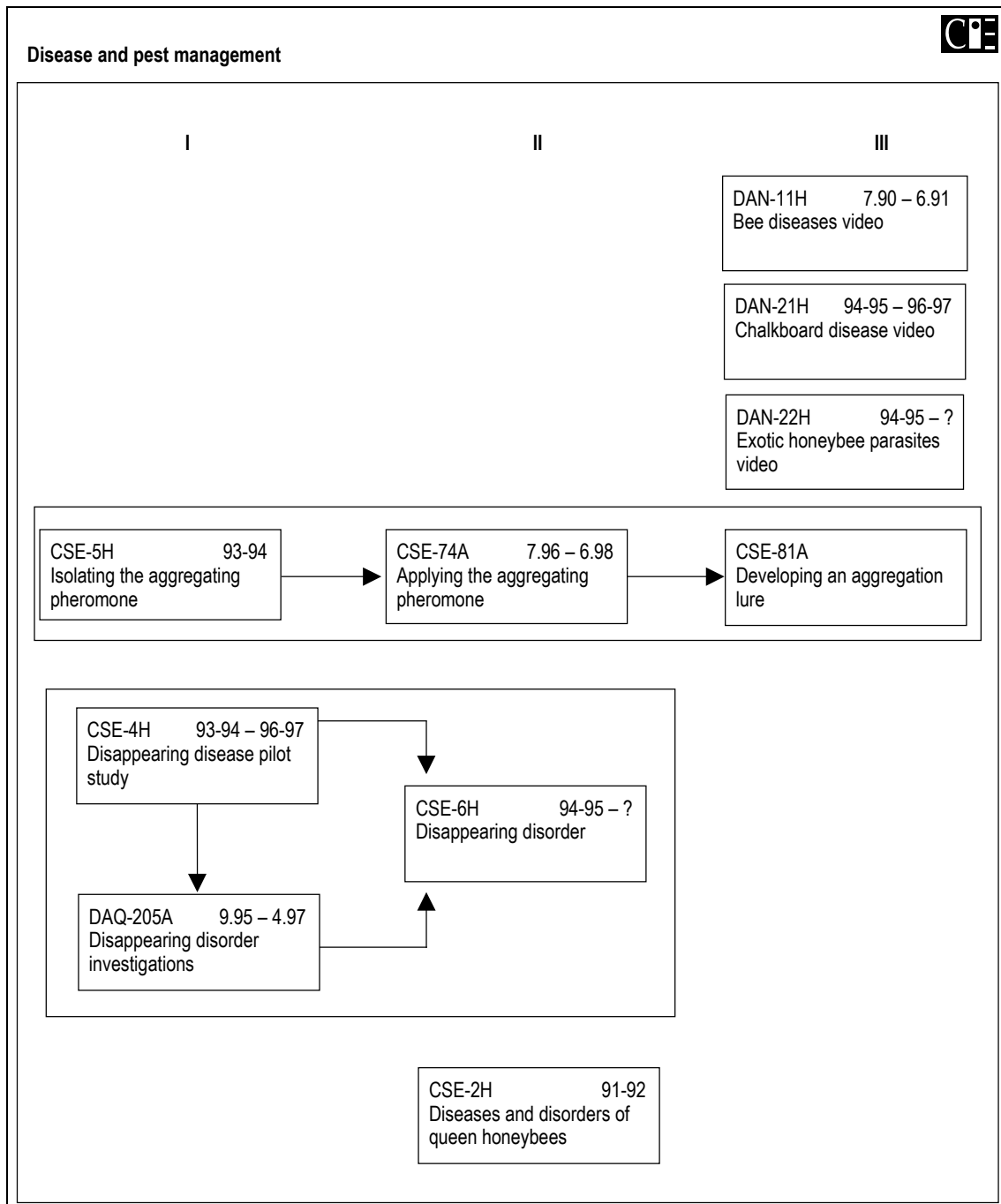
Continued on next page

1.3 Classification of projects for evaluation Continued



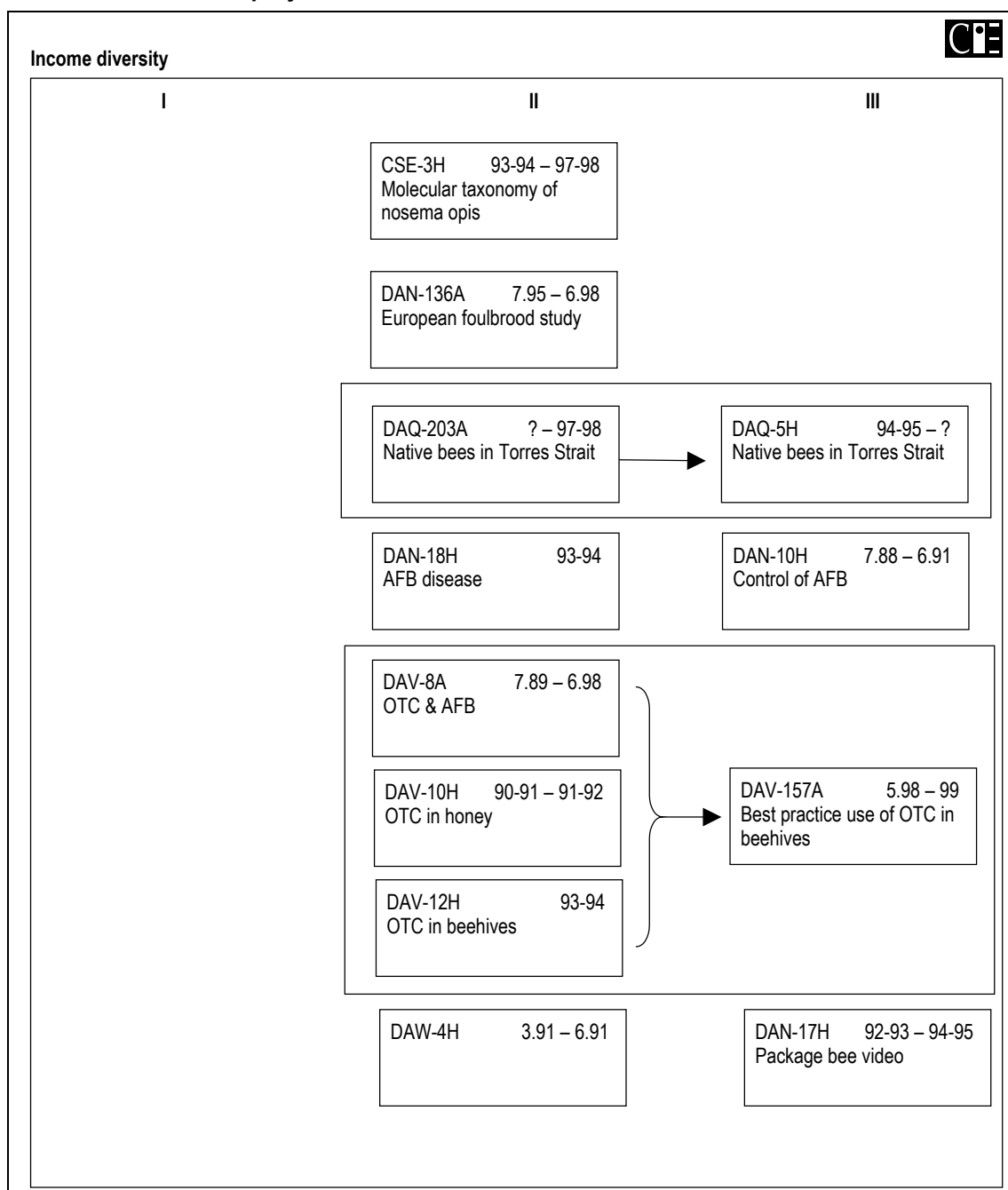
Continued on next page

1.3 Classification of projects for evaluation Continued



Continued on next page

1.3 Classification of projects for evaluation Continued

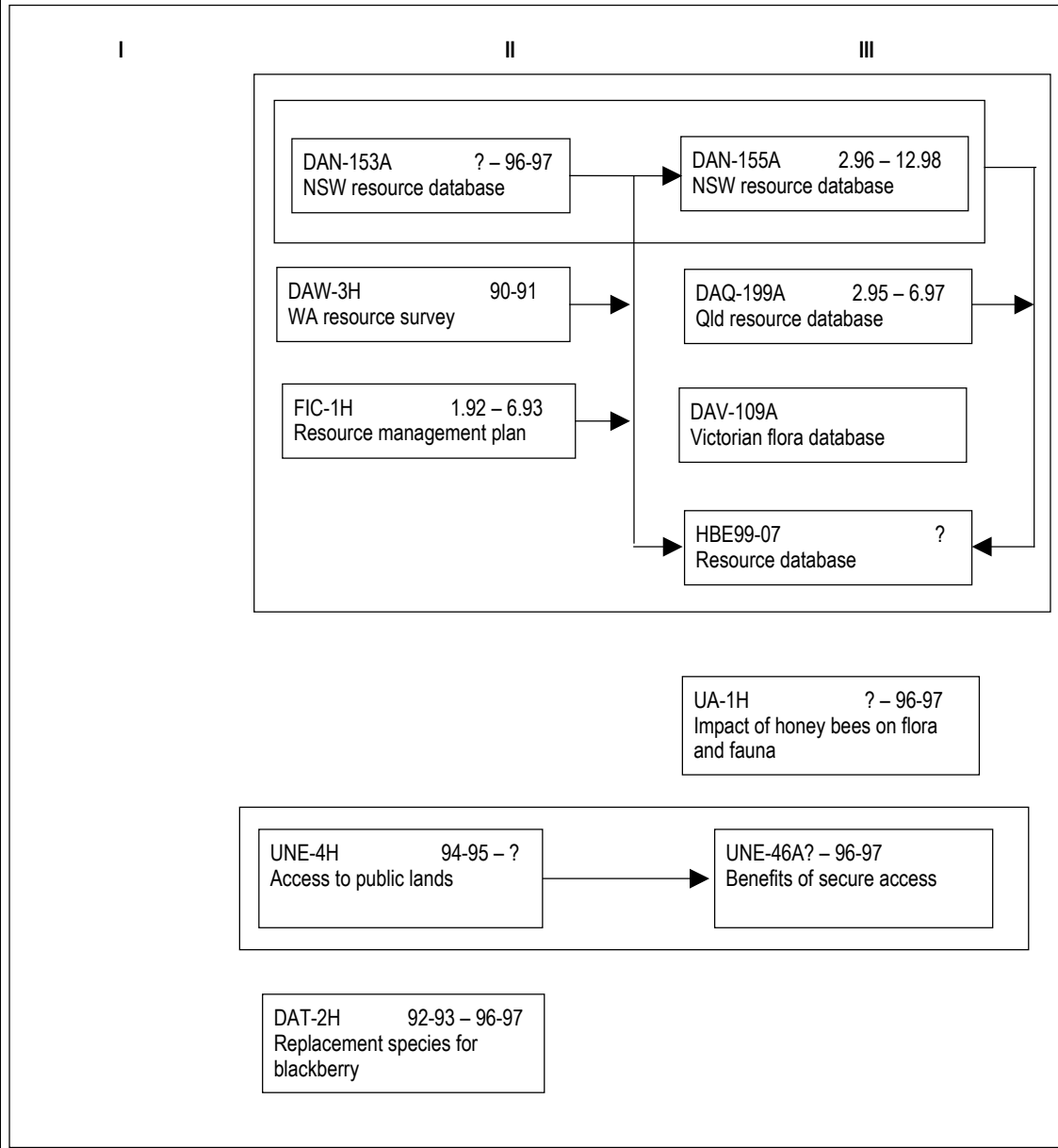


Continued on next page

1.3 Classification of projects for evaluation Continued

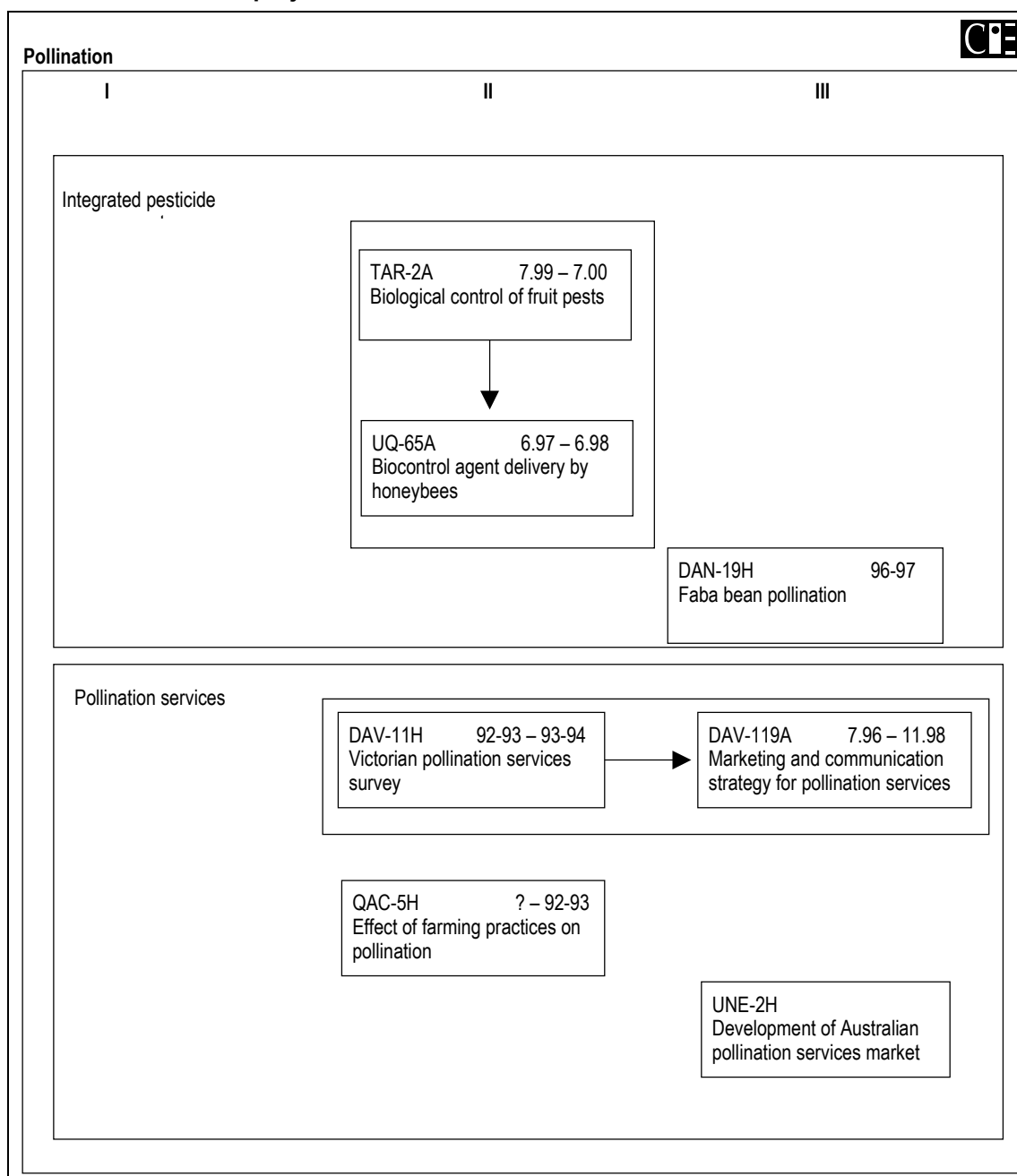
Resources

Access to flora and native flora



Continued on next page

1.3 Classification of projects for evaluation Continued



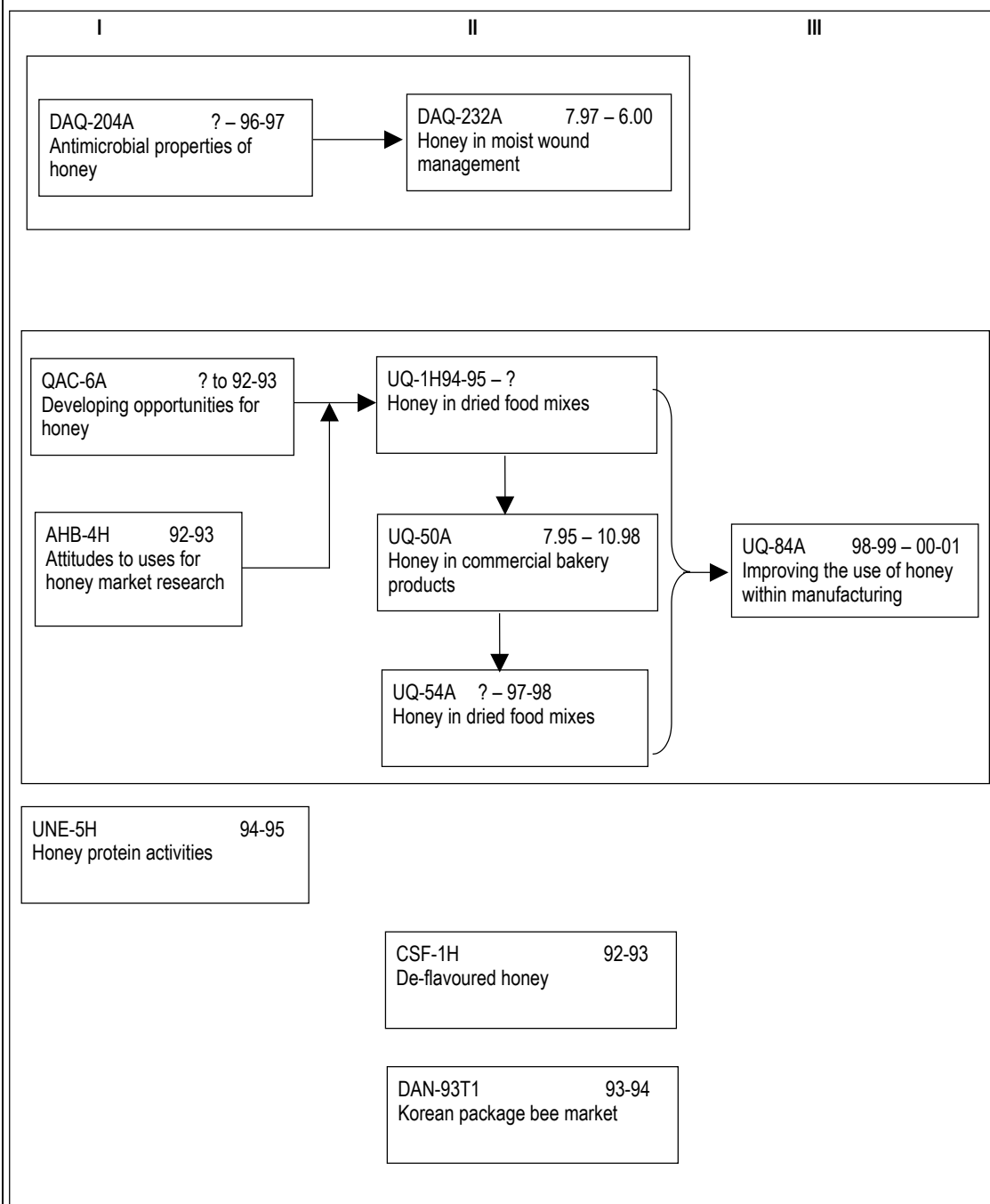
Continued on next page

1.3 Classification of projects for evaluation Continued



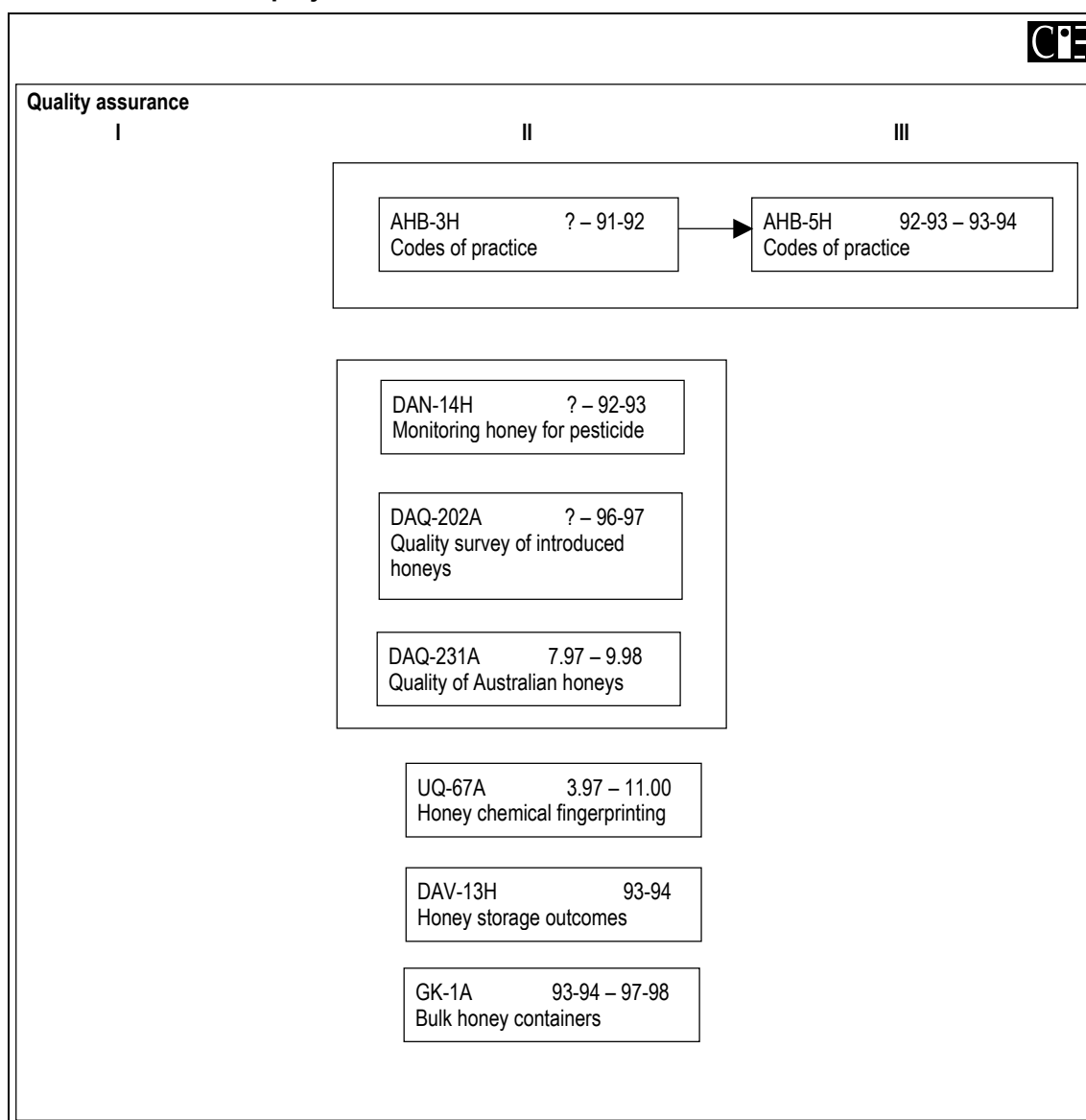
Off-farm issues

Apiary products



Continued on next page

1.3 Classification of projects for evaluation Continued



Source: Program Managers and CIE assessment.

Disease and pest management

This is the largest class of projects in the key research area of production. Four production sets and eight stand-alone projects are identified.

- Projects CSE-5H, CSE-71A and CSE-81A are all directly related and attempt to develop a mechanism (aggregating pheromone) by which the serious pest of *Apis cerana* can be identified and contained. The mite originating on this honeybee has decimated domestic and feral honeybee populations, and is considered to pose the most significant threat to Australian honeybee populations. Only project CSE-81A will have a commercial application and this project is currently in progress.
- Projects CSE-4H, DAQ-205A and CSE-6H investigate Disappearing Disease. Disappearing Disease effects honeybee colonies in south-east Queensland and north-east New South Wales. The disease may result in reduced honey crops and occasionally the death of entire

colonies. All projects are directly related, with DAQ-205A recovering the work of CSE-4H. With the findings of DAQ-205A, CSE-6H can now progress. Output from these projects will only be of use to other R&D projects.

- DAQ-203A is a direct input into DAQ-5H. By promoting the importance of native bees in the Torres Strait Islands, these projects aim to prevent the movement of honeybee mites from Papua New Guinea to mainland Australia. DAQ-5H has been rated as having a good output. DAQ-203A is still in progress.
- DAV-8H, DAV-10H, DAV-12H and DAV-157A are all associated with the use of OTC to treat American Foulbrood disease (AFB). Technological improvements mean that the guidelines established in projects DAV-8H, DAV-10H and DAV-12H for the treatment of AFB with OTC may no longer be appropriate. Project DAV-157A is re-establishing the guidelines for the best practice use of OTC in beehives.
- The projects DAN-11H, DAN-21H and DAN-22H are all stand-alone, yet they are related in that they all resulted in the production of an educational video relating to honeybee disease and pest identification, control, and management. The output of each of these projects has been classified as excellent.
- Project CSE-2H investigated diseases and disorders of the queen honeybee (*Apis mellifera*). The output of this project is not known.
- CSE-3H is a stand-alone project investigating Disappearing Disorder. Attempts were made to describe the symptoms of the disorder and identify the causative agent. The project was not successful.
- Both DAN-16H and DAN-10H are stand-alone projects investigating AFB. DAN-16H researched the disease producing mechanism of AFB. This project had an output of low value. DAN-10H developed techniques for the identification and control of AFB. The output of this project was rated as excellent. Due to the widespread nature of this disease and its potential to devastate the industry, a cost–benefit analysis of DAN-10H would mostly likely yield a high benefit–cost ratio. There has been international interest in the findings of DAN-10H.
- DAN-136A was a study into the OTC sensitivity of the causative agent of European Foulbrood Disease. This project has been classified as having a good output.

Nutrition

All nutrition projects are related. Two projects currently in progress (HBE99-06/12) attempt to draw the other nutrition projects together to form a comprehensive database on honeybee nutrition requirements.

- The project set of DAN-4H, DAN-15H, DAN-18H, DAN-134A, DAW-75A, DAW-91A, GK-2A and HBE99-06/12 (will) provide a comprehensive Australia-wide nutritional database for apiarists. Poor nutritional information has been identified as a contributing factor to variation in hive productivity. The output of this project set is expected to be good.

Genetic stock

There are three sets of projects and one stand-alone project that have attempted to improve or characterise the honeybee genetic stock. Only one set of projects was at the stage III R&D level.

- DAN-12H is a direct input to project UWS-1H. In project DAN-12H queen bees from the USSR were brought to Australia and, in project UWS-1H, these bees were evaluated for undesirable traits prior to being released in Australia. It was found that the USSR stock was not suitable for Australian conditions.
- DAW-2H is a direct input into HAW-5H. The former project attempted to maintain a stock of improved Italian honeybees that were selected for increased honey production. The latter sought to maintain and improve genetically superior strains of the Italian honeybee. These projects were stopped in 1991-92 and 1992-93 respectively when genetically superior queen bees were sold commercially to overcome a funding shortfall associated with the Eastern Australia Breeding Program. It was deemed such actions did not fall under the HBRDC–RIRDC charter. Both projects were rated as having a good output.
- ULA-2H is a direct input into US-39A. ULA-2H attempted to speed the development of hygienic honeybee genotypes and adoption of these genotypes to minimise the effects of chalkbrood disease. US-39A, which is still in progress, is trying to develop the genetic markers to permit the easy identification of hygienic breeding stock. The output from these projects is only expected to be of use in other R&D projects.
- ULA-1H looks at the (mitochondrial) DNA characteristics of honeybees. Output of this project would be used to characterise Australian commercial and feral honeybee strains, and develop rapid diagnostic tests for such strains. Output is not expected to have a commercial application.

Income diversity

There are only two projects that deal with the issue of income diversification.

- DAW-4H surveyed beekeepers in Western Australia to establish the cost of honey production and develop a debt profile of beekeepers. The survey found that beekeepers (in Western Australia) were often reliant on other sources of income to supplement their beekeeping business. The output classification of this project is unknown.
- DAN-17H resulted in the production of an educational videotape showing beekeepers how to produce package bees and supply those bees to world markets. This project was rated as having an excellent output. Conducting a cost–benefit analysis of this project would require surveying beekeepers to estimate awareness and adoption of the new information. The survey would also need to establish whether beekeepers have started package bee production as a result of the videotape.

Resources

There are 11 projects covering topics dealing with access to flora and native flora. Seven of these projects belong to the one project set. Two project sets and two stand-alone projects have been identified.

- The project set of DAN-153A, DAW-3H, FIC-1H, DAN-155A, DAQ-199A, DAV-109A and HBE99-07 (will) provide a comprehensive Australia-wide nutritional database for apiarists. Project HBE99-07 will draw together the outputs of the other projects in the set. A subset of projects is DAN-153A and DAN-155A. The former is a direct input into the latter. All of the stage III projects (DAN-155A, DAQ-199A, DAV-109A and HBE99-07) are still in progress.
- UNE-4H investigated the benefits to the beekeeping industry and society from secure access to public lands. The output of this project directly fed into UNE-46A, which produced a report outlining an appropriate stakeholder driven mechanism for the joint consideration of key policy operatives and industry interests. The output of both of these projects was classified as good.
- UA-1H assessed the impact of honeybees on native flora and fauna of Ngarkat Conservation Park. The project found that introduced honeybees do not have a detrimental impact on native flora and fauna of the conservation park. The output of this stage III project was rated as excellent. It is uncertain whether the findings can be extrapolated to other conservation or national parks. This means that it is not feasible to conduct a cost–benefit analysis of this project.
- DAT-2H researched the introduction and evaluation of a replacement species for blackberry, which is considered a pest in Tasmania and is being eliminated. It is estimated that complete removal of blackberry from Tasmania would cost the industry \$277 000. This project was classified as having a good output.

Pollination

Two project sets and three stand-alone projects have been identified. One project set investigated the use of honeybees in integrated pesticide management; all other projects pertain to the use of honeybees in pollination.

Integrated pesticide management

- TAR-1A and UQ-65A are both stage II projects, with TAR-1A being a direct input into UQ-65A. Both of these projects are researching the use of honeybees as a delivery mechanism for biological control agents, thereby reducing the need for pesticide spraying. Both of these projects are still in progress.

Pollination services

- DAV-11H is a direct input into DAV-119A. These projects relate to a Victorian marketing and communication strategy for bee pollination services. Project DAV-119A should come under the key research area of communication and extension. However, it is reported here because of its relationship to project DAV-11H, which conducted a survey of farmers in Victoria growing fruit, field and seed crops. Farmers were surveyed on their knowledge about honeybee pollination and the economic advantages of introducing honeybees to crops. The project used this information to try and develop a market for pollination services. This project was classified as having a good output. Project DAV-119A is currently in progress.

- QAC-5H was rated as having an excellent output. This project established the effects of farming practices on honeybee foraging behaviour (pollination) and resultant crop yields. Adoption of findings may have significant impact in terms of farm chemical usage and farming practices so as to encourage bee foraging.
- UNE-2H is a stage III project aimed at the promotion and development of guidelines for an Australian pollination services market. Such a market would give beekeepers an alternative income stream and may benefit farmers by enhanced crop pollination. Output from this project was rated as good.
- DAN-19H was undertaken to overcome the lack of knowledge of the pollination requirements of faba beans grown under Australian conditions. Results indicated that honeybee activity on flowering plants increased crop yield. It was recommended that managed honeybee hives be moved into the crop area when in flower. The output of this project was rated as being of good value.

Off-farm issues

Projects in this key research area address two issues — development of new apiary products and quality assurance.

Development of apicultural products

- The project set of DAQ-204A and DAQ-232A investigates the antimicrobial properties of Australian honeys and the potential use of honey in moist wound management. If found to be suitable, extensive growth and income opportunities for the Australian honey industry will arise. The output of DAQ-204A was rated as good. DAQ-232A is still in progress, but its output is anticipated to be of at least good value.
- The project set of QAC-6H, AHB-4H, UQ-1H, UQ-50A, UQ-54A and UQ-84A revolves around identifying opportunities for honey usage in the food manufacturing industry, and improving and facilitating the use of honey in food processing. The stage III project (UQ-84A), which will attempt to commercialise the use of honey in food production, is still in progress.
- UNE-5H attempted to examine honey for the presence of polypeptides which are used to clarify fruit juices and inhibit fruit browning. This project was not successful.
- CSF-1H attempted to reduce the flavour of Australian honeys using the spinning cone flavour recovery system. Australian honeys are considered too strongly flavoured for Asian markets. This project was not successful.
- DAN-93T1 funded a study tour to South Korea to investigate the package bee market and exotic diseases. Australian package bee producers are the largest suppliers of package bees to Korea. This project attempted to identify Korean issues of concern with respect to Australian package bees, particularly quality and cost. The nature of the project means that a cost-benefit analysis would be difficult.

Quality assurance

- Project AHB-3H is a direct input into AHB-5H. AHB-3H established a code of practice for Assuring the Quality of Australian Honey. Project AHB-5H published the code of practice, developed a video and made presentations to state conferences on methods for assuring the quality of Australian honeys. The output of both projects was rated as good.
- DAN-14H, DAQ-202A and DAQ-231A are all related to the topic of Australian honey quality, and how it compares to the quality of imported honeys. These projects established quality benchmarks against which the quality of Australian honeys can be compared.
- Project UQ-67A is attempting to develop a chemical fingerprinting quality assurance technique that can be used to assure the flavour quality of Australian honeys. This project is still in progress, but initial indications are that the output of the project will be a good value.
- DAV-13H and GK-1A are not related, yet both investigate metallic residues in honey arising from bulk storage in metal containers. As a result of the findings of project GK-1A, Capilano — Australia's largest honey producer — no longer stores its honey in metal containers. The output of both projects is rated as good.

Evaluation

Table 4.4 summarises the expected outputs and outcomes from the projects. Approximately 60 per cent of projects are type II R&D, 30 per cent type III and 10 per cent type I. Over 50 per cent of the type III projects occur in the key research area of production.

1.4 Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
AHB-3H	Codes of practice for assuring the quality of Australian honey	II	Single product (honey), existing product, all markets	QA	AHB-5H	Medium
AHB-4H	Consumer market research into attitudes to and uses for Australian honey	I	Multi-industry effect, existing product, domestic market	M	QAC-6H, UQ-1H, UQ-50A, UQ-54A, UQ-84A	Medium
AHB-5H	Codes of practice for assuring the quality of Australian honey	III	Single product (honey), existing product, all markets	QA	AHB-3H	Medium
AQB-1B	Introduction and performance of queen bees — survey of queen bee breeders' apiaries	II	Industry level effect, existing product, all markets	BHM	DAN-164A	Too early

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
CSE-2H	Diseases and disorders of the queen honeybee (<i>Apis mellifera</i>)	I	Industry level effect, existing product, all markets	DPM	Stand-alone	Not known
CSE-3H	Molecular taxonomy of nosema apis	II	Industry level effect (regional), existing product, all markets	DPM	Stand-alone	No output

CSE-4H	A pilot study of disappearing disease of honeybee colonies	I	Industry level effect (regional), existing product, all markets	DPM	CSE-6H, DAQ-205A	No final output
CSE-5H	A study to isolate, identify and apply the Nasonov pheromone of the Asian honeybee <i>Apis cerana</i>	II	Industry level effect, existing product, all markets	DPM	CSE-74A, CSE-81A	No final output
CSE-6H	Disappearing disorder	II	Industry level effect (regional), existing product, all markets	DPM	CSE-4H, DAQ-205A	No final output
CSE-74A	Identification and application of the aggregating pheromone of <i>Apis cerana</i>	II	Industry level effect, existing product, all markets	DPM	CSE-5H, CSE-81A	No final output
CSE-81A	Development of a specific aggregation lure for <i>Apis cerana javana</i>	III	Industry level effect, existing product, all markets	DPM	CSE-5H, CSE-71A	Too early
CSF-1H	Production of de-flavoured honey and honey flavours using the spinning cone column flavour recovery system	II	Single product, new product, export market	AP	Stand-alone	No output
CUT-4A	Testing an electronic device that emits queen piping sounds to find a queen bee in a colony	II	Industry level effect, existing product, all markets	BHM	Stand-alone	No output
DAN-10H	The development of techniques for the prevention and control of American Foulbrood	III	Industry level effect, existing product, all markets	DPM	Stand-alone	High
DAN-11H	The production of bee diseases, parasites and pests video	III	Industry level effect, new to Australia, all markets	DPM	Stand-alone	High
DAN-12H	Government mission to USSR	I	Industry level effect, new to Australia, all markets	GS	UWS-1H	Not known
DAN-134A	Crude protein and amino acid levels of pollens collected by honeybees in southern NSW	II	Industry level effect (regional), existing product, all markets	N	DAN-4H, DAN-15H, DAN-18H, DAW-75A, DAW-91A, GK-2A, HBE99-06, HBE99-12	No final output
DAN-135A	Development of remote sensing, beehive production status monitoring system	III	Industry level effect, new product, all markets	BHM	Stand-alone	Medium
DAN-136A	Oxytetracycline sensitivity, diversity and study of <i>Melissococcus pluton</i> (European Foulbrood)	II	Industry level effect, existing product, all markets	DPM	Stand-alone	Medium

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
DAN-14H	Safeguarding honey quality through pesticide monitoring in high risk areas	II	Single product (regional honey), new to region, all markets	QA	DAQ-202A, DAQ-231A	Medium
DAN-153A	Natural resources database for the NSW apiary industry	II	Industry level effect (regional), new to region, all markets	ANF	DAN-155A, DAQ-199A, DAV-109A, DAW-3H, FIC-1H, HBE99-07	No final output
DAN-155A	Floral resource database for the NSW apiary industry	III	Industry level effect (regional), new to region, all markets	ANF, N	DAN-153A, DAQ-199A, DAV-109A, DAW-3H, FIC-1H, HBE99-07	Too early
DAN-15H	Amino acid profiles and crude protein levels of pollens	II	Industry level effect (regional), existing product, all markets	N	DAN-4H, DAN-18H, DAN-134A, DAW-75A, DAW-91A, GK-2A, HBE99-06, HBE99-12	No final output
DAN-164A	Introduction and performance of queen bees — introduction apiary status and post introduction results	II	Industry level effect, existing product, all markets	BHM	AQB-1B	Too early
DAN-16H	Disease producing mechanisms of American Foulbrood	II	Industry level effect, new to Australia, all markets	DPM	DAN-10H, DAV-8H, QBA-2A	Low
DAN-17H	Educational videotape on package bees	III	Industry level effect, new to Australia, all markets	ID, AP, QA		High
DAN-18H	Palatability and nutritional value of six commonly available non floral feed stuffs available to honeybees	II	Industry level effect, existing product, all markets	N	DAN-4H, DAN-15H, DAN-134A, DAW-75A, DAW-91A, GK-2A, HBE99-06, HBE99-12	No final output
DAN-19H	Pollination of faba beans	III	Multi-industry effect, existing product, all markets of multi-industries	PS, N	Stand-alone	Medium
DAN-21H	Production of a video on chalkbrood disease	III	Industry level effect, new to Australia, all markets	DPM	Stand-alone	High
DAN-22H	Production of a video on external exotic honeybee parasites	III	Industry level effect, new product, all markets	DPM	becomes DAN-139A	High

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

Project no.	Project title	Stage	Product	Classification	Related projects	Initial assessment
DAN-4H	Amino acid profiles and crude protein levels of pollens for maximising honey production and crop pollination	II	Industry level effect (regional), existing product, all markets	N	DAN-15H, DAN-18H, DAN-134A, DAW-75A, DAW-91A, GK-2A, HBE99-06, HBE99-12	No final output
DAN-93T1	Travel to Korea to study the package bee industry and exotic diseases	II	Single product (package bees), existing product, export market	AP, M	Stand-alone	Medium
DAQ-199A	The development of a natural resource database for the Queensland apiary industry	III	Industry level effect (regional), new to region, all markets	ANF, N	DAN-153A, DAN-155A, DAV-109A, DAW-3H, FIC-1H, HBE99-07	Too early
DAQ-202A	Quality survey of introduced honeys	II	Single product (honey), existing product, domestic market	QA	DAN-14H, DAQ-231A	Medium
DAQ-203A	Promotion of native bees in the Torres Strait	III	Industry level effect, existing product, all markets	DPM	Stand-alone	Medium
DAQ-204A	Antimicrobial properties of Australian honeys	I	Single product, new product, domestic and export markets	AP	DAQ-232A	Medium
DAQ-205A	Investigations into Disappearing Disorder — a problem of honeybees in south east Queensland	I	Industry level effect (regional), existing product, all markets	DPM	CSE-6H	No final output
DAQ-231A	A quality survey of Australian honeys	II	Single product (honey), existing product, domestic and export markets	QA	DAN-14H, DAQ-202A	Medium
DAQ-232A	The use of Australian honey in moist wound management	II	Single product, new product, domestic and export markets	AP	DAQ-204A	Too early (expected medium)
DAQ-5H	Promotion of native bees in the Torres Strait	III	Multi-industry effect, existing product, local pollination market	DPM, PS	DAQ-203A	Medium
DAT-2H	Introduction and evaluation of replacement species for blackberry in Tasmania	II	Industry level effect (regional), new to region, all markets	AF	Stand-alone	Medium
DAV-109A	A comprehensive study of beekeepers' use of honey and pollen flora resource in Victoria	III	Industry level effect (regional), new to region, all markets	ANF, N	DAN-153A, DAN-155A, DAQ-199A, DAW-3H, FIC-1H, HBE99-07	Too early

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
DAV-10H	Oxytetracycline hydrochloride in Australian honey	II	Single product (honey), existing product, all markets	DPM, QA	DAV-8H, DAV-12H, DAV-157A	Not known
DAV-119A	Developing a communications and marketing strategy for honeybee crop pollination	III	Multi-industry effect, new product, all markets of multi-industries	C, PS, M	DAV-11H	Too early
DAV-11H	A survey of pollination services in Victoria	II	Multi-industry effect, existing product, , all markets of multi-industries	PS	DAV-119A	Medium
DAV-12H	The storage of oxytetracycline hydrochloride in beehives	II	Single product (honey), existing product, all markets	DPM, QA	DAV-8H, DAV-10H, DAV-157A	Not known
DAV-13H	Metallic residues in honey stored in bulk containers	II	Single product (honey), existing product, all markets	QA	Stand-alone	Not known
DAV-157A	Best practice use of oxytetracycline hydrochloride (OTC) in beehives	III		QA	DAV-8H, DAV-10H, DAV-12H	Medium
DAV-8H	Control of American Brood Disease with oxytetracycline	II	Industry level effect, existing product, all markets	DPM, QA	DAV-10H, DAV-12H, DAV-157A	Not known
DAW-2H	Genetic improvement of queen bee breeding stock in Australia	II/III	Industry level effect, new product, all markets	GS	HAW-5H	Medium
DAW-3H	A natural resource questionnaire for beekeepers	II	Industry level effect (regional), new to region, all markets	ANF	DAN-153A, DAN-155A, DAQ-199A, DAV-109A, FIC-1H, HBE99-07	No final output
DAW-4H	Survey of the cost of production and income of WA honey farmers	II	Multi-industry, existing product, all markets	ID	Stand-alone	Not known
DAW-69A	Using swarming acoustics of honeybees to clear honey supers of honeybees	II	Industry level effect, new product, all markets	BHM	Stand-alone	No output
DAW-75A	Export package bees — evaluating a lupin flour based feed for increased live bee production	II	Industry level effect, new product, all markets	N	DAN-4H, DAN-15H, DAN-18H, DAN-134A, DAW-91A, GK-2A, HBE99-06, HBE99-12	No final output
DAW-91A	Pollen analysis of Eucalyptus patens (Blackbutt), E. accedens (Powderbark) and E. wandoo (Winter Wandoo variety) in Western Australia	II	Industry level effect, new product, all markets	N	DAN-4H, DAN-15H, DAN-18H, DAN-134A, DAW-75A, GK-2A, HBE99-06, HBE99-12	No final output

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
FIC-1H	Leatherwood nectar resource management plan	II	Industry level effect (regional), new to region, all markets	ANF, N	DAN-153A, DAN-155A, DAQ-199A, DAV-109A, DAW-3H, HBE99-07	No final output
GK-1A	Bulk honey containers	II	Single product (honey), existing product, all markets	QA	Stand-alone	Medium
GK-2A	Strategic planning and action meeting for honeybee nutrition	II	Industry level effect, new product, all markets	N	DAN-4H, DAN-15H, DAN-18H, DAN-134A, DAW-75A, DAW-91A, HBE99-06, HBE99-12	Medium
HAW-5H	Eastern bee breeding scheme	II/III	Industry level effect, new product, all markets	GS	DAW-2H	Medium
QAC-5H	The effects of farming practices on honeybee foraging behaviour and resultant yields in Entomophilous crops	II	Multi-industry effect, existing product, all markets of multi-industries	PS, IPM	Stand-alone	High
QAC-6H	Developing opportunities for Australian honey	I	Multi-industry effect, new product, processed food market	AP	UQ-1H, UQ-50A, UQ-54A, UQ-84A	No final output
QBA-2A	Laboratory and field trials relating to heat treatment of AFB infected bee equipment	II	Industry level effect, existing product, all markets	DPM	HBE99-09	No final output
TAR-1A	Non-fungicidal and biological control of core rots in pome fruit	II	Multi-industry effect, existing product, all markets of multi-industries	IPM	UQ-65A	Too early
UA-1H	Impact of commercially managed honeybees <i>Apis mellifera</i> on the flora and fauna of Banksia Heathland in Ngarkat conservation park	III	Industry level effect (regional), new to region, all markets	ANF	Stand-alone	High
ULA-1H	Mitochondrial DNA characteristics of Australian honeybee strains	II	Industry level effect, new product, all markets	GS	Stand-alone	No final output
ULA-2H	Evaluation of honeybees for hygienic behaviour	II	Industry level effect, existing product, all markets	GS	US-39A	Low
UNE-2H	The promotion and strategic development of the Australian pollination services market	III	Multi-industry effect, existing product, all markets of multi-industries	PS	Stand-alone	Medium

Continued on next page

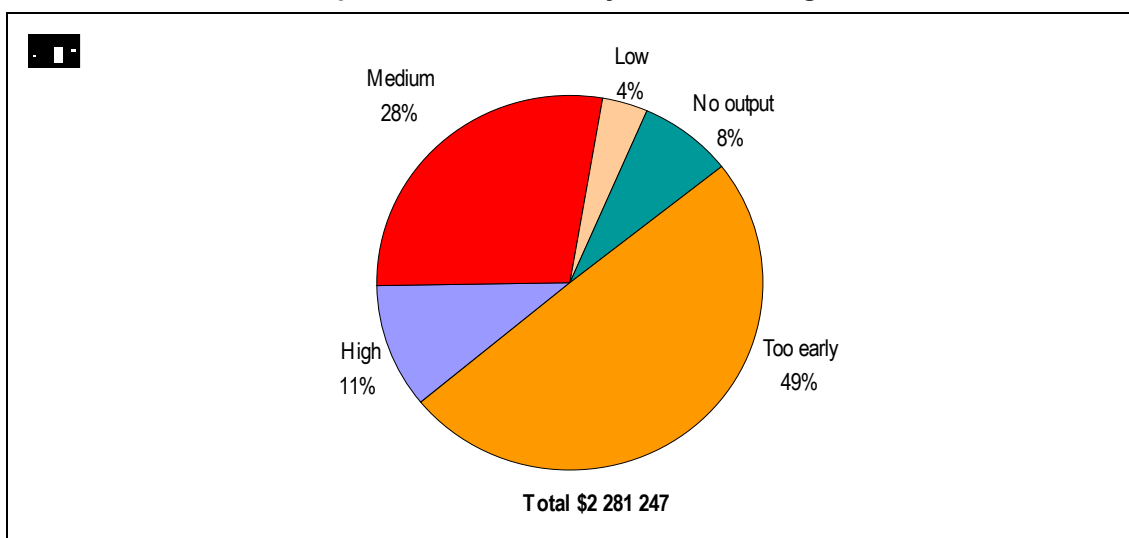
1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
UNE-46A	Benefits of secure access to public lands and their melliferous resources	II	Industry level effect, new product, all markets	ANF	UNE-4H	Medium
UNE-4H	The benefits to the beekeeping industry and society from secure access to public lands and their melliferous resources	III	Industry level effect, new product, all markets	ANF	UNE-46A	Medium
UNE-5H	Verification of honey protein activities	I	Single product (honey), new product, processed food market	AP	Stand-alone	No output
UQ-1H	Australian honey in dried food mixes	II	Multi-industry effect, new product, processed food market	AP	AHB-4H, QAC-6H, UQ-50A, UQ-54A, UQ-84A	Medium
UQ-50A	Australian liquid honey in commercial bakery products	II	Multi-industry effect, new product, processed food market	AP	AHB-4H, QAC-6H, UQ-1H, UQ-54A, UQ-84A	Medium
UQ-54A	Australian honey in dried food mixes	II	Multi-industry effect, new product, processed food market	AP	AHB-4H, QAC-6H, UQ-1H, UQ-50A, UQ-84A	Medium
UQ-65A	The use of honeybees to deliver biocontrol agents to Geraldton waxflower	II	Multi-industry effect, existing product, all markets of multi-industries	IPM	TAR-1A	Too early
UQ-67A	Flavour quality assurance of Australian floral honeys by chemical fingerprinting	II	Single product (honey), new product, all markets	QA	Stand-alone	Too early (expected medium)
UQ-84A	Improving the movement/use of liquid Australian honey within manufacturing processes	III	Multi-industry effect, new product, processed food market	AP	AHB-4H, QAC-6H, UQ-1H, UQ-50A, UQ-54A	Too early
US-39A	Breeding hygienic disease resistant bees	II	Industry level effect, new product, all markets	GS	Stand-alone	No final output
UWS-1H	Evaluation of imported honeybee stock in Australia	II	Industry level effect, new product, all markets	GS	DAN-12H	No output

Source: Program managers and CIE assessment.

Chart 4.5 summarises the likely outcomes by budget allocation. The outcomes are indicative only. From the chart we can see that approximately 36 per cent of HBRDC–RIRDC funding went to projects which delivered an output of at least good value. A large number (33 per cent) of projects are either still in progress or not expected to deliver outputs for a period of time.

1.5 Initial assessment of potential outcomes by RIRDC funding



Data source: Program managers and CIE assessment.

Recommendations for evaluation

Two project sets and six stand-alone projects have been identified as candidates for detailed evaluation. Projects have been identified due to their importance for industry success and growth opportunities.

Production

The majority of projects and project sets identified for potential evaluation address the key R&D area of production — specifically, the areas of disease and pest management, and nutrition. One project set — encompassing eight individual projects — has been identified as warranting cost-benefit analysis, as have five stand-alone projects.

- The project set of DAN-4H, DAN-15H, DAN-18H, DAN-134A, DAW-75A, DAW-91A, GK-2A and HBE99-06/12 will provide a comprehensive Australia-wide nutritional database for apiarists. Poor nutritional information is a contributing factor to variation in hive productivity, especially with respect to the varying quantities of honey produced by hives with similar characteristics. The benefits flowing from improved nutritional information could be assessed via changes in hive productivity. However, a survey would be needed to estimate awareness and adoption of the new information. As some of the projects in this set are still in progress, the analysis would be ex-ante, which is typically expensive.
- DAN-10H is a stand-alone project with commercial applications. The project developed a new technique for identifying American Foulbrood disease (AFB). The new technique greatly facilitated and expedited AFB diagnosis, and allows the tracing of AFB to the source of infection. Benefits of this project include cost savings in disease diagnosis and greater confidence in honey being AFB free. All state agricultural departments have adopted as standard AFB identification practice the technique developed in project DAN-10H. There has been international interest in the outputs from this project. Assessment of the net benefit flowing from this project would be relatively straightforward.
- The other stand-alone projects are videos dealing with disease and pest management (DAN-11H, DAN-21H and DAN-22H) and income diversification (DAN-17H). Each of these

projects would be relatively straightforward to assess — however, surveys would be required to assess awareness and adoption of the new information. Establishing the base case — what could have been expected to occur in the absence of the projects — would be difficult.

Pollination

- QAC-5H is a stand-alone project looking into the effects of farm practices on honeybee crop pollination behaviour and consequent crop yield and quality. Assessment of the benefits of this project would require determining how the project has changed farmer behaviour with respect to pesticide usage and how this has impacted on the efficiency of honeybee pollination of crops. As a large number of factors could influence honeybee pollination efficiency, estimated benefits flowing from the project would be subject to a large degree of uncertainty. An expert in the area of farm practices would be required to assist in an evaluation of this project.

Off-farm issues

- The project set containing DAQ-204A and DAQ-232A investigates the use of honey in wound management. Project DAN-204A looks into the antimicrobial properties of Australian honeys and DAN-232A investigates the use of Australian honeys in moist wound management. As DAN-232A is still in progress, assessment of the benefits flowing from the project set is difficult. Evaluation of this project would require an ex-ante assessment and detailed knowledge of the wound management product market.

1. Rice Industry Program

Overview

Background

The Australian rice industry produces around 1.2 million tonnes of rice a year, earning over \$650 million. Ninety per cent of production is exported, earning around \$500 million in export revenue.

The industry is highly concentrated in the Murrumbidgee and Murray Valleys. It is vertically integrated, with the growers owning the processing and marketing businesses.

The world market is highly distorted with domestic markets protected from external competition, resulting in less than 5 per cent of global production traded. Australian exports account for around 5 per cent of this trade. Speciality and long grain rice earn a premium on the price of medium grain rice.

Research and development activities

There has been an active R&D program in rice since the beginning of rice production in the MIA in the 1920s. Early R&D concentrated on improving productivity, but from the 1950s, the Ricegrowers' Co-operative has also funded R&D in marketing and value added product development. They continue to support R&D in this area today. In addition, various government organisations have supported R&D in rice.

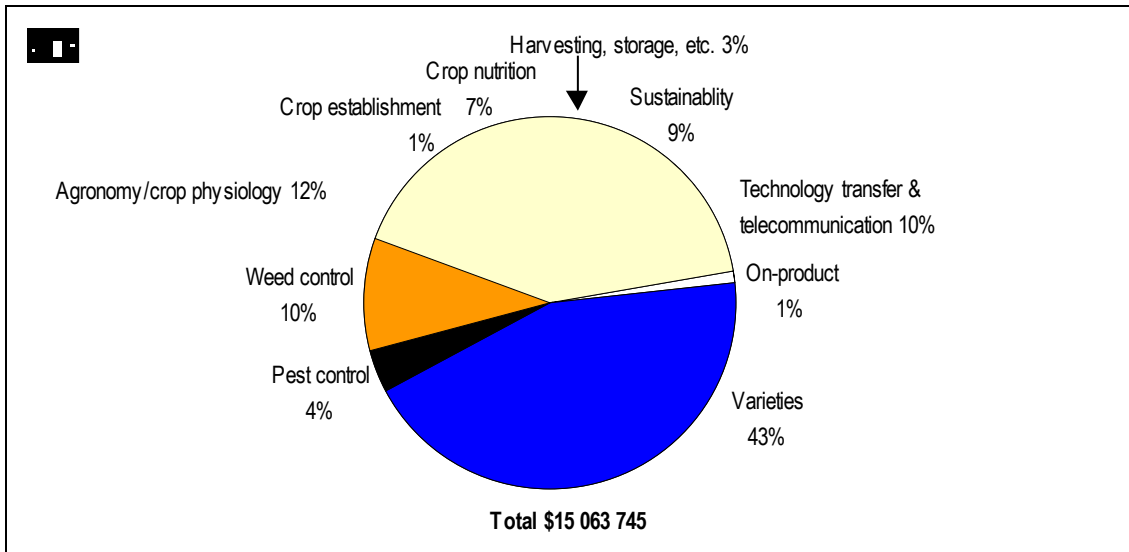
RIRDC's involvement began in 1992 when it was established to replace the Australian Special Rural Research Council. An industry levy and matching government funds support the R&D program. The RIRDC program concentrates on the production side of the industry; R&D in marketing and value added products being more appropriate for industry to conduct.

The annual budget for the program in 1997-98 was \$2.85 million.

A five year plan for R&D was developed in 1996. Nine program areas were identified.

- ▣ Varietal improvement and pure seed maintenance.
- ▣ Crop establishment.
- ▣ Agronomy/crop physiology.
- ▣ Crop nutrition.
- ▣ Crop protection.
- ▣ Sustainable farming systems.
- ▣ Technology transfer.

1.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

- ▣ Harvesting, storage, handling and transport.
- ▣ Milling and processing.

These categories fit fairly naturally into categories for evaluation. We have added the category of on-products, which had been funded in the past by ACRR, but is now funded by the Ricegrowers' Co-operative. Crop protection is also divided in pest control and weed control.

In chart 5.1 the classification of projects is by the classification used for evaluation sets. The shares are based on the RIRDC funds expended and committed for the projects. Projects associated with the breeding program account for over 44 per cent of the funding by RIRDC. With the exception of harvesting and storage, the other areas in the five year plan make up around 10 per cent each.

List of projects

Table 5.2 lists the projects that have been identified in the Rice Industry Program. Projects that are currently under way or have been approved are included in the listing. A start and finish date are provided where available. As far as possible the total cost of the project has been estimated (sum of the annual dollar amounts, not discounted), to give a rough indication of the relative size of the projects. The cost includes contributions from the industry to the research institution as well as RIRDC funding. RIRDC funding is given in the last column. Some old projects, where little information is available, are listed at the bottom of the table. They are not included in the initial assessment except to the extent that they are input into more recent projects.

1.2 Completed and continuing projects

Project no.	Project title	Start	Finish	Total cost	RIRDC cost
				\$	\$
ABT-1A	Reduction of bird damage to rice crops	1/07/96	29/06/97	78 500	31 500
AGR-1A	Improved rice weed control	7/01/94	30/6/95	29 286	29 286
AGR-2A	Herbicide resistance management in rice	7/01/94	30/6/95	124 000	124 000
				\$	\$
AGR-3A	Herbicide resistance management in rice	1/07/95	30/09/98	294 950	294 950
AGR-4A	Development and adoption of ground-rig spraying for rice in NSW	1/07/96	30/06/97	1 500	1 500
AGR-5A	Evaluation of a growth regulator in rice	1/07/96	30/06/97	23 100	11 550
AGR-6A	Rotational weed control practices for rice (continuation of AGR-3A)	1/07/98	30/06/02	361 200	361 200
ANU-17A	Investigation of root morphogenesis and the induction of nodule-like structures on the roots of rice seedlings	1/10/93	1/01/94	6 000	6 000
ANU-28A	Towards the development of more effective nitrogen-fixing associations between rice cultivars and endophytic bacteria	1/07/97	15/02/98	130 120	6 000
ANU-29A	Investigation of the molecular mechanisms causing cold induced sterility in rice	1/07/97	30/06/00	536 064	141 000
ANU-34A	Towards the development of more effective nitrogen-fixing associations between rice cultivars and endophytic bacteria	1/07/98	30/06/00	304 507	12 000
APL-1A	Dry broadcast seeding of rice	1/07/94	30/06/96	25 740	25 740
APL-2A	Improvements in rice weed control	1/07/91	30/06/96	68 640	68 640
BRE-1A	Quality rice for North Asia	1/10/96	30/06/99	449 875	224 875
BRE-2A	Relation of sensory evaluation and texture profiles to objective measures of cooked rice texture	1/07/98	30/06/99	132 600	50 600
CMB-1A	Molecular methods for hybrid rice production	1/06/96	31/05/00	1 376 897	231 000
CS-11A	Duck control in rice crops	7/01/87	30/12/88	Too old no records	
CSE-50A	Warehouse beetle	1/07/91	30/06/93	204 860	154 860
CSI-1A	Minimising deep percolation from rice culture	1/07/91	30/06/93	767 567	105 409
CSI-2A	Optimising rice production within sustainable environmental constraints	7/01/89	30/6/93	75 700	37 850
CSI-4A	Swagman options - helping maximise profitability of rice based cropping systems	1/07/93	30/06/94	112 106	49 490
CSI-5A	Adopting puddling to minimise deep percolation from rice	1/07/93	30/06/94	354 253	71 548
CSI-7A	Identifying and overcoming constraints to rice establishment and yield in the western Murray Valley	1/09/94	31/03/98	1 028 857	288 831
CSL-2A	Evaluation of compaction for reducing recharge from rice	1/03/97	30/06/98	130 130	77 466
CSL-5A	Survey of current rice stubble management practices for identification of research needs and future policy	1/02/99	30/09/99	44 955	6 955
CSN-1A	Volatile fatty acid production through the large bowel fermentation of rice starch		1993-94	No records	
CSP-3A	A new method to facilitate rice hybridisation	1/07/96	30/06/97	126 455	41 374
CST-2A	Seed treatment and foliar application of glycinebetaine to increase crop establishment and cold tolerance in rice	1/07/97	30/06/98	96 740	53 860
DAN-107A	Increasing the yield potential in the NSW rice industry	1/07/94	30/06/97	350 976	155 517
DAN-108A	Maximising the future pay-off from rice breeding	1/07/94	11/08/97	313 309	137 097
DAN-109A	Seed soakage techniques	1/07/94	30/06/96	56 554	15 050
DAN-110A	Tailoring fertiliser recommendations to requirements	1/07/94	30/06/97	415 054	200 617
DAN-114A	The development of business checks for rice farms	1/08/94	15/09/94	5 400	5 400
DAN-118A	Rice variety development, testing and pure seed maintenance	1/07/95	30/09/98	1 543 877	739 937
DAN-119A	The yield stability of short season rices	1/07/95	15/02/99	157 454	51 917
DAN-120A	Resistance to bloodworm attack in selected rice varieties - evaluation of root vigour and entibiosis	1/01/96	30/06/98	150 957	85 252
DAN-121A	Further development of a mycoherbicide for control of Alismataceae weeds in rice	1/07/95	30/09/99	696 096	118 925

Continued on next page

1.2 Completed and continuing projects

Project no.	Project title	Start	Finish	Total cost	RIRDC cost
				\$	\$
DAN-122A	Business checks for rice farms	1/07/95	30/06/96	37 010	10 000
DAN-123A	Defining the mineral levels in rice needed to sustain yield and quality	1/07/95	30/09/98	444 108	241 592
DAN-137A	Preliminary studies on biology and control of the rice worm <i>Eukerria saltensis</i>	1/10/95	1/10/96	11 150	11 150
DAN-140A	Study tour to the International Rice Institute	20/8/96	9/05/96	6 026	6 026
DAN-145A	EM to estimate ground water recharge from rice growing	1/07/96	30/06/99	401 372	179 139
DAN-146A	Sustainable control of aquatic earthworms and bloodworms in rice	1/07/96	30/06/99	475 752	212 242
DAN-147A	Evaluation of rice grain quality - II	1/07/96	30/06/99	774 275	385 700
DAN-148A	NIR for improved fertilizer predictions	1/07/96	30/06/99	634 401	265 113
DAN-150A	Ground water use in rice rotations - phase II	1/07/96	30/09/97	148 311	42 979
DAN-154A	Enhancing progress on developing cold resistant varieties and management practices	1/09/96	30/06/97	38 149	18 020
DAN-156A	Screening rice varieties for tolerance to stem rot	1/07/96	30/06/98	19 000	3 000
DAN-15A	Advanced farming systems for rice growers	10/01/87	4/01/91		
DAN-160A	Rice physiology: Maximising rice yields beyond 2000	1/07/97	30/06/02	2 710 055	1 152 048
DAN-161A	Identification and management of soil acidification in irrigated farming systems of southern NSW	1/07/97	30/06/00	326 950	30 000
DAN-162A	Better extension programs for improved rice yields	1/01/98	30/06/00	344 818	156 786
DAN-167A	Rice improvement	1/07/98	30/06/03	3 053 163	1 704 044
DAN-16A	Identification of rice varieties with low inherent endosperm colour and low rates of yellowing	7/01/87	30/6/90		
DAN-175A	Relating minerals in rice shoots and grain to soil tests, yield and grain quality	1/07/98	30/06/01	683 311	372 435
DAN-26A	Early evaluation of rice starch viscosity	7/01/88	30/6/90	Too old no records	
DAN-3A	Prediction of nitrogen use by rice crops	9/01/85	6/01/88	Too old no records	
DAN-4A	Development and evaluation of early maturing rice varieties	7/01/85	30/6/88	Too old no records	
DAN-63A	Improved production systems for rice in New South Wales	1/07/91	30/06/94	515 065	134 797
DAN-64A	Mineral nutrient profiling for improved rice crop fertiliser management	1/07/91	30/06/94	388 449	151 960
DAN-69A	Gypsum and ground water use in rice rotations	1/07/91	30/06/93	250 200	65 195
DAN-6A	Development of improved weed control strategies in aerial sown rice	1987	30/6/92	Too old no records	
DAN-70A	Producing rice varieties with superior inherent stable whiteness	1/07/90	30/06/93	284 830	51 500
DAN-71A	Improvement of rice seeding establishment in New South Wales	7/01/89	30/6/92	68 408	19 579
DAN-72A	Development and evaluation of aromatic rice varieties for the New South Wales rice industry	7/01/89	30/6/92	no records this is a puzzle?	
DAN-73A	Improved management strategies for bloodworms and aquatic snails in rice		Sep-94	no records this is a puzzle?	
DAN-77A	Biological control of <i>Alisma Lanceolatum</i>	1/07/92	30/06/95	685 279	95 470
DAN-78A	Selection for improved rice seedling vigour	1/07/92	30/06/95	197 885	129 485
DAN-79A	Developing a fragrant rice variety with export potential using micro-propagation	1/07/92	30/06/95	262 557	104 226
DAN-80A	Rice grain dimension selection by image analysis	1/07/92	30/06/95	190 795	100 795
DAN-81A	Performance evaluation of commercial rice crops	1/07/92	31/12/96	520 457	226 945
DAN-82A	Prediction of rice fertiliser requirements using NIR	1/07/92	30/06/95	593 133	244 933
DAN-83A	Evaluation of rice grain quality - II	1/07/92	30/06/96	1 010 565	450 565
DAN-84A	Rice district trials and pure seed management	1/07/92	30/06/95	427 350	142 350
DAN-85A	Rice varietal improvement	1/07/92	30/06/95	1 086 191	441 692
DAN-86A	Improvement of rice grain quality	1/01/93	31/08/98	492 667	257 432
DAN-94A	Developing rices suitable for export to Japan	1/07/93	30/06/96	217 684	127 684

Continued on next page

1.2 Completed and continuing projects

Project no.	Project title	Start	Finish	Total cost	RIRDC cost
				\$	\$
DAN-95A	Riceland suitability assessment	1/07/93	30/06/96	338 122	118 442
DAN-96A	Ground water use in rice rotations	1/07/93	30/06/96	364 139	55 814
DAN-97A	Reduced insecticide applications for rice crop protection in southern New South Wales	1/07/93	30/06/96	636 432	153 380
DAQ-100A	Breeding long grain tropical rice for tolerance to needle nematode	1/07/90	30/06/93	69 010	33 620
DAQ-118A	On-farm development of a tropical irrigated rice-soyabean cropping system	1/07/91	1/06/94	460 223	19 500
DAQ-157A	Biotechnological introduction of zizania genes into Australia	1/07/93	30/06/96	272 694	159 444
DAQ-22A	Nitrogen management of four rice plant types in north Queensland	7/01/86	30/6/88	Too old no records	
DAQ-30A	Breeding long grain tropical rice resistant to bacterial leaf blight (<i>Xanthomonas Campestris</i> PV. <i>Oryzae</i>)	7/01/88	30/6/91	Too old no records	
DAQ-70A	Maximising productivity in a tropical irrigated rice-based cropping system	1988	30/6/92	Too old no records	
DAQ-82A	Biology and management of field pests of rice	7/01/89	30/6/92	14 900	7 450
DAV-14A	Development of complete diets for sheep and goats based on ground rice hulls and whole cereal grains	9/01/88	31/12/90	Too old no records	
DAV-79A	Development of instant cooked rice and rice based products	1/07/93	30/06/95	271 464	168 964
IRE-1A	Coordination of irrigation R&D in the Irrigation Areas of Southern NSW	1/07/92	30/06/94	1 109 814	168 490
IRE-2A	Improving technology transfer in the NSW rice industry and co-ordination of irrigation R&D for other irrigated enterprises (IRE-1A)	1/07/94	30/06/97	732 410	267 230
IRE-3A	Technology transfer for a more productive and sustainable rice farming system	1/07/97	30/06/02	1 399 885	521 224
KDI-11A	Performance evaluation of rice harvesting equipment	15/03/96	31/12/96	54 000	44 000
KDI-17A	Evaluation of trash levels on-farm during the 1997 rice harvest	15/01/97	30/10/97	57 600	57 600
KDI-18A	An evaluation of rice harvesting machinery and systems	1/07/97	31/12/98	149 600	73 500
MS967-11	Rice CRC	1995			
MS967-48	5 year R&D plan of rice	1995			
MS978-06	Production of rice invertebrate field guide	1995			
MS978-45	Publication of special rice R&D farmer's newsletter	1995			
MS978-52	Evaluation of the ricecheck program	1995			
RCL-1A	Evaluation of near infrared transmission for rice receival segregation	1/07/94	30/06/97	430 549	195 309
RCL-2A	Hygiene and inert dust protection of on-farm rice harvesting equipment	23/08/94	30/06/95	15 000	15 000
RRA-1A	Improving seed quality in early generations of experimental rice varieties	1/02/93	30/06/94	745 752	509 340
RRA-2A	Groundrig spraying development for rice	1/07/97	31/03/99	45 500	29 250
RRC-1A	A rapid review of overseas experience on cold tolerance of rice		30/8/90	no records	
UCS-16A	Biology of arrowhead (<i>Sagittaria montevidensis</i>)	1/07/96	30/11/00	183 000	75 000
UCS-20A	Development of integrated weed management strategies for the rice weed <i>Cyperus difformis</i> and <i>Alisma plantago-aquatica</i>	1/07/97	31/07/01	602 000	198 500
UCS-23A	Herbicide resistance development in dirty dora (<i>Cyperus difformis</i>) and starfruit (<i>Damasonium minus</i>)	1/07/98	30/12/98	19 156	6 364
UCS-7A	Biological control of starfruit in rice fields using a mycoherbicide	1/07/96	30/09/99	227 256	100 635
UNS-12A	Flavour and texture qualities of new Australian fragrant rice cultivars	1/02/97	30/04/00	226 000	106 000

Continued on next page

1.2 Completed and continuing projects

Project no.	Project title	Start	Finish	Total cost	RIRDC cost
				\$	\$
UNS-6A	Chemistry of fragrant rice flavour volatiles	1/01/93	31/12/94	41 900	21 900

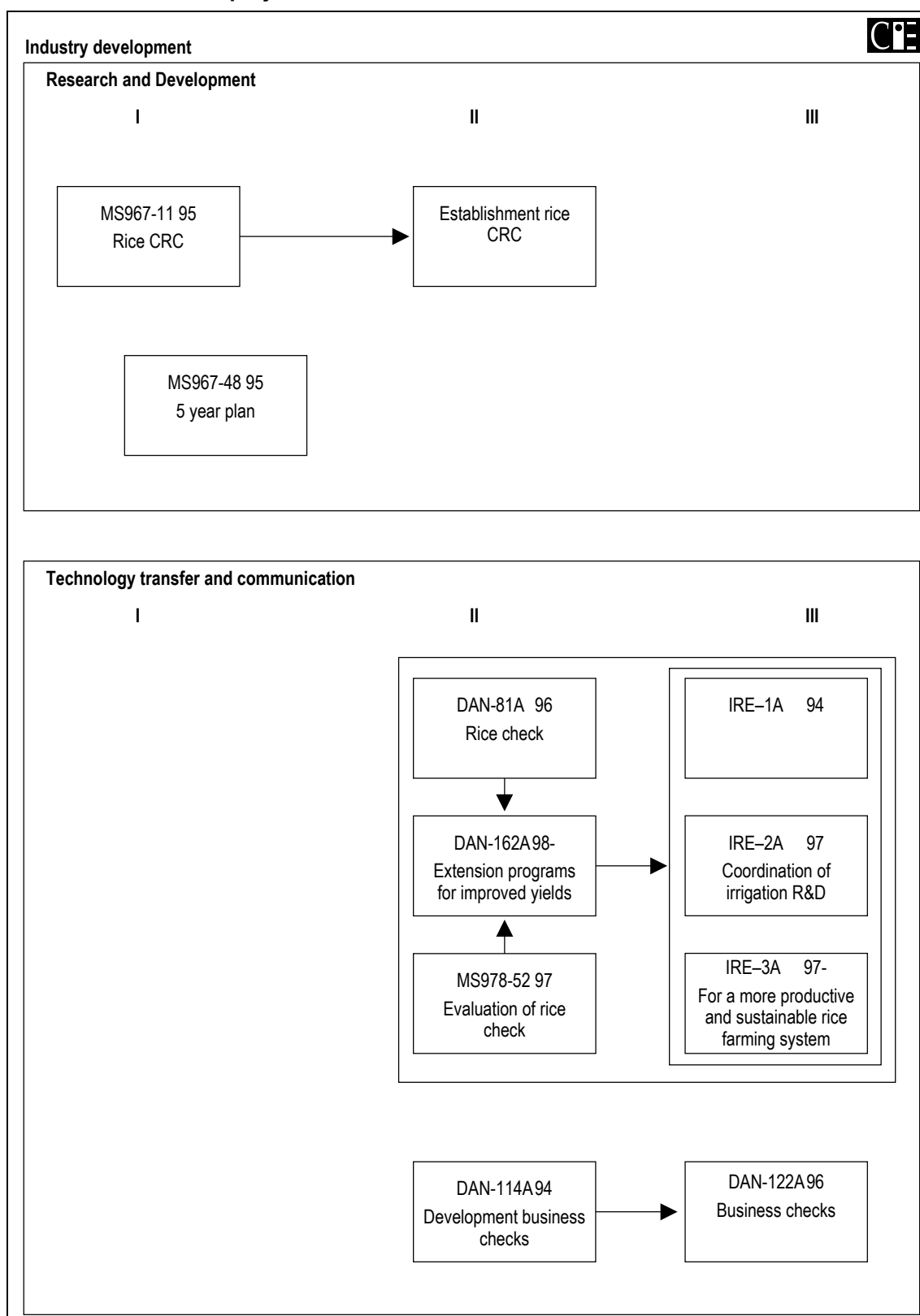
US-22A	Cold tolerance of rice		1995	No records	
USC-1A	Genetic engineering of Australian rice varieties for improved cold tolerance and grain quality	1/07/96	30/06/99	379 190	265 790
USC-2A	Application of molecular markers to rice breeding in Australia	1/01/97	31/12/99	293 900	174 500

Source: RIRDC database, compendiums.

Project sets and initial evaluation

Chart 5.3 sets out the projects in sets for evaluation. Projects can be evaluated individually, or in small or large sets. The boxes indicate groups of projects that might be evaluated as a set. Where projects are joined by an arrow they should be evaluated together, or at least part of the cost of the preceding projects allocated against the benefit flows from the following projects.

1.3 Classification of projects for evaluation

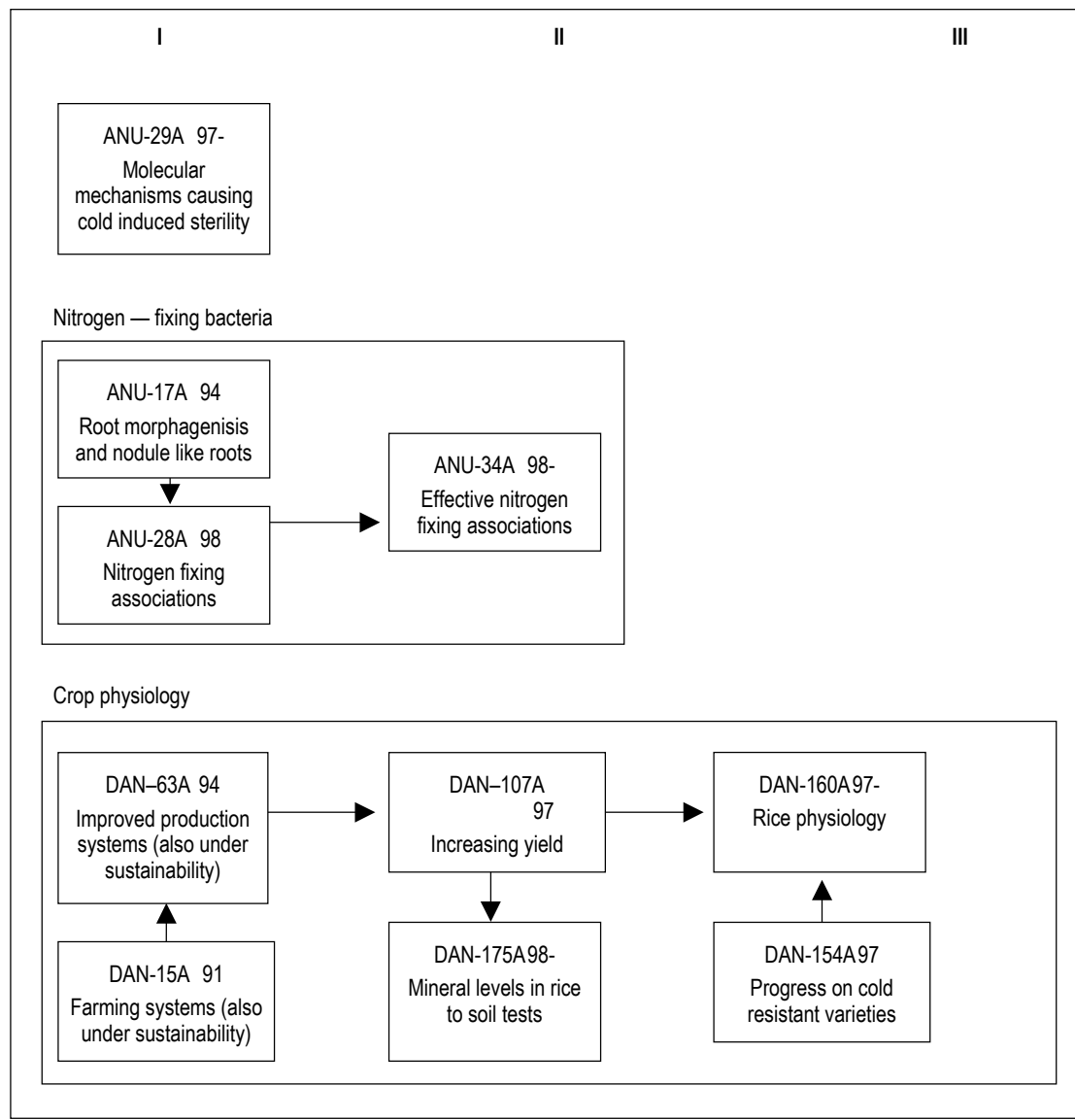


Continued on next page

1.3 Classification of projects for evaluation Continued

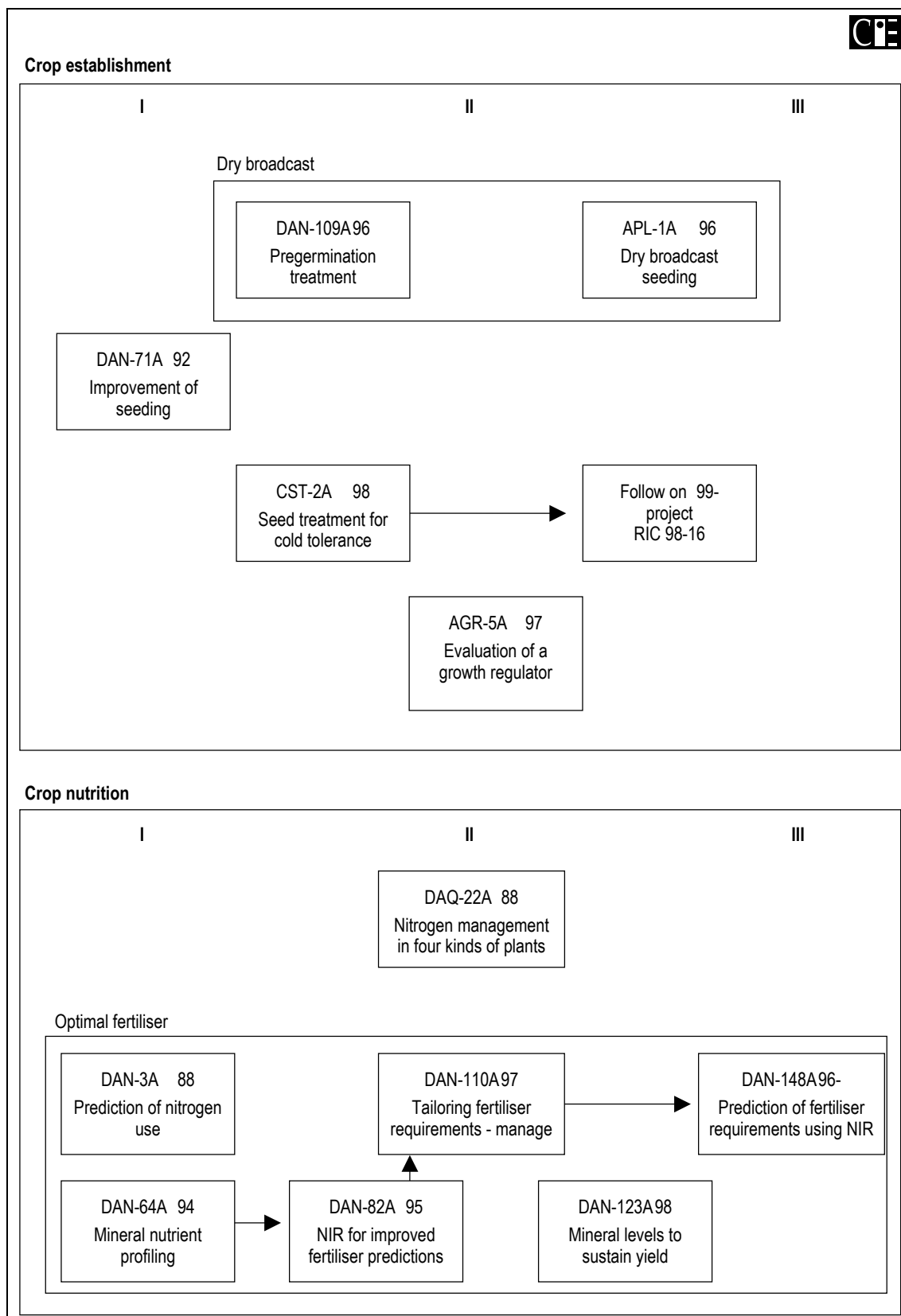


Agronomy/crop physiology

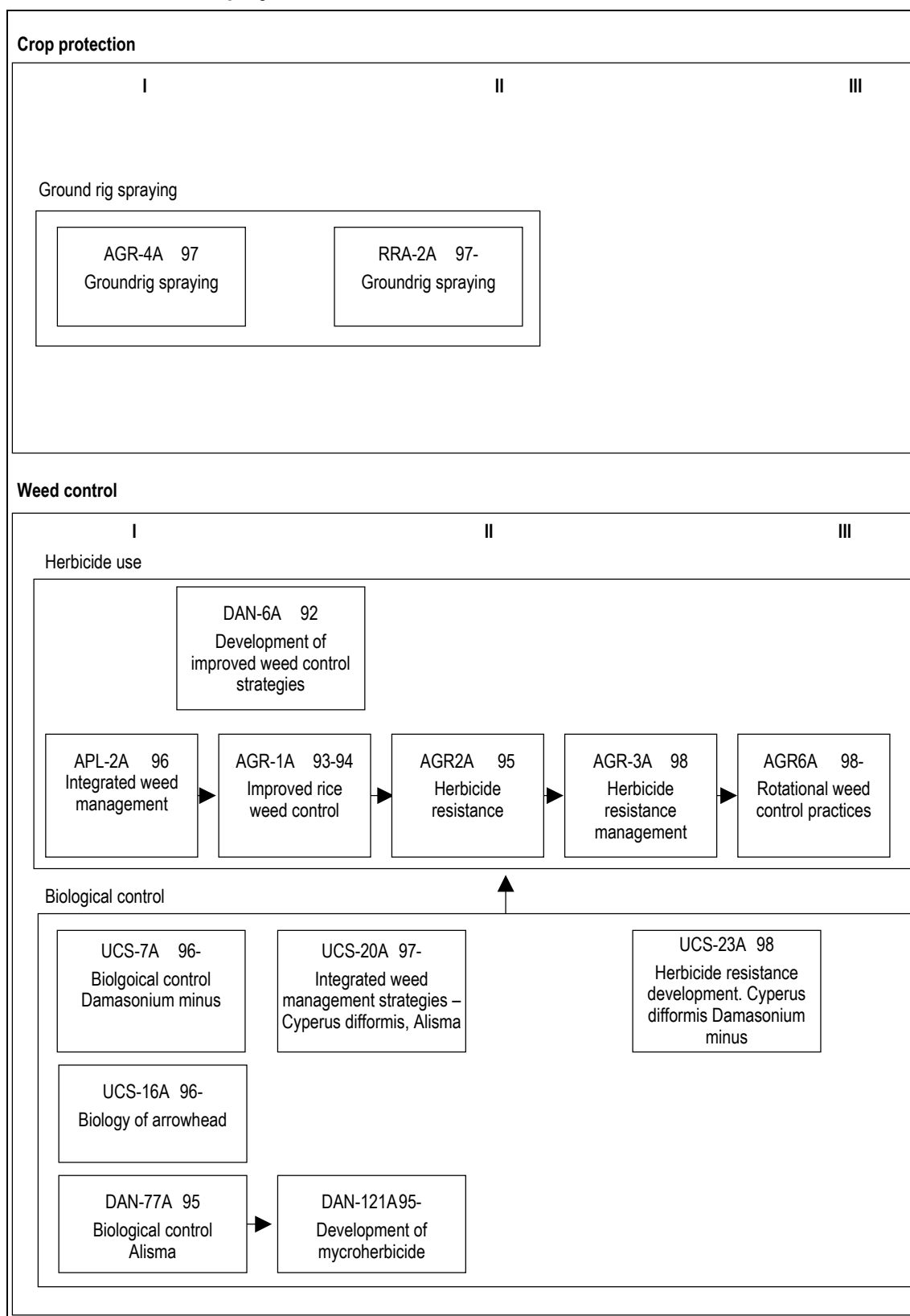


Continued on next page

1.3 Classification of projects for evaluation Continued

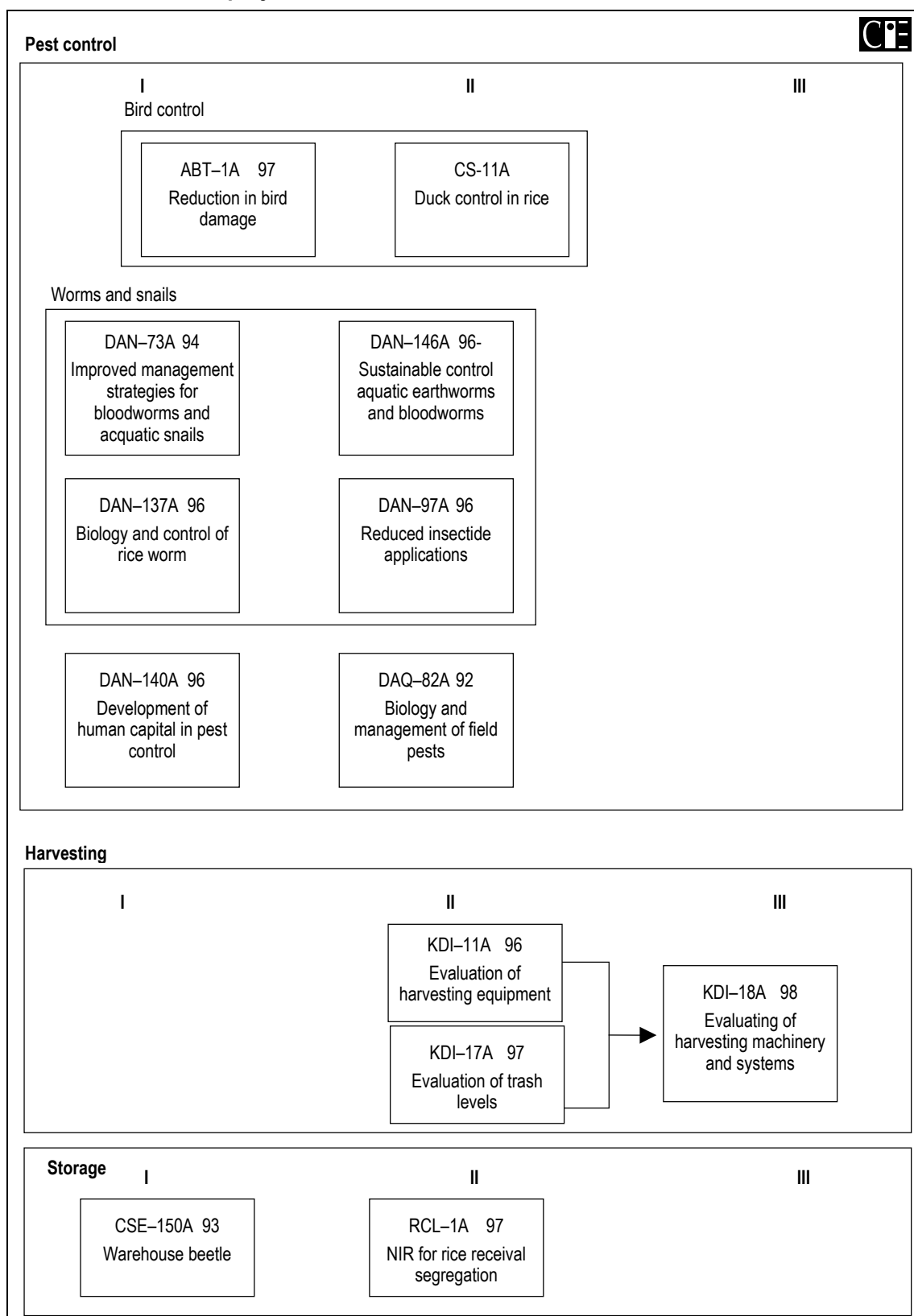


1.3 Classification of projects for evaluation Continued



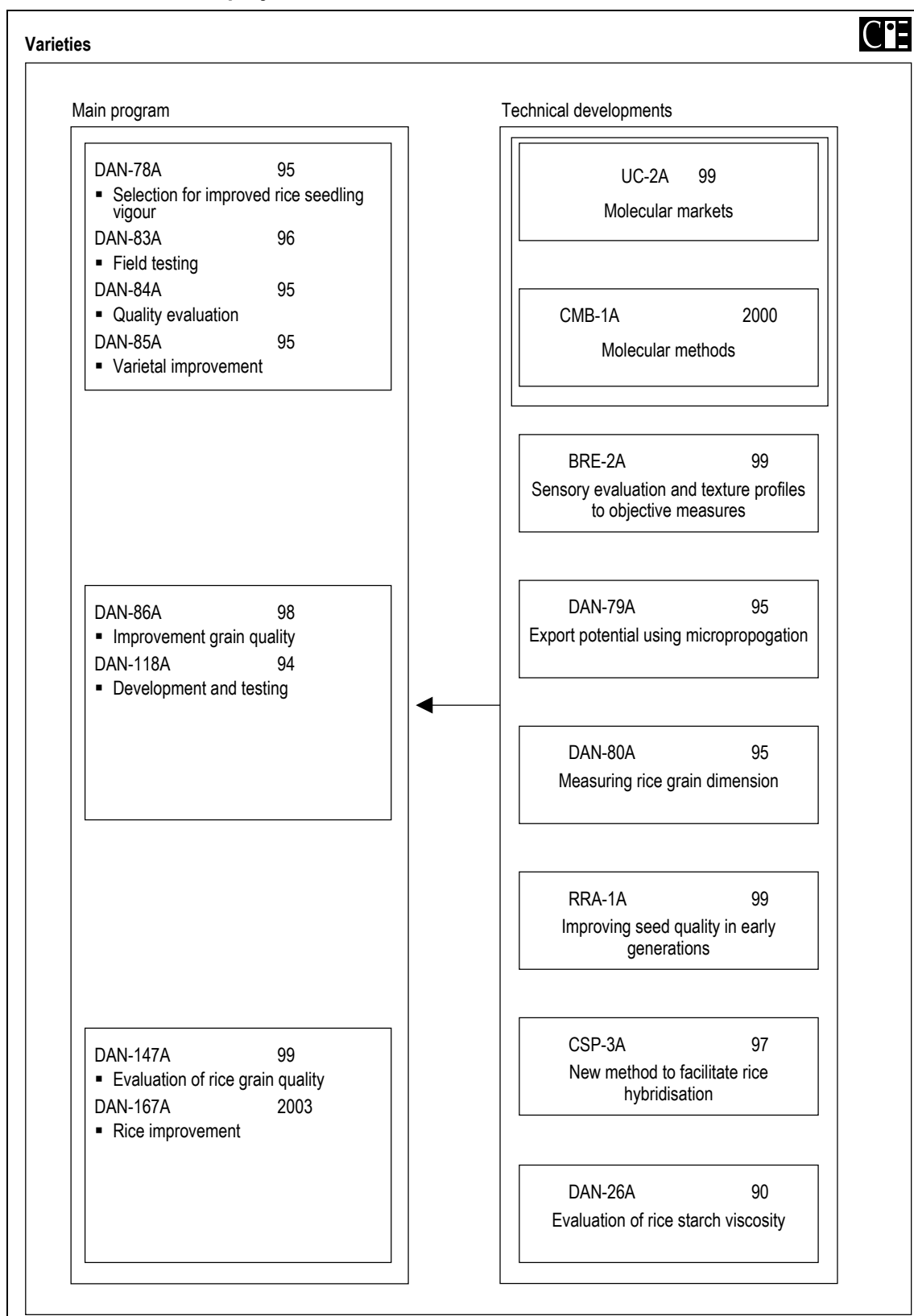
Continued on next page

1.3 Classification of projects for evaluation Continued



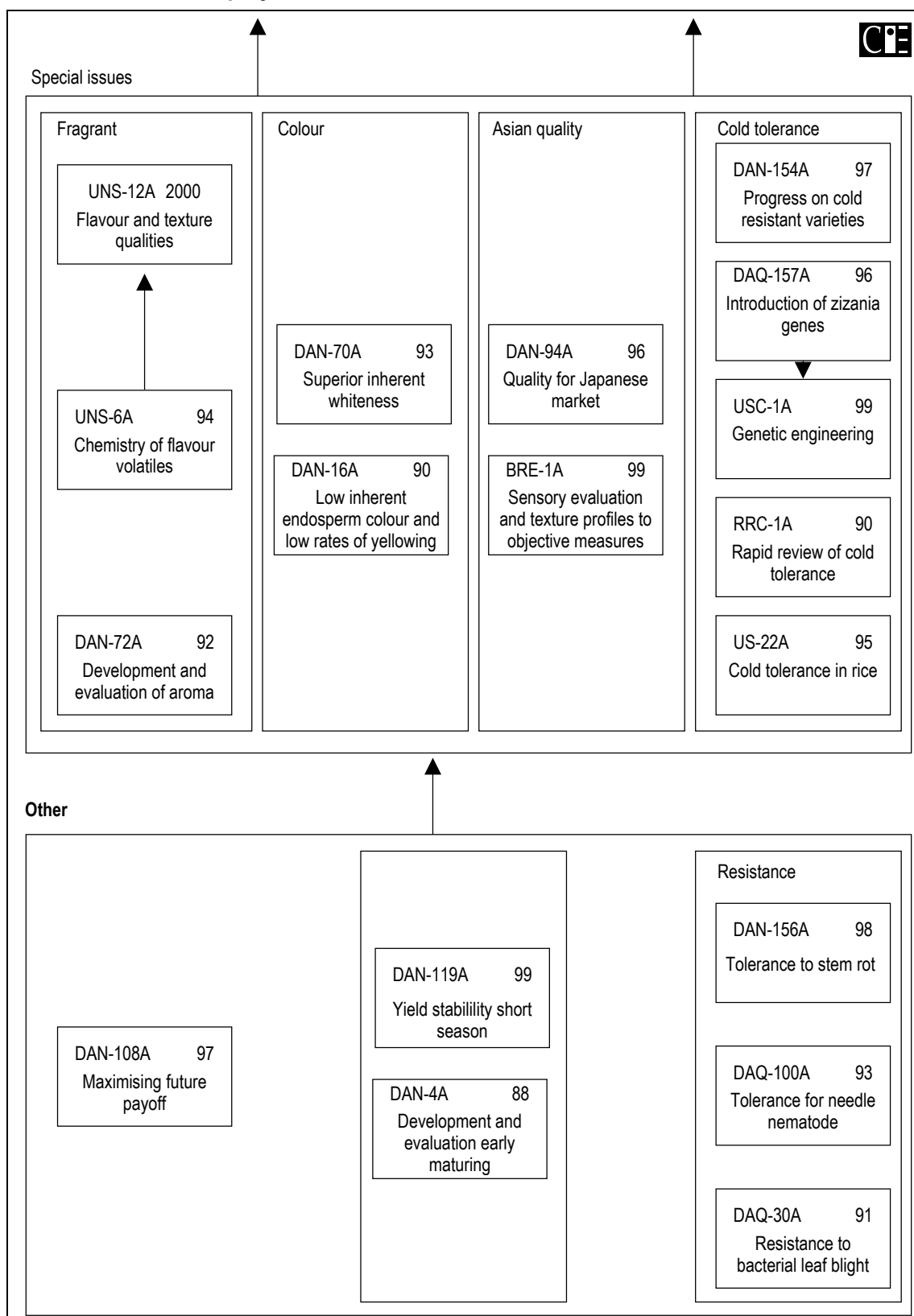
Continued on next page

1.3 Classification of projects for evaluation Continued



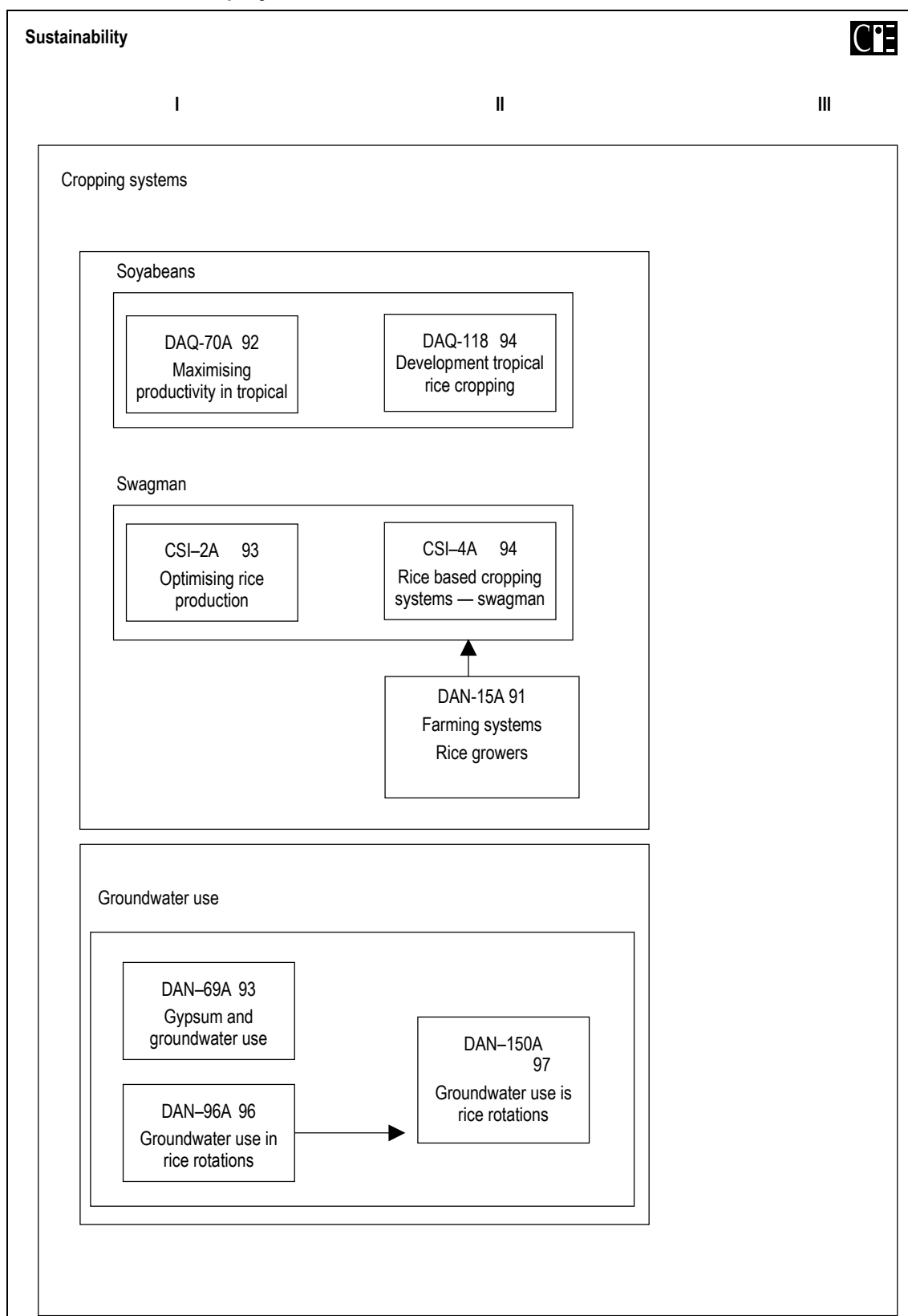
Continued on next page

1.3 Classification of projects for evaluation Continued



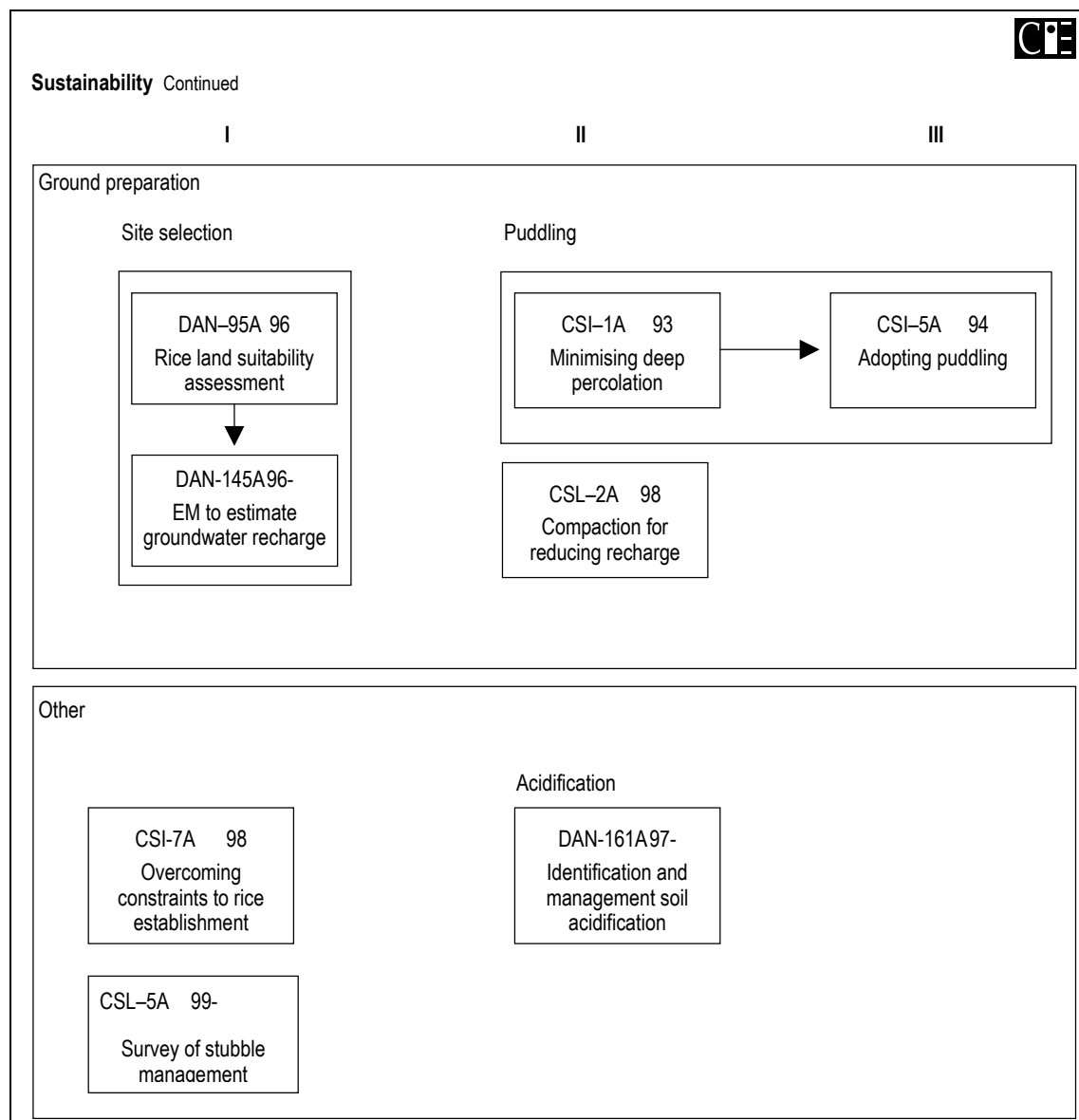
Continued on next page

1.3 Classification of projects for evaluation Continued



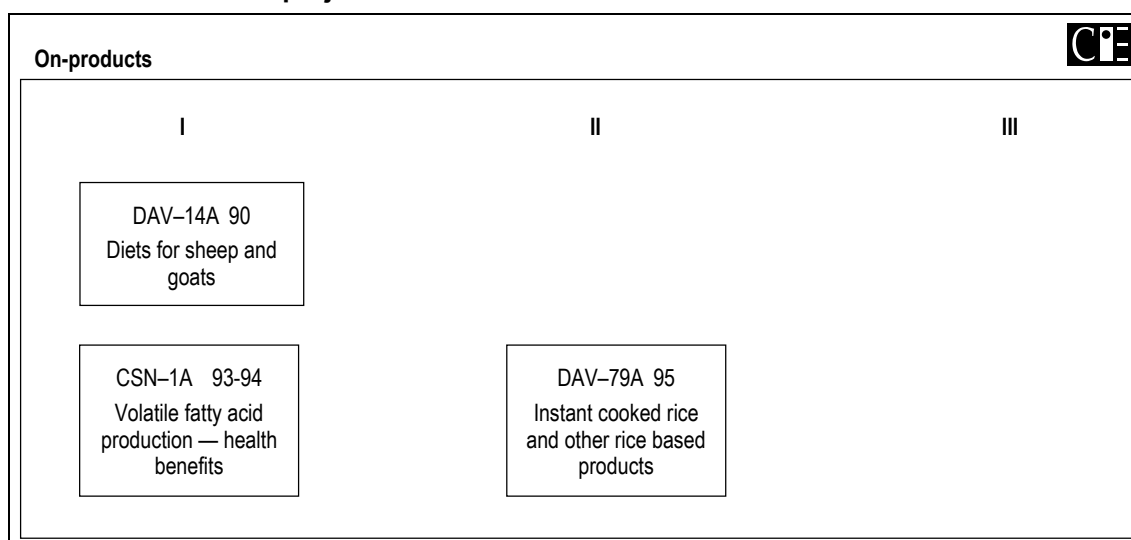
Continued on next page

1.3 Classification of projects for evaluation Continued



Continued on next page

1.3 Classification of projects for evaluation Continued



Data source: Program managers and CIE assessment.

Industry development

R&D development

There are two sets of projects.

- MS967-48 developed the five year plan. This plan has been followed in selecting research projects. It clarified the role of RIRDC funded projects and those funded solely by the industry.
- MS967-11 is a workshop on the establishment of a Cooperative Research Centre (CRC) for rice. RIRDC has been involved in the proposal development, and have committed \$0.5 million a year for seven years. The CRC funding is an additional \$1.25 million a year. CRR-1A funds the CRC for Sustainable Rice Production. The CRC will focus more on the environmental implications of rice growing and management of environmental problems, over time reducing the allocation in the RIRDC program to projects in the sustainability classification.

Technology transfer and communication

Allocation of the technology transfer projects into a separate category is difficult where projects follow on from other R&D projects. When this is the case they should be evaluated as part of that set rather than as stand-alone technology transfer projects. There are two sets of projects and several stand-alone projects.

- The set of projects DAN-81A, DAN-162A and MS978-52 developed the RICECHECK program. This program aims at providing annual updates of the latest R&D, and management and production systems. Projects IRE-1A, IRE-2A and IRE-3A provide an extensive range of grower meetings, field days and publications to support the program. For example, eight sets of grower meetings (about 600 individual meetings) are held at different stages of the crop development. The output is assessed as excellent. An evaluation would

need to assess the extent to which these projects speed up adoption of new technology, varieties and management systems.

- Two projects, DAN-114A and DAN-122A have developed a financial program for improving business management by rice farmers. These projects are assessed as good, but the impact would be difficult to evaluate. These projects can be considered a side part of RICECHECK, addressing an identified need.
- MS978-06 and MS978-45 provided support for publication of research results of general information.

Agronomy – crop physiology

There are two sets of projects and several stand-alone projects.

- ANU-29A investigates the molecular mechanisms causing cold induced sterility in rice. The project may have a patentable output that might also have implications for other crops. However, it is too early to assess the benefits.
- ANU-17A, ANU-28A and ANU-34A investigate the possibility of developing nitrogen-fixing bacteria that would substantially reduce fertiliser requirements in rice. This would have substantial cost savings in terms of reduced fertiliser needs and also environmental benefits. These projects fall in the low probability of success, but high returns if they are successful, category. It is too early to assess what the output will be.
- DAN-119A investigates the yield stability of short season rice. This project provided funding for PhD study. It investigated characteristics of interest to the breeding program.
- DAN-175 provides information on the relationship between minerals and crop development. It is related to DAN-107A, which feeds into DAN-160A, which looks at rice physiology and provides information on the yields achieved for the different species. DAN-160A is a big project and parts have already had an impact as the information is fed into RICECHECK. DAN-63A is the forerunner of DAN-107. DAN-15 is only marginally related to the later physiology projects — its soil information has been used in a number of projects. This set may be interesting to evaluate.

Crop establishment

- There are two projects that would benefit dry seeding. They can be assessed separately. DAN-109A tested pregermination treatments to improve establishment with dry seeding. The techniques tested were not found to influence productivity. APL-1A tested techniques for dry seeding. It is still more expensive than aerial sowing onto flooded paddies, so the impact of the project is low.
- DAN-71A investigates improving aerial sowing. It is an early project in the seed treatment improvement set. It identified a problem with seedling vigour that contributed to the following set of projects.
- CST-2A and its follow-on project RIC98-16 focus on developing a seed treatment to increase crop establishment and cold tolerance. A tea tree product has been identified as having potential. A patent has been taken out on the product. The product will not be expensive so, if it works, the outcome will be good. It is too early to judge at this stage.

- AGR-5A evaluated a growth regulator that is commonly used by the industry. It was found to have no impact on growth. This project should have resulted in cost savings for farmers who were using the product. It should be relatively easy to evaluate.

Crop nutrition

There are several stand-alone projects and one set which have explored methods of identifying optimal fertiliser application.

- DAN-123A explores the effect of mineral levels on rice quality and yield. This project sounds similar to DAN-175A, but, the focus of this project was on understanding the optimal fertiliser application rate. It was an important part of the development of MaNage Rice. The impact of this management tool is considered to be good.
- DAQ-22A looked at nitrogen levels in four tropical rice plants. The outputs are not known and the industry has since closed in Queensland.
- DAN-3A is an early project that has similar goals to the following set — to identify optimal fertiliser needs. The outputs are not known.
- DAN-64A, DAN-82A, DAN-110A and DAN-148A have all contributed to the development of a NIR technique for assessing fertiliser requirements. This technique benefits farmers through savings on fertiliser and perhaps through improving yields. It also has environmental benefits in reducing nutrient run-off. The output appears to be good.

Crop protection – general

There are two projects that are complementary to the other crop protection projects.

- AGR-4A and RRA-2A developed ground rig spraying for rice. It is not clear whether this will provide a cost saving over aerial spraying for the industry. However, the industry may be forced to adopt ground rig spraying due to environmental concerns or if dry broadcast becomes the preferred method of seeding. Currently, a cost saving is not provided so adoption is low. However, there may be a pay-off in the future.

Weed control

Herbicide use

- DAN-6A looked at developing weed control strategies for aerially sown rice. It first identified LONDAX for aerial sown rice and studied Alima control. Output was good, although the project was terminated.
- The series of projects APL-2A, AGR-1A, AGR-2A, AGR-3A and AGR-6A evaluate what chemical companies propose as integrated weed management strategies. They have found that the recommendations for application are generally too high. These findings, if acted on, can produce substantial cost savings. The projects also run tests on new herbicides found elsewhere in the world. This would be an interesting and, for cost saving, relatively straightforward evaluation.

Biological control

Increasingly, the environmental costs of chemical weed and pest controls, and potential health risks are being recognised. In addition, weeds and pests build up resistance to chemical controls. The future will see an increased reliance on biological controls. These projects explore the biology of weeds and are the first round in developing such controls. There are also projects that are the second round. The surveys of resistance provide very useful information on the development of integrated weed management strategies, but are yet to have outputs that have a major impact.

- UCS-7A, UCS-20A and UCS-23A focus on dirty dora (*Cyperus difformis*), *Alisma plantago-aquatica* and starfruit (*Damasonium minus*).
- UCS-16A focuses on arrowhead (*Sagittaria montevidensis*).
- DAN-77A leads into DAN-121A, which focus on Alismataceae weeds. The project is investigating whether the fungi identified as having the potential to reduce weeds can be brewed up for commercial application.

Pest control

Bird control

- CS-11A estimated the economic damage caused by ducks. The value of the output is not known.
- ABT-1A investigated a chemical that was thought to have potential to prevent birds eating the rice. The chemical was found to kill the rice. This finding is of value to the industry as it prevented any losses that would have arisen from its use.

Worms and snails

Solutions to the worm and snail problem are still largely unknown. So far, varying cultural practices seems to give the best results in pest control. The cost to the industry of these pests, and hence how much effort should be put toward control, would be part of an evaluation of these projects. This would be a complex evaluation.

- DAN-73A looks at improving management strategies for bloodworms and aquatic snails.
- DAN-97A develops guidelines for reduced insecticide applications.
- DAN-137A is a preliminary study on the biology of rice worm (*Eukerria saltensis*). It is too early to be able to assess the outputs.
- DAN-146A explores controls for aquatic earthworms and bloodworms. It is too early to be able to assess the outputs.
- DAN-140A funded a study tour. It is an input into these other projects.

Other pests

- DAQ-82A investigates the biology and management of field pests. This is a Queensland project, so the pay-off is probably low, unless the pests in Queensland are similar to those in New South Wales.

Harvesting, storage, etc.

- KDI-11A, KDI-17A and KDI-18A are three closely related projects. The first evaluated a number of harvesters for yield efficiency. The second measured the trash generated by different harvester types. And the third project put this information together in a publication. They should be evaluated as a set and should be relatively easy to evaluate. The output is good and the outcome is expected to be good.
- RCL-2A conducted research into dust protection in harvesting. Nothing is known about the output of this project.
- CSE-50A is an old project on warehouse beetles. It was found that the beetle is impossible to get rid of and explored management strategies. The outcome is not known.
- RCL-1A evaluated a system for measuring the quality of rice as it arrives for storage. A commercial system is still in the development phase, but the potential benefit could be high. The test developed in this project and further feedback systems would be able to quickly inform the grower about optimal time for harvesting to raise quality levels. This project is linked to the fertiliser projects using NIR through common equipment.

Sustainability

The projects under this objective can be classified into those that focus on developing production mixes to improve productivity and reduce water table damage, those that focus on ground selection and preparation, and other.

Cropping systems

- DAN-15A developed a mixed system based on pasture rice rotations. It was an early project in the series DAN-63A leading to DAN-160A. DAN-63A developed a decision tool for crop rotations. This project led to DAN-107A, which improved information on yields, then to DAN-160A on crop physiology.
- DAQ-70A and DAQ-118A developed soybean–rice mixed cropping systems appropriate for Queensland. The decline of the rice industry there suggests these projects did not pay-off.
- CSI-2A and CSI-4A have developed a system called Swagman. This is a tool to selecting an appropriate cropping mix. It is not clear what the impact of this project has been.
- DAN-96A and DAN-150A explore ground water use in rice rotations. The projects found that rice could be used to leach the ground water, but the systems were very management intensive and prone to failure. The impact of the project output is low.
- DAN-69A tested the benefits of the use of gypsum in crop rotations. Use raised the productivity of rotation crops, but created subsequent problems for rice paddy preparation. The impact is low as this was not a widely considered practice.

Ground preparation

- DAN-95A and DAN-145A have developed a technique for identifying leaky spots in rice paddies. These can then be avoided or methods to reduce the leaks can be adopted. The system works well and is potentially of considerable value to the farmers in reduced water use. Currently, several groups are setting up commercial operations to sell the services to rice farmers. The system is also of great benefit to the environment in reducing seepage to the water table. Evaluation of the water saving should be relatively simple, while benefit to the environment and hence sustainability of the industry is more difficult to assess. This would be a useful evaluation.
- CSI-1A and CSI-5A developed and tested a technique called puddling. It was found to reduce recharge but has not been widely adopted by growers. It is still used in some situations by some growers.
- CSL-2A evaluated the benefits from compaction of the paddy in preparation for flooding. The benefits would be water saving and reduced seepage to the water table. Compaction appears to achieve these aims and companies are contracting to provide compaction services. However, the long term implications for other crops have not been explored. If these are not important, the impact should be good.

Other

- CSI-7A investigates the possible causes of the dramatic differences in yields in the western Murray area. It has confirmed the difference, but has not identified any clear causes.
- DAN-161A has implemented a program for identifying and managing acidification of soils. It is too early to assess the impact of this project.
- CSL-5A is a survey of current rice stubble management practices. Currently, the stubble is burnt, with attendant environmental costs. It is too early to assess the output from this project. It would be difficult to evaluate as it is providing information into directing future research rather than providing a final output.

Varieties

The breeding program has a core series of projects that fund the main breeding and quality testing activities. Breeding consists of crossing, seed production and selection (F1 to F3), further selection and replicated and unreplicated plot production (F3 to F6), district trials (to F9), seed increase, and cultivar release. Quality testing occurs at three stages in the breeding cycle, early generation (F3 and F4), mid generation (F5 and F6), and late generation (from district trials).

The rice breeding program has been evaluated (Brennan and Singh 1997) for the purpose of guiding investment decisions. This summary draws on the information presented in these reports. The program has three main areas.

- Medium grain rice is the standard rice, which in 1994-95 was priced at \$167 a tonne on the domestic market. The focus has been on improving yield and quality. Six varieties have been released since the program began in 1958.
- Long grain rice attracts a 17 per cent price premium. The focus has been on yield and quality. Six varieties have been released since 1958.

- Specialty rice developed in the breeding program are fragrant jasmine (two varieties released since 1975), long grain firm cooking (one variety released since 1970), medium grain Japanese (one variety released since 1980), arborio (three varieties released since 1980), fragrant basmati (1988), medium large (1987) and waxy (1970). Specialty rice attracts a 69 per cent premium on the domestic market. For fragrant rice, the main focus has been on improving yields.

For most varieties, yield improvement is sought through improved short season lines, improved seedling vigour and improved cold tolerance. The main quality issues apart from specialty rice and standard quality is softer cooking short and medium grain rice.

Currently, around 30 per cent of the breeding resources are used for standard medium grain, 30 per cent for standard long grain and 40 per cent for specialty rice. Brennan and Singh (1997) estimated that the net present value (in 1996 at an 8 per cent discount rate) of the breeding program was \$3.1 million per variety for medium grain, \$6.6 million per variety for long grain and an average of \$0.1 million for specialty varieties. The benefit–cost ratios were 7.6, 16.2 and 3.3 respectively. The main factors behind the different outcomes are that yield on long grain had considerable potential to improve (as their yields were well below those of medium grains) and, for specialty rice varieties, very small production areas and niche domestic markets limited the potential benefit.

These estimates assume that prices and areas of production remain unchanged and that input prices do not vary with the variety. The world market for rice is highly distorted and export markets are largely limited to standard varieties, reducing the scope for expanding specialty rice production.

In chart 5.3 the breeding projects are grouped into four sets: core projects; special projects; stand-alone projects; and technical developments. Apart from the stand-alone projects, the breeding program should be assessed as a set.

Core projects

The core projects are the main breeding and testing projects. There appears to have been three rounds of funding since RIRDC became involved.

- DAN-78A, DAN-83A, DAN-84A, DAN-85A — all finished in 1995 or 1996.
- DAN-86A and DAN-118A — finished in 1998.
- DAN-147A and DAN-167A — two continuing core projects.

Special issue projects

- UNS-6A and UNS-12A focus on identifying and isolating the source of the characteristics of fragrant rice in order to better select parents for crosses. This should improve the success rate in achieving fragrant offspring from fragrant parents. It is too early in the project to assess the output. DAN-72A also conducted tests to evaluate aroma, but not at this technical level. The output at this stage is perceived to be limited.

- DAN-16A developed techniques for measuring the colour of milled rice which was then used to assess the ageing process in various varieties. DAN-70A concentrated on improving techniques and led to the incorporation of a regular measurement of colour in the selection process. DAN-70A has been a major screening tool.
- DAN-94A and BRE-1A examined the characteristics of rice demanded in Japan and North Asia respectively. They focused on the chemistry of the qualities in demand. This information feeds into the breeding of specialty rice for these markets. These projects have had an important impact and a new variety is about to be released.
- A number of projects, ANU-29A, US-22A, USC-1A, DAN-154A, DAN-157A and RRC-1A, have provided input into the development of more cold tolerant varieties in the breeding program.
 - ANU-29A is ongoing and is attempting to identify the molecular mechanisms that cause cold induced sterility. If successful, the project will be of considerable value in improving selection for cold tolerance, not only in rice, but also potentially in other crops.
 - DAN-154A provided useful information on physiology that was input into the breeding program and into DAN-160A.
 - DAN-157A supported the introduction and testing of zicania genes into Australia. This project led to USC-1A that is still underway. It is a genetic engineering project aimed at improving cold tolerance in Australian rice varieties. The project has achieved success, but the plant material developed, while valuable, is yet to be incorporated into the breeding program. A provisional patent has been requested on the transformation technique.
 - RRC-1A reviewed experience in cold tolerance in other countries. It assisted understanding of cold tolerance screening – particularly in Korea. US-22A was not completed.

Stand-alone projects

There are a number of projects that stand-alone in the sense that they do not provide direct inputs into particular parts of the breeding program.

- DAN-108A funded the economic evaluation of the breeding program. A tool for analysing the best alternative project mix was developed and is being used by the breeders. This has the potential to raise the returns to and costs of the breeding program significantly.
- DAN-119A explored features of short season rice yield stability. It provided funding for the PhD program for a member of the breeding staff. The value of the project is perhaps more in the skills acquired than in the output of the project.
- DAN-4A is an old project that looked at the development and evaluation of early maturing rice. It was probably an input to pre-RIRDC breeding activities.
- DAN-156A examined tolerance to stem rot. This project identified varieties that are susceptible and provided recommendations for handling the problem. It is difficult to estimate the impact without a more detailed assessment.

- DAQ-100A and DAQ-30A examined tolerance for needle nematode and resistance to bacterial leaf blight respectively. These were particular problems for Queensland rice growers. With the decline of that segment of the industry, the value of these projects is probably low. These problems appear to be specific to Queensland so, given the collapse of the industry there, have not had an impact.

Technical developments

There are several projects that can be grouped; others appear to be independent. All feed into the breeding program by providing better information, tools or techniques for undertaking core activities.

- USC-2A and CMB-1A are developing molecular markers that will assist in the selection process. These projects are still in progress.
- BRE-2A is trying to develop objective measurement techniques of quality characteristics such as taste and texture. This will allow easier and more consistent testing in the breeding program. It is still in the early stages of the project.
- DAN-79A looked at raising export potential using micropropagation. This project focused on reducing the time to breed up additional generations by using greenhouse production rather than field production. The technique is used infrequently in the breeding program — however, screening techniques developed in the project are still used in the regular breeding program.
- DAN-80A developed a technique for rapid and accurate measurement of rice grain dimension. This is used in the evaluation of quality as dimension is one of the characteristics targeted in the breeding program. The technique is regularly used in the breeding program. No other technique provides such a reliable and comprehensive measure of dimension analysis. Outcome is very positive, particularly for rice varieties where dimension is important in some markets and also in the processing sector.
- RRA-1A focused on improving seed quality in early generations. It provided important output and particularly seed production facilities that are still used to:
 - speed release of varieties; and for
 - special purpose grading for pure seed production.
- CSP-3A developed a new method to facilitate rice hybridisation. The method was essentially unsuccessful in rice (although useful for other crops). The breeding program is not using the output, although experience gained in nutrient culture techniques is now regularly used in other programs.
- DAN-26A is an early project evaluating rice starch viscosity. The outcome is not known.

On-products

Three projects were identified as producing on-products. They are all too old to warrant evaluation. Little is known of their outputs or outcomes.

- DAV-14A developed diets for sheep and goats based on the rice hulls.

- CSN-1A explored the fatty acid production associated with the digestion of rice. This has suggested health benefits.
- DAV-79A developed instant cooked rice and other rice products.

Evaluation

Table 5.4 summarises the expected outputs and outcomes from the projects. The majority of the projects were successful in achieving their targeted outputs and, for the large part, these outputs were likely to have a good impact on the industry. The main exceptions are projects related to rice growing in Queensland, due to the decline of the industry in this state. However, there are some questions raised as to the value of some of the crop protection projects, particularly pest control. It is also difficult to assess the likely impact of the technical development projects in the breeding project as they are intermediate outputs in that they feed into the core breeding program and adoption rates are generally not known from the files.

1.4 Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
ABT-1A	Reduction of bird damage to rice crops	I	Pest control	Chemical	Stand-alone	Medium	Human health
AGR-1A	Improved rice weed control	II	Weed control	Chemical	AGR-1A AGR-2A AGR-3A AGR-6A	Medium	
AGR-2A	Herbicide resistance management in rice	II	Weed control	Chemical	AGR-1A AGR-2A AGR-3A AGR-6A	Medium	
AGR-3A	Herbicide resistance management in rice	II	Weed control	Chemical biological	AGR-1A AGR-2A AGR-3A AGR-6A	Medium	
AGR-4A	Development and adoption of ground-rig spraying for rice in NSW	II	Crop protection	Machines	ARG-4A RRA-2A	Low	

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
AGR-5A	Evaluation of a growth regulator in rice	II	Crop establishment	Growth regulator	Stand-alone	Medium	
AGR-6A	Rotational weed control practices for rice (continuation of AGR-3A)	II	Weed control	Chemical biological	AGR-1A AGR-2A AGR-3A AGR-6A	Medium	
ANU-17A	Investigation of root morphogenesis and the induction of nodule-like structures on the roots of rice seedlings	I	Agronomy – crop physiology	Nitrogen fixing bacteria	ANU-17A ANU-28A ANU-34A	Too early	Environment - reduced fertiliser

ANU-28A	Towards the development of more effective nitrogen-fixing associations between rice cultivars and endophytic bacteria	I	Agronomy – crop physiology	Nitrogen fixing bacteria	ANU-17A ANU-28A ANU-34A	Too early	Environment - reduced fertiliser
ANU-29A	Investigation of the molecular mechanisms causing cold induced sterility in rice	I	Agronomy – crop physiology	Cold tolerance	Stand-alone	Too early	Other crops for hybrids
ANU-34A	Towards the development of more effective nitrogen-fixing associations between rice cultivars and endophytic bacteria	II	Agronomy – crop physiology	Nitrogen fixing bacteria	ANU-17A ANU-28A ANU-34A	Too early	Environment - reduced fertiliser
APL-1A	Dry broadcast seeding of rice	II	Crop establishment	Dry sowing	Stand-alone	Low	
APL-2A	Improvements in rice weed control	II	Weed control	Integrated weed management strategies	Led to AGR series	Medium	
BRE-1A	Quality rice for North Asia	I	Varieties	Asian market analysis - tastes	Input to breeding	Too early	
BRE-2A	Relation of sensory evaluation and texture profiles to objective measures of cooked rice texture	I	Varieties	Techniques - quality	Input to breeding	No final output	
CMB-1A	Molecular methods for hybrid rice production	I	Varieties	Techniques	Input to breeding	No final output	
CS-11A	Duck control in rice crops	I	Pest control	Economic losses	Stand-alone	Too old	
CSE-50A	Warehouse beetle	II	Harvesting, storage, etc.	Pest control	Stand-alone	Low	
CSI-1A	Minimising deep percolation from rice culture	I	Sustainability	Production systems - ground preparation	CSI-1A CSI-5A	Low	Environment - watertable
CSI-2A	Optimising rice production within sustainable environmental constraints	I	Sustainability	Production systems - cropping mix	CSI-2A CSI-4A	Low	Environment - watertable
CSI-4A	Swagman options — helping maximise profitability of rice based cropping systems	II	Sustainability	Production systems - cropping mix	CSI-2A CSI-4A	Medium	Environment - watertable

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
CSI-5A	Adopting puddling to minimise deep percolation from rice	II	Sustainability	Production systems - ground preparation	CSI-1A CSI-5A	Low	Environment - watertable
CSI-7A	Identifying and overcoming constraints to rice establishment and yield in the western Murray Valley	I	Sustainability	Production systems - water control	Follow on RIC 99-08?	Low	
CSL-2A	Evaluation of compaction for reducing recharge from rice	I	Sustainability	Production systems - ground preparation	Stand-alone	Medium	Environment - watertable

CSL-5A	Survey of current rice stubble management practices for identification of research needs and future policy	I	Sustainability	Production systems - stubble management	Scoping study for follow on	Too early	Environment
CSN-1A	Volatile fatty acid production through the large bowel fermentation of rice starch	I	On-product	Health benefits	Stand-alone	Unknown	
CSP-3A	A new method to facilitate rice hybridisation	II	Varieties	Techniques	Input to breeding	No final output	
CST-2A	Seed treatment and foliar application of glycinebetaine to increase crop establishment and cold tolerance in rice	I	Crop establishment	Seed preparation	CST-2A RIC98-16	Too early	
DAN-107A	Increasing the yield potential in the NSW rice industry	I	Technology transfer and communication	Yield - information input	DAN-107A DAN-160A	Medium	
DAN-108A	Maximising the future pay-off from rice breeding	II	Varieties	Economic input to selection	Stand-alone input to future breeding	Medium	
DAN-109A	Seed soakage techniques	II	Crop establishment	Seed preparation	Stand-alone	Low	
DAN-110A	Tailoring fertiliser recommendations to requirements	III	Crop nutrition	Management systems - manage	DAN-3A DAN-110A	Medium	Environment - fertiliser
DAN-114A	The development of business checks for rice farms	II	Technology transfer and communication	Financial management	DAN-114A DAN-122A	Medium	
DAN-118A	Rice variety development, testing and pure seed maintenance	II	Varieties	Field testing	Main breeding program	Medium	
DAN-119A	The yield stability of short season rices	I	Agronomy – crop physiology	Early maturing	DAN-4A DAN-119A	Too early	Other crops for hybrids
DAN-120A	Resistance to bloodworm attack in selected rice varieties - evaluation of root vigour and entibiosis	I	Pest control	Chemical	DAN-97A DAN-120A	Medium	Environment - pesticides

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
DAN-121A	Further development of a mycoherbicide for control of Alismataceae weeds in rice	II	Weed control	Chemical	DAN-77A DAN-121A	Too early	
DAN-122A	Business checks for rice farms	III	Technology transfer and communication	Financial management	DAN-114A DAN-122A	Medium	
DAN-123A	Defining the mineral levels in rice needed to sustain yield and quality	I	Crop nutrition	Production systems	DAN-123A DAN-175A	Medium	
DAN-137A	Preliminary studies on biology and control of the rice worm Eukerria saltensis	I	Pest control	Biology	Stand-alone	Too early	

DAN-140A	Study tour to the International Rice Institute	I	Pest control	Techniques - human capital	Input to another project ??	na	
DAN-145A	EM to estimate ground water recharge from rice growing	II	Sustainability	Site selection	DAN-95A DAN-145A	Medium	Environment - watertable
DAN-146A	Sustainable control of aquatic earthworms and bloodworms in rice	II	Pest control	Chemical	DAN-73A DAN-146A	Too early	
DAN-147A	Evaluation of rice grain quality - II	II	Varieties	Quality	Main breeding program	Medium	
DAN-148A	NIR for improved fertilizer predictions	II	Crop nutrition	Fertiliser	DAN-64A DAN-82A DAN-148A	Medium	Environment - fertiliser
DAN-150A	Ground water use in rice rotations - phase II	II	Sustainability	Production systems - water control	DAN-96A DAN-150A	Low	Environment - watertable
DAN-154A	Enhancing progress on developing cold resistant varieties and management practices	I	Varieties	Cold tolerant	USC-1A DAQ-157A DAN-154A breeding	Medium	
DAN-156A	Screening rice varieties for tolerance to stem rot	II	Varieties	Disease resistance	Input to breeding	No final output	
DAN-15A	Advanced farming systems for rice growers	II	Sustainability	Pastures	DAN-15A DAN-63A DAN-107A DAN-160A	Too old	
DAN-160A	Rice physiology: Maximising rice yields beyond 2000	II	Agronomy – crop physiology	Production systems	DAN-15A DAN-63A DAN-107A DAN-160A	Medium	
DAN-161A	Identification and management of soil acidification in irrigated farming systems of southern NSW	III	Sustainability	Identification and management		Too early	Environment - soil acidification
DAN-162A	Better extension programs for improved rice yields	II	Technology transfer and communication	Performance information	DAN-81A DAN-162A IRE-1A IRE-2A IRE-3A MS978-52	Medium	

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
DAN-167A	Rice improvement	II	Varieties	Quality and yield - pure seed	Main breeding program	Medium	
DAN-16A	Identification of rice varieties with low inherent endosperm colour and low rates of yellowing	I	Varieties	Colour	Input to breeding	Too old	
DAN-175A	Relating minerals in rice shoots and grain to soil tests, yield and grain quality	II	Agronomy – crop physiology	Production systems - minerals	DAN-123A DAN-175A	Too early	
DAN-26A	Early evaluation of rice starch viscosity	II	Varieties	Techniques	Input to breeding	No final output	
DAN-3A	Prediction of nitrogen use by rice crops	II	Crop nutrition	Management systems - manage	DAN-3A DAN-110A	Too old	

DAN-4A	Development and evaluation of II early maturing rice varieties		Varieties	Early maturing	Input to breeding	Too old	
DAN-63A	Improved production systems II for rice in New South Wales		Sustain- ability	Production systems - decision tools	DAN-15A DAN-63A DAN-107A DAN-160A	Medium	Environ- ment - watertable
DAN-64A	Mineral nutrient profiling for I improved rice crop fertiliser management		Crop nutrition	Fertiliser	DAN-64A DAN-82A DAN-148A	Medium	Environ- ment - fertiliser
DAN-69A	Gypsum and ground water use I in rice rotations		Sustain- ability	Production systems - ground preparation	Stand- alone	Low	Environ- ment - watertable
DAN-6A	Development of improved II weed control strategies in aerial sown rice		Weed control	Chemical	Stand- alone	Medium	
DAN-70A	Producing rice varieties with II superior inherent stable whiteness		Varieties	Colour	Input to breeding	No final output	
DAN-71A	Improvement of rice seeding I establishment in New South Wales		Crop establish- ment	Aerial sowing		Medium	
DAN-72A	Development and evaluation of I aromatic rice varieties for the New South Wales rice industry		Varieties	Fragrant	UNS-6A UNS-12A DAN-72A DAN-79A	Medium	
DAN-73A	Improved management I strategies for bloodworms and aquatic snails in rice		Pest control	Chemical	DAN-73A DAN-146A	No final output	
DAN-77A	Biological control of Alisma I Lanceolatum		Weed control	Chemical	DAN-77A DAN-121A	Too early	
DAN-78A	Selection for improved rice I seedling vigour		Varieties	Yield	Main breeding program	Medium	
DAN-79A	Developing a fragrant rice II variety with export potential using micro-propagation		Varieties	Fragrant - technology	UNS-6A UNS-12A DAN-72A DAN-79A	Medium	

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
DAN-80A	Rice grain dimension selection I by image analysis		Varieties	Techniques - measuring quality	Input to breeding	No final output	
DAN-81A	Performance evaluation of II commercial rice crops		Technology transfer and communi- cation	Production systems - RICECHECK	DAN-81A DAN-162A IRE-1A IRE-2A IRE-3A MS978-52	Medium	
DAN-82A	Prediction of rice fertiliser II requirements using NIR		Crop nutrition	Fertiliser	DAN-64A DAN-82A DAN-148A	Medium	
DAN-83A	Evaluation of rice grain quality I - II		Varieties	Quality evaluation	Main breeding program	Medium	

DAN-84A	Rice district trials and pure seed management	II	Varieties	Field testing	Main breeding program	Medium
DAN-85A	Rice varietal improvement	II	Varieties	Yield and quality	Main breeding program	Medium
DAN-86A	Improvement of rice grain quality	II	Varieties	Production systems - quality	Main breeding program	Medium
DAN-94A	Developing rices suitable for export to Japan	I	Varieties	Quality - Japanese market	Input to breeding	No final output
DAN-95A	Riceland suitability assessment	II	Sustainability	Site selection	DAN-95A DAN-145A	Medium
DAN-96A	Ground water use in rice rotations	I	Sustainability	Production systems - water control	DAN-96A DAN-150A	Low
DAN-97A	Reduced insecticide applications for rice crop protection in southern New South Wales	II	Pest control	Chemical	DAN-97A DAN-120A	Medium
DAQ-100A	Breeding long grain tropical rice for tolerance to needle nematode	II	Varieties	Pest resistance	Stand-alone	Low
DAQ-118A	On-farm development of a tropical irrigated rice–soyabean cropping system	II	Sustainability	Mixed cropping - soyabeans	DAQ-70A DAQ-118A	Low
DAQ-157A	Biotechnological introduction of zizania genes into Australia	I	Varieties	Cold tolerant	USC-1A DAQ-157A DAN-154A breeding	Medium
DAQ-22A	Nitrogen management of four rice plant types in North Queensland	II	Crop nutrition	Fertiliser	Stand-alone	Low
DAQ-30A	Breeding long grain tropical rice resistant to bacterial leaf blight (<i>Xanthomonas Campestris</i> PV. <i>Oryzae</i>)	II	Varieties	Disease resistant	Stand-alone	Too old

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
DAQ-70A	Maximising productivity in a tropical irrigated rice-based cropping system	II	Sustainability	Mixed cropping - soyabeans	DAQ-70A DAQ-118A	Low	
DAQ-82A	Biology and management of field pests of rice	II	Pest control	Chemical	Stand-alone	Low	
DAV-14A	Development of complete diets for sheep and goats based on ground rice hulls and whole cereal grains	I	On-product	Animal feed	Stand-alone	Too old	
DAV-79A	Development of instant cooked rice and rice based products	II	On-product	Food	Stand-alone	Too old	
IRE-1A	Coordination of irrigation R&D in the irrigation areas of southern New South Wales	III	Technology transfer and communication	Communication	IRE-1A IRE-2A IRE-3A	Medium	

IRE-2A	Improving technology transfer in the NSW rice industry and co-ordination of irrigation R&D for other irrigated enterprises (IRE-1A)	III	Technology transfer and communication	Communication	IRE-1A IRE-2A IRE-3A	Medium
IRE-3A	Technology transfer for a more productive and sustainable rice farming system	III	Technology transfer and communication	Communication	IRE-1A IRE-2A IRE-3A	Medium
KDI-11A	Performance evaluation of rice harvesting equipment	II	Harvesting, storage, etc.	Machinery - yield	KDI-11A KDI-17A KDI-18A	Medium
KDI-17A	Evaluation of trash levels on-farm during the 1997 rice harvest	II	Harvesting, storage, etc.	Machinery - trash	KDI-11A KDI-17A KDI-18A	Medium
KDI-18A	An evaluation of rice harvesting machinery and systems	III	Harvesting, storage, etc.	Best practice	KDI-11A KDI-17A KDI-18A	Medium
MS967-11	Rice CRC	I	Industry development	R&D		Too early
MS967-48	5 year R&D plan of rice	I	Industry development	R&D		Medium
MS978-06	Production of rice invertibrate field guide		Technology transfer and communication	Publication	all pest projects	Medium
MS978-45	Publication of special rice R&D farmer's newsletter		Technology transfer and communication	Publication	all projects	Medium
MS978-52	Evaluation of the ricecheck program		Technology transfer and communication		DAN-81A DAN-162A IRE-1A IRE-2A IRE-3A MS978-52	Medium

Continued on next page

1.4 Initial assessment of completed and continuing projects Continued

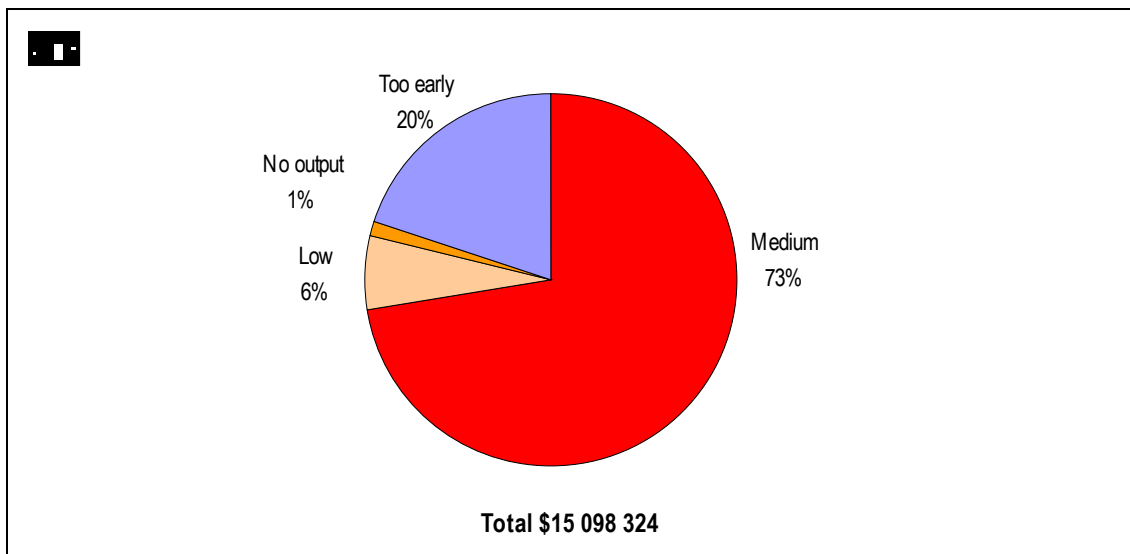
<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Category</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>	<i>Spillovers</i>
RCL-1A	Evaluation of near infrared transmission for rice receival segregation	II	Harvesting, storage, etc.	Quality - technology	Stand-alone	Medium	
RCL-2A	Hygiene and inert dust protection of on-farm rice harvesting equipment	II	Harvesting, storage, etc.	Health benefits	Stand-alone	Not known	
RRA-1A	Improving seed quality in early generations of experimental rice varieties	II	Varieties	Techniques - quality	Input to breeding	No final output	
RRA-2A	Groundrig spraying development for rice	I	Crop protection	Machines	ARG-4A RRA-2A	Low	
RRC-1A	A rapid review of overseas experience on cold tolerance of rice	I	Varieties	Cold tolerance	Input to breeding	No final output	
UCS-16A	Biology of arrowhead (<i>Sagittaria montevidensis</i>)	I	Weed control	Biology	Stand-alone	Too early	

UCS-20A	Development of integrated weed management strategies for the rice weed <i>Cyperus difformis</i> and <i>Alisma plantago-aquatica</i>	II	Weed control	Integrated weed management strategies	UCS-7A UCS-20A UCS-23A	Too early
UCS-23A	Herbicide resistance development in dirty dora (<i>Cyperus difformis</i>) and starfruit (<i>Damasonium minus</i>)	I	Weed control	Intergrated weed management strategies	UCS-7A UCS-20A UCS-23A	Too early
UCS-7A	Biological control of starfruit in rice fields using a mycoherbicide	I	Weed control	Biology - integrated weed management strategies	UCS-7A UCS-20A UCS-23A	Too early
UNS-12A	Flavour and texture qualities of new Australian fragrant rice cultivars	I	Varieties	Fragrant - technology	UNS-6A UNS-12A DAN-72A DAN-79A	Medium
UNS-6A	Chemistry of fragrant rice flavour volatiles	I	Varieties	Fragrant - technology	UNS-6A UNS-12A DAN-72A DAN-79A	Medium
US-22A	Cold tolerance of rice	I	Varieties	Cold tolerance	Stand-alone	No output
USC-1A	Genetic engineering of Australian rice varieties for improved cold tolerance and grain quality	I	Varieties	Cold tolerance	USC-1A DAQ-157A DAN-154A breeding	Medium
USC-2A	Application of molecular markers to rice breeding in Australia	I	Varieties	Techniques	Input to breeding	No final output

Data source: Program managers and CIE assessment.

Chart 5.5 summarises the initial assessments of the likely outcomes of the projects. All projects in a set that would need to be evaluated together are given the same assessment as the final project in the set. Note that this assessment looks only at the likely benefit stream and does not take into account the cost or the timing. The assessment of outcomes assumes high rates of

1.5 Initial assessment of potential outcomes by RIRDC funding



Data source: Program managers and CIE assessment.

adoption, which is very likely in the rice industry due to the RICECHECK program and the cohesive structure of the industry.

Recommendations for evaluation

Most of the project sets are difficult to evaluate. There are four sets of projects that are suggested as suitable for evaluation in this round.

- The series of projects AGR-1A, 2A, 3A, and 6A, starting with APL-2A provides a number of possibilities for evaluation. Either all IWMS and herbicides tested could be examined, or a selection made. If the focus of the evaluation is on the cost savings to farmers, it should be relatively simple. Assessing the longer term impacts on resistance levels and the environment is more complex.
- The series of projects on worms and snails is a candidate for evaluation. These projects have led to the adoption of some different management practices. The cost of these pests to the industry is not known. Consequently, it is not clear how much R&D in this area is warranted. While a complex evaluation, it could provide considerable information into the R&D program decision making in the future.
- The three projects (KDI-11A, KDI-17A and KDI-18A) on harvester efficiency should be relatively easy to evaluate, as long as information on the type and age structure of the current harvester fleet is easily available.
- The projects DAN-95A and DAN-145A would be interesting projects to evaluate. There are a number of possible levels to the evaluation. At the simplest level are the water savings less the costs from adoption of the technique. Longer term benefits to the producer, and more complex to evaluate, are the reduction in the rise in water tables and the associated increase in productivity, and the relatively greater availability of water through demonstrated more efficient use.

6. Horsemeat Industry Program

Overview

Background

The horse industry is made up of a very diverse group of stakeholders. At one end is the businesses of racing and breeding (thoroughbred and standardbred), through to breeding of other breeds such as quarterhorses and endurance horses, training, showing, pony club and other recreational uses of horses. Veterinary clinics that specialise in horses are also a key part of the industry.

The value of the horse industry is unknown. The thoroughbred racing sector alone has a turnover of \$15 billion annually. In 1993-94 horse studs had an annual income of \$210.3 million with \$3.4 million in exports.

Australia has an excellent international reputation as a source of horses and related expertise — however, exports remain low. In 1992 the export of live horses was around \$30 million. The major markets for horse exports are New Zealand, SouthEast Asia (particularly Hong Kong and Singapore) and, more recently, South Africa.

Around 70 stallions are moved between the northern and southern hemisphere for breeding each year. This is worth around \$110 million in stud fees. In addition, the export of other athletic horses returns around \$1 to \$2 million a year.

Research and development activities

RIRDC involvement in equine research stems from two workshops held in 1990 and 1991. Prior to this, research was mainly supported by the Australian Equine Research Foundation (AERF). This foundation, established in 1972, is supported by industry contributions and grants, donations and appeals. Thoroughbred breeders contributed through a broodmare levy, and the Australian Harness Racing Council also contributed through a levy on live foals. The Australian Equine Veterinary Association also contributed through a voluntary levy from its membership fees. Funding for research is also provided by some states from general revenue or an allocation from TAB revenues.

The RIRDC program did not really get under way until 1995, when a R&D advisory committee was established and a part-time program manager appointed. Several early RIRDC projects focused on the horsemeat industry, but the emphasis prior to 1995 had already switched to the live horse industry. The current focus is on animal health.

Industry contributions come mainly from a voluntary levy on the registration of racehorses from the Australian Racing Council. This levy raises about \$280 000 each year to fund research. It was intended to be temporary to allow the program to be developed. It may be withdrawn if an overall industry levy is not agreed to in the next year. Other voluntary contributions (totalling around \$80 000) are made by a number of equine associations. A levy on horseshoes is proposed

to provide funding for continued R&D. This levy is estimated to raise \$800 000 a year once in place. The introduction of the levy needs to demonstrate that the benefits that flow from the R&D outweigh the costs and flow to all the people who would contribute to the levy.

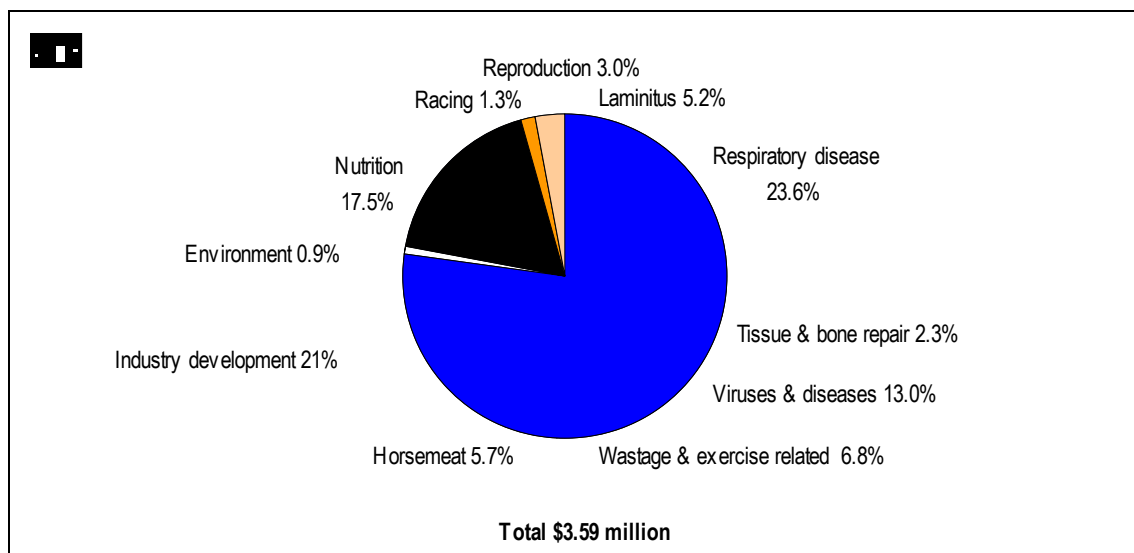
A five year plan for R&D was developed in 1996. Eight program areas were identified:

- information technology for the horse industry;
- industry development and development of equine research infrastructure in Australia;
- respiratory diseases — improving the respiratory health of horses;
- nutrition research — developing better ways to feed horses;
- lameness and limb injury — developing more effective methods for prevention, diagnosis and treatment;
- exercise and metabolic disease — optimising fitness and reducing training related disease;
- reducing reproductive failure in mares and stallions, and establishing more effective treatments for diseases of foals; and
- improving racetracks and working surfaces for horses.

These categories fit naturally into categories for evaluation. We have added the categories of horsemeat and the environment.

In chart 6.1 the classification of projects is by the classification used for evaluation sets. The shares are based on the RIRDC funds expended and committed for the projects. As seen in this chart, animal health, in particular respiratory disease, has attracted the major portion of the funding to date.

6.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

6.2 Completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Cost</i>	<i>RIRDC cost</i>
				\$	\$
AHI-1A	An assessment of the extent, nature and source of support for an R&D levy for the Australian horse industry	1/11/97	30/08/98	33 000	12 000
AQIS-1A	Road transport of horses for slaughter: the relationship between biochemical and physical status and mode of transport	1/06/93	1/06/94	59 128	31 712
BSG-1A	Effect of equine somatotropin on tissue growth and repair in horses	1/06/96	30/08/97	96 723	25 000
CSK-1A	A study of acute equine respiratory syndrome — a new virus disease of horses (also known to infect humans)	1/04/96	30/04/98	154 154	65 000
DAV-105A	Pasture management technology transfer for the horse industry	8/01/95	6/03/96	71 361	37 153
DAV-118A	Improved pastures: more than just grass for horses to exercise on?	1/06/96	30/06/99	311 772	151 386
DAV-156A	Drought feeding information bulletin for the horse industry	1/10/98	30/06/99	5 447	5 447
DPI-11A	Workshop R&D needs	1991	1992	50 000	50 000
DPI-7A	Scope and research needs	1990	1991	40 000	40 000
FLP-1A	Learning within the equine industry	1/07/98	30/12/99	49 000	49 000
GEH-1A	Further studies on abilities of progestagens to maintain pregnancy in mares	1/09/95	30/06/97	57 000	27 000
GVE-2A	Delaying ovulation in cycling mares	9/01/94	30/6/95	37 300	15 000
HAN-1A	Prevention of diet induced laminitis in horses	1/07/93	30/06/95	152 670	68 270
HOW-1A	Evaluation of the provision of training programs for the horse industry in Australia	1/07/98	30/12/98	20 000	18 388
MS967-44	Workshop to consider the development of a rotavirus vaccine for horses	20/6/97	30/9/97	7 260	7 260
MS978-30	Equine nutrition research review — Professor Frank Annison	10/03/98	30/06/98	1 000	1 000
PTP-12A	Horses and land use on small properties	17/08/98	31/10/98	12 000	10 000
PTP-3A	Sustainable land use for depastured horses	1/06/96	30/05/97	22 550	19 550
PTP-5A	Review of devices currently available for assessing racetrack conditions	1/06/96	28/02/97	15 300	12 300
PTP-6A	1997 Racecourse Managers' Conference	17/4/97	18/4/97	1 500	1 500
PTP-9A	1998 Racecourse Managers' Conference	26/05/98	30/06/98	22 000	2 500
SAR-14A	Literature review on air quality and air quality during transport — project and printing	1/07/98	30/09/98	5 000	5 000
TGT-1A	Assessment of turf species composition and maintenance of grass racetracks in Australia as an indicator of surface quality for horseracing	1/07/95	30/06/96	34 876	24 876
UA-36A	Establishing the application of malatonin implants in the horse	31/10/95	31/01/96	2 000	2 000
UCS-18A	Information service for the horse industry	1/07/97	30/06/98	132 347	29 798
UCS-22A	Pasture intake and selectivity by grazing horses	1/07/97	31/12/99	55 135	8 280
UM-17A	Reducing wastage in Australian thoroughbred horses from birth to 18 months: improving the quality and quantity	1/07/93	30/06/96	476 017	106 505
UM-23A	Diagnosis of equine virus diseases using polymerase chain reactions and development of a blood test and vaccine for equine rhinovirus	1/07/95	30/09/98	416 537	95 516
UM-29A	Molecular epidemiology of Rhodococcus equine	1/01/97	30/12/99	277 255	77 274
UM-30A	Molecular diagnosis of equine parasitism	1/07/96	30/12/98	174 000	44 000
UM-35A	Quantitative changes in surfactant protein A and surfactant phospholipids in exercise induced pulmonary haemorrhage	1/05/97	31/12/97	4 000	4 000
UM-36A	Methods of quantitative assessment for intra pulmonary blood accumulation in racehorses with EIPH	1/07/97	30/06/98	20 000	20 000
UM-40A	Epidemiology of equine rhinovirus type 2 (ERhV2)	6/07/98	30/07/00	179 692	50 000
UMA-14A	Development of a recombinant vaccine against equine herpesvirus 1 (equine abortion virus) and equine herpesvirus 4	1/07/94	30/06/97	527 722	148 152
UMA-15A	Improved vaccine strategies for management of equine herpesvirus diseases	1/07/98	30/06/01	727 476	144 532

Continued on next page

6.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Cost</i>	<i>RIRDC cost</i>
				\$	\$
UMU-17A	The effect of topical TGF-B on wound healing in horses	1/06/96	31/08/97	7 318	3 318
UMU-18A	Studies of the intestinal absorption of immunoglobulins and the effects of passive immune status on the functional development of the equine neonatal immune system	1/06/96	30/11/97	67 939	22 000
UMU-22A	Identification of infectious respiratory disease in horses as a basis for better management of cases	1/07/97	30/06/00	187 350	89 000
UNE-31A	Survey of agronomic practices on thoroughbred horse stud farms	1/12/93	31/12/94	57 942	25 677
UNE-62A	Safe and effective grain feeding for horses	1/01/98	30/06/00	263 428	89 000
UQ-28A	A study of the grey horse melanoma with special reference to prevalence tumour structure and biology and associated pigment	1/04/92	31/03/97	9 700	8 300
UQ-38A	To investigate the aetiopathogenesis of exercise induced pulmonary haemorrhage (EIPH) in horses	1/07/94	31/12/97	98 000	44 000
UQ-3A	Toxicity from <i>Indiofera</i> toxins			Too old - no records	
UQ-43A	The influence of season on follicular dynamics and the relationships with endocrinology and oviduct physiology in the mare	24/08/95	30/06/98	51 700	51 700
UQ-45A	Nutrition of grazing broodmares, their foals and young horses	1/07/95	30/06/99	417 747	139 739
UQ-46A	Assessment and prevention of toxicity from indospicine contaminated horsemeat	1/07/95	31/12/99	165 134	139 739
UQ-47A	Investigations into the cause and prevention of equine laminitis	1/07/95	31/12/98	208 053	96 000
UQ-59A	Control of intraocular inflammation by topically applied nonsteroidal anti-inflammatory drugs (NSAIDS)	1/06/96	1/08/98	15 000	15 000
UQ-71A	Novel anti-inflammatory drugs to treat inflammatory diseases in horses	1/09/98	1/09/01	93 756	30 000
UQ-72A	Nutritent intake and growth of young horses	1/07/98	30/06/01	194 440	100 000
UQ-73A	Repeatability and reliability of Brochoalveolar Lavage (BAL) in the horse	1/07/98	30/06/99	56 850	12 590
UQ-75A	The pathogenesis and prevention of equine laminitis	1/07/98	30/06/02	260 315	120 000
US-23A	Studies on M-protein of streptococcus equine: composition and role in host defense	(07/94)	(06/97)	Terminated	10 000
US-24A	Studies on the host-parasite interactions in disease induced by <i>Streptococcus equine</i> subsp. <i>equine</i>	1/01/95	30/09/98	285 278	85 511
US-25A	Identification and characterisation of causes of wastage in the Australian horse racing industry	1/07/94	30/06/97	243 693	98 730
US-31A	Production of an equine research newsletter	1/05/95	30/06/96	90 889	90 889
US-33A	Viral respiratory disease in racehorses: incidence and contribution to wastage	1/01/96	30/12/98	208 786	81 551
US-41A	Bacterial respiratory disease in racehorses: incidence, aetiology and contribution to wastage	1/07/96	30/06/99	179 267	66 950
US-42A	Production on an equine research newsletter and internet website	1/07/96	1/12/97	53 760	53 760
US-45A	A research review of causes and prevention of developmental orthopaedic disease in young horses	1/06/97	31/08/97	4 000	4 000
US-50A	Communication and information programs for the horse industry	1/07/97	1/07/00	243 083	243 083
US-52A	Biomechanical and biochemical response of equine superficial flexor tendon to training and injury	1/07/97	30/06/99	161 947	44 499
US-53A	Respiratory ventilation and tracheal sounds in horses with airway disease	1/10/97	30/09/98	36 600	9 000
US-58A	Serological investigation of equine influenza in Australia	1/07/98	30/12/98	3 494	3 494
US-69A	Workshop on the future of farriery	1/05/98	30/07/98	39 505	39 505
US-73A	Scone Forum — Equine Research Seminar for Breeders, Owners, Trainers and Veterinarians	30/06/98	30/08/98	22 000	17 000
US-77A	Training and fitness in athletic horses	1/12/98	31/08/99	5 000	5 000

Continued on next page

6.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Cost</i>	<i>RIRDC cost</i>
				\$	\$
USA-6A	Diagnosis of and protection against infections caused by Rhodococcus equine	3/02/98	30/03/00	54 000	24 000
UCS-4A	Improved nutrition of young horses (nutrition planning)	(Jul 93)	(Jun 96)	Terminated	6 500
UWS-13A	Australian feeding standards (NRC) project	1/08/95	31/10/98	302 343	74 935
Not included in the evaluation					
TA967-16	Attendance at the British Equine Veterinary Association Conference - Animal Health Trust - Glasgow Veterinary School	8/09/96	28/09/96	500	500
TA967-45	International Equine Gene Mapping Program (IEGMP) Workshop	1/01/98	31/01/98	1700	1700
GVE-1A	Suppression of follicular activity of cycling mares by vaccination against gonadotrophin	(Jan 94)	(Jun 95)	Terminated	No money spent

Source: RIRDC database, compendiums.

List of projects

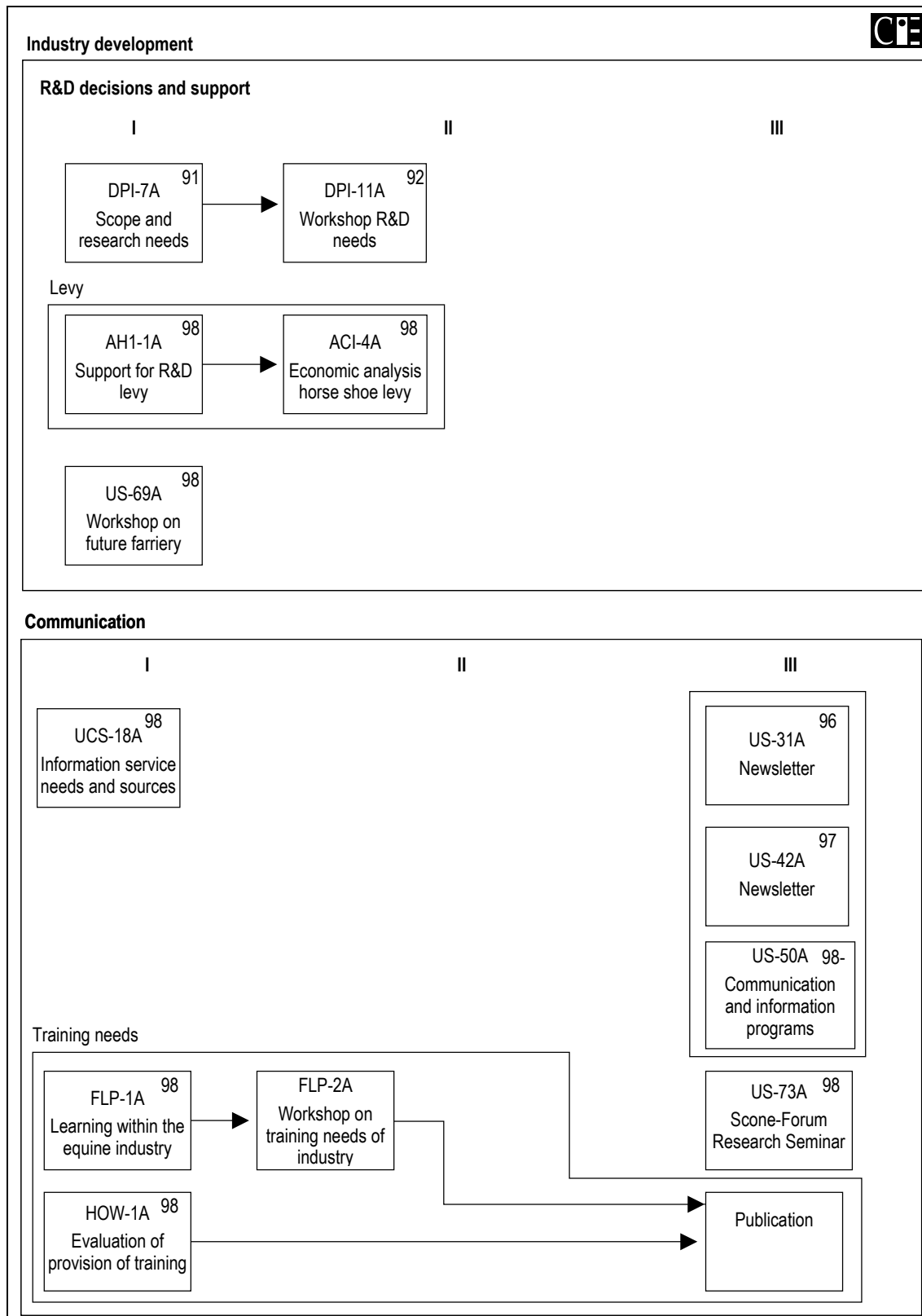
Table 6.2 lists the projects that have been identified in the Horsemeat Industry Program. Projects that are currently under way or have been approved are included in the listing. A start and finish date are provided where available. As far as possible the total cost of the project has been estimated (sum of the annual dollar amounts, not discounted) to give a rough indication of the relative size of the projects. The cost includes contributions from the industry and the research institution as well as RIRDC funding. RIRDC funding is given in the last column.

Project sets and initial evaluation

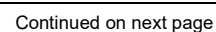
Chart 6.3 sets out the projects in sets for evaluation. Projects can be evaluated individually, or in small or large sets. The boxes indicate groups of projects that might be evaluated as a set. Where projects are joined by an arrow they should be evaluated together, or at least part of the cost of the preceding projects allocated against the benefit flows from the following projects.

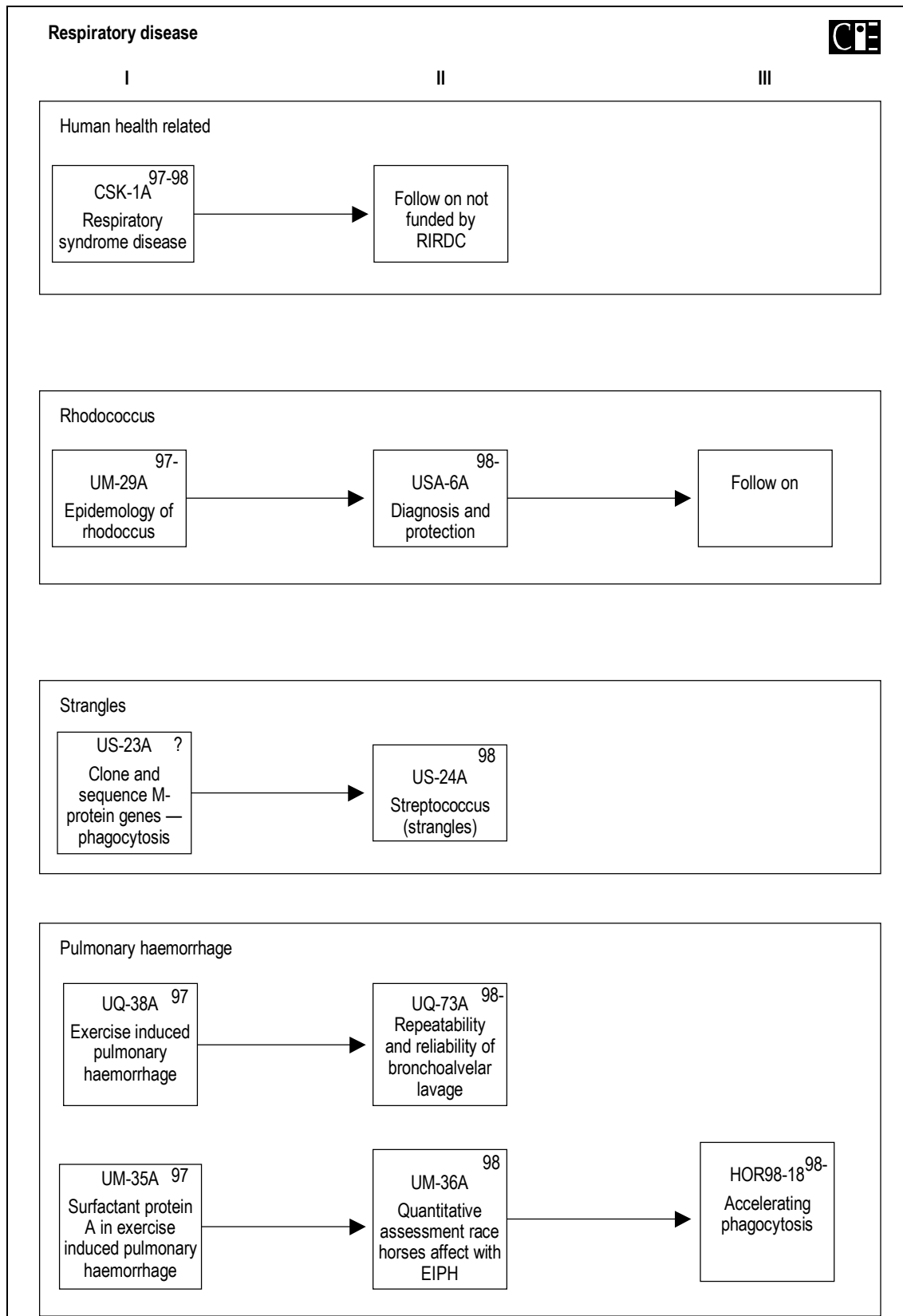
Very few of the projects are relevant only to the racing industry or to horse breeders. This makes their impact quite difficult to assess as the industry is diverse and little information that would be needed to estimate the benefit flows is known for many of the segments. Evaluations would tend to concentrate on the most easily quantifiable benefits, those to the racing and horse stud industries.

6.3 Classification of projects for evaluation



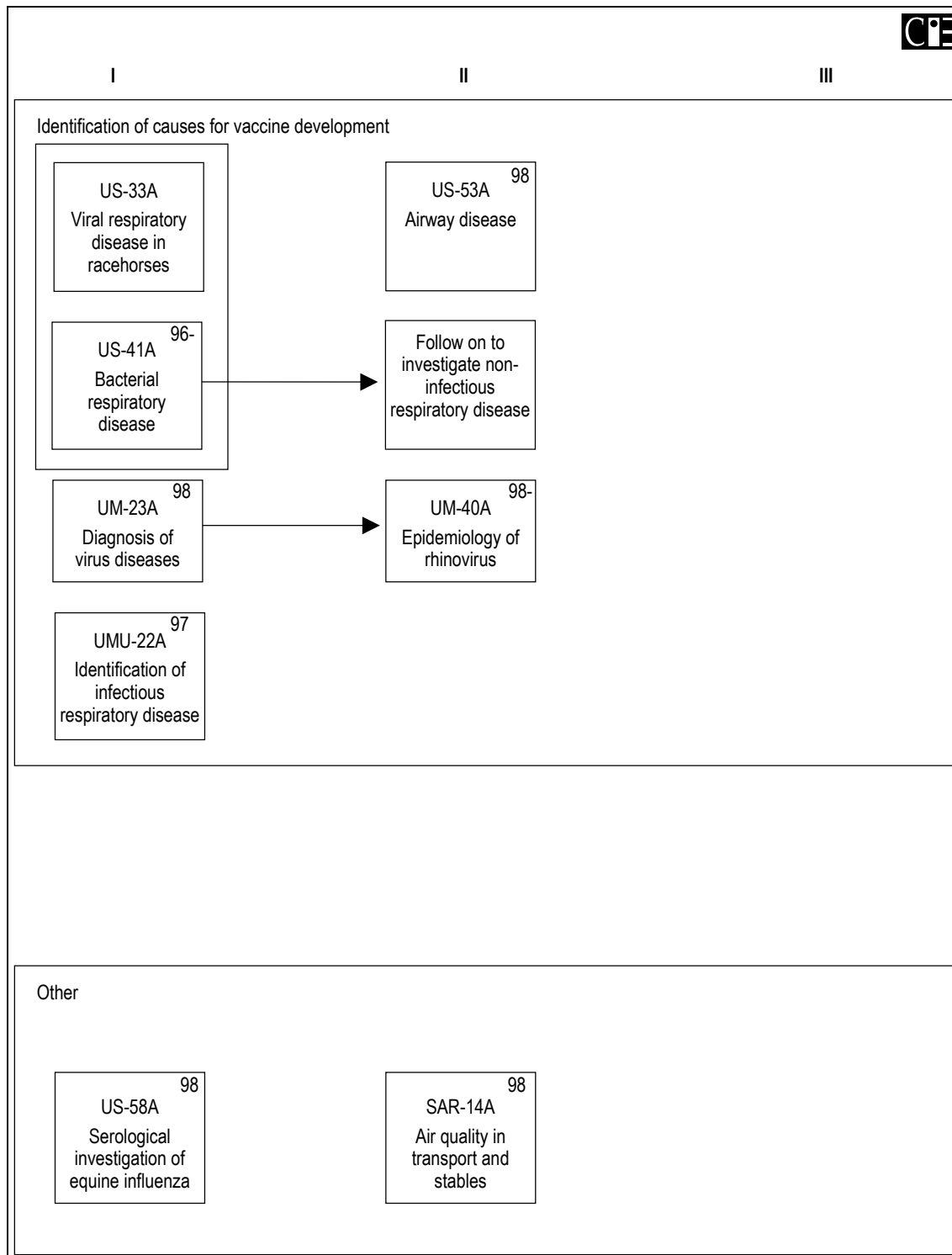
Continued on next page



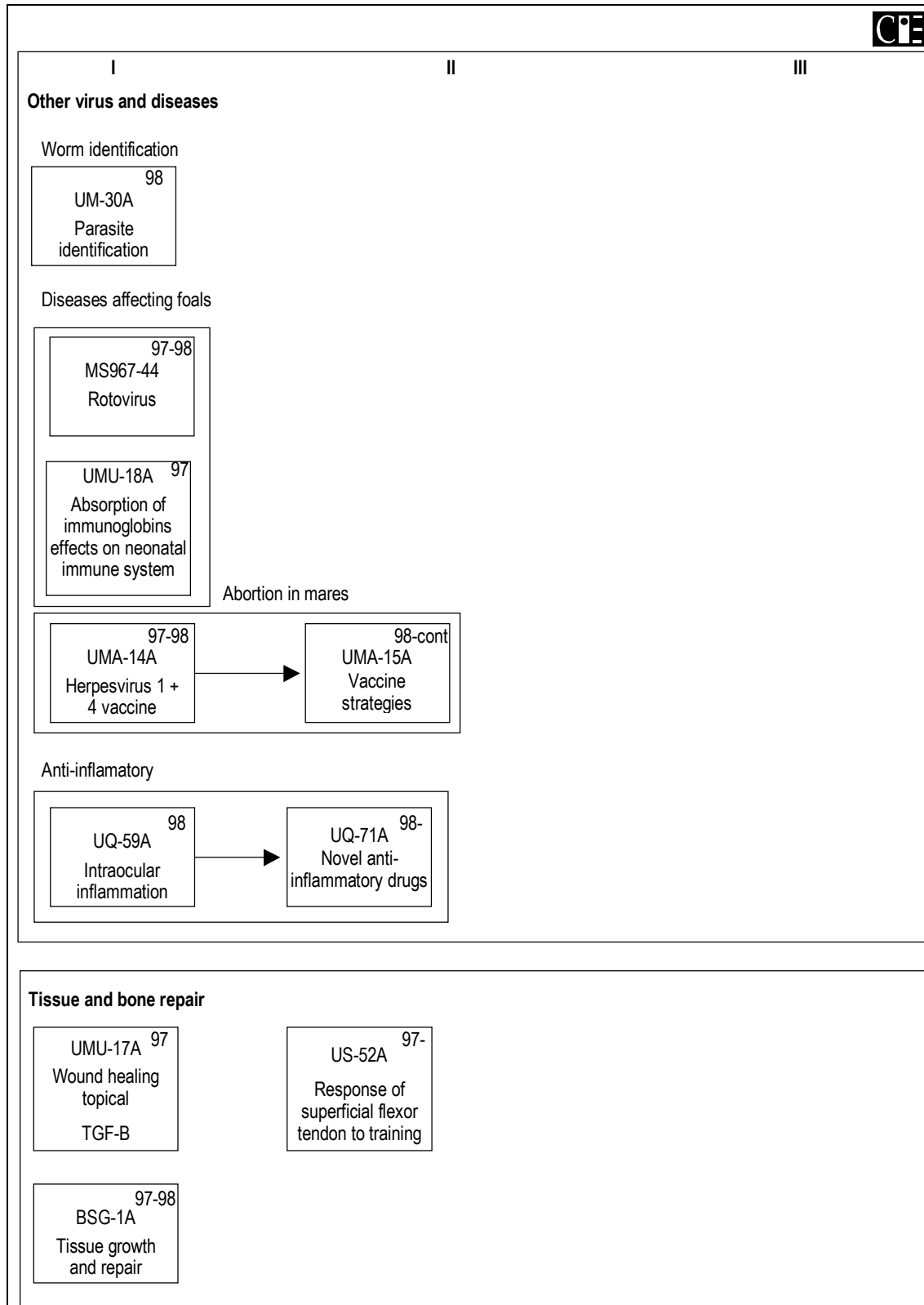


Continued on next page

6.3 Classification of projects for evaluation Continued

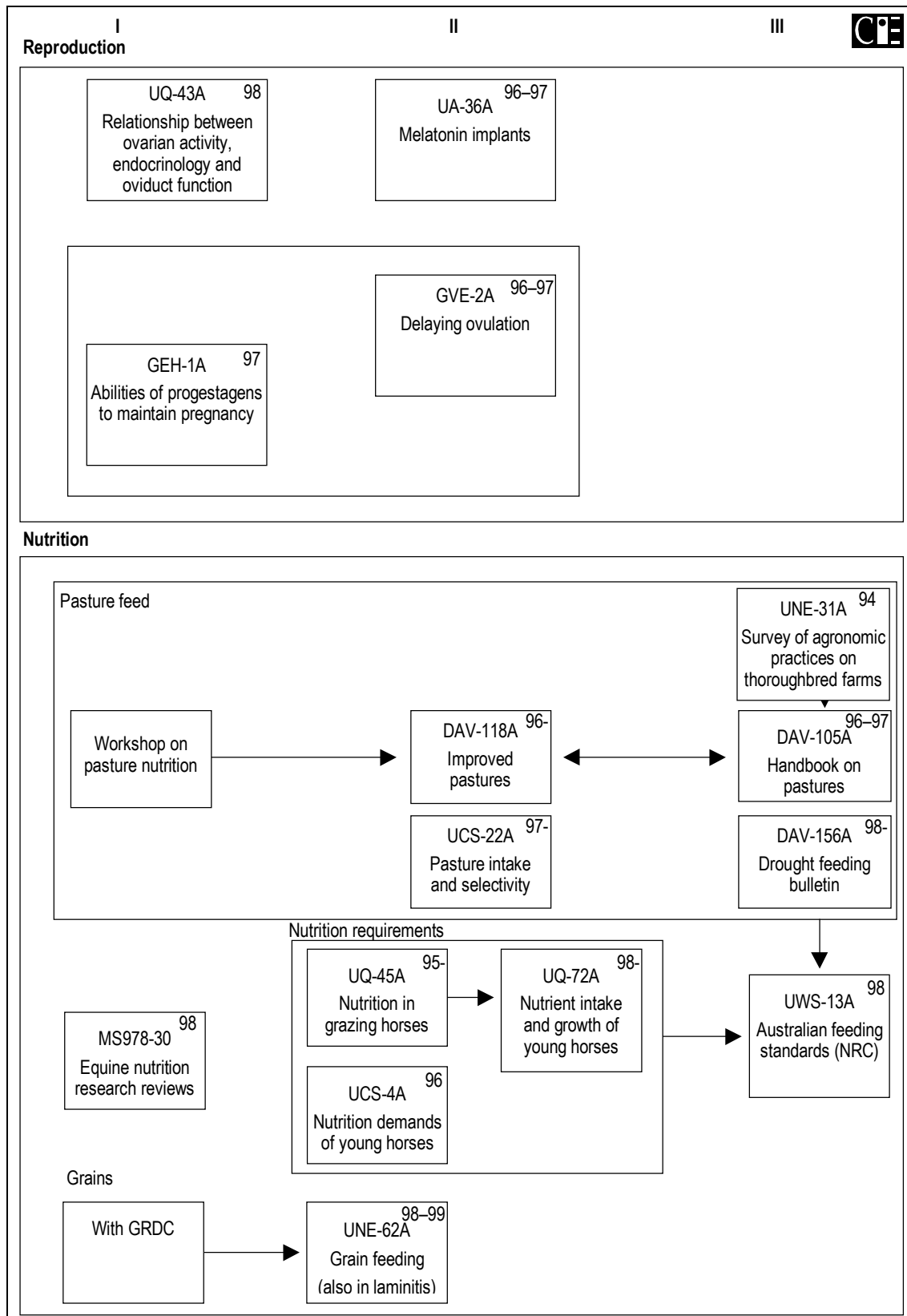


Continued on next page



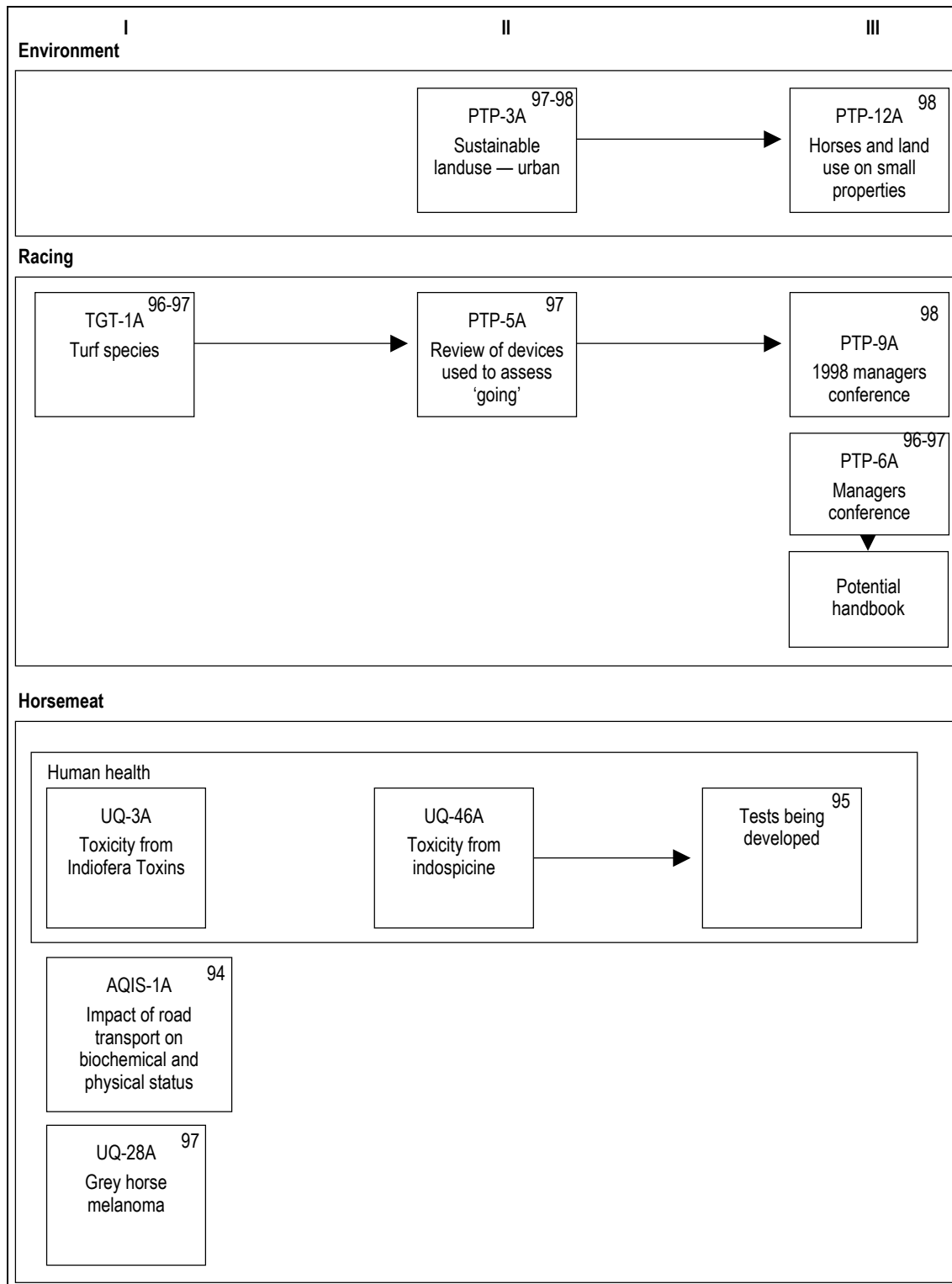
Continued on next page

6.3 Classification of projects for evaluation Continued



Continued on next page

6.3 Classification of projects for evaluation Continued



Industry development

R&D development

There is one set of projects and two stand-alone projects.

- DPI-7A and DPI-11A are very early projects that were instrumental in developing the program. The five year plan should also be included in this set. The output stemming from these projects is good in that research has increased substantially in the industry. To the extent that the program has delivered benefits to the industry, the outcome is good.
- AHI-1A assessed the support for a horseshoe levy to allow continuation and expansion of the R&D program. The outputs are judged as good, but the outcome — whether a levy will be established — is uncertain.
- US-69A was a workshop on the future of farriery. It was well attended and considered highly successful.

Communication

Evaluation of the economic impact of communication projects is difficult as the impact is diffuse and usually indirect. There are two sets of projects and two stand-alone projects.

- The set of projects US-31A, US-42A and US-50A targeted various methods of communicating with the industry. The first two projects involved creation of a newsletter and the distribution of 10 000 copies through 700 contacts. The last project also developed the website as a means of communicating with the industry. The output is assessed as excellent.
- Two projects, FLP-1A and HOW-1A, have explored training needs and training programs respectively. A workshop was also held as an input to the first project. A publication of the training programs available is forthcoming, and a follow-on project will develop a strategy to fill unmet needs. These projects are assessed as excellent.
- UCS-18A evaluated the potential for a commercial communication system for the main industry players. It was a stand-alone project. RIRDC funding was sought to further develop the system, but the benefits were judged to be largely private so funding was not made available.
- US-73A was a research seminar held in Scone. It attracted over 200 people and a publication of the proceedings is forthcoming. It was judged to be a success and a survey from the seminar indicated a very positive response from industry personnel. An evaluation of the impact is very difficult as adoption rates by a diverse group would need to be assessed.

Animal health

Wastage

- UM-17A is an early project on wastage, the output of which is not known.
- US-25A conducted an epidemiological study on the incidence and causes of wastage in the racing industry. A handbook on the findings has been produced. This information is of great

value in highlighting factors to be investigated and a number of projects have followed on. The information is also of immediate practical use. For example, hard tracks were identified as contributing to breakdown. This information has been brought to the attention of the Australian Racing Board and race track managers.

- US-45A follows one of the leads from US-25A and investigates a problem with bent legs in foals. This problem is particularly prevalent in the Hunter Valley (30 per cent of foals) and is estimated to cost studs around \$9 million a year. However, the cost of further research into the problem was viewed as too expensive given the current limited budget for the horse program.

Exercise related health issues

There is one project that fits directly into this classification.

- US-77A produced a booklet on training and fitness in athletic horses. This was in response to an industry survey showing demand for this kind of information. The advice is not limited just to the racing industry but also to all types of athletic horses.

Laminitis

Laminitis is a costly disease when it strikes and little is known about the causes. The benefits of prevention is difficult to estimate because it varies greatly from year to year. The most heard about this disease is when it affects very expensive horses. For example, some years ago an stallion insured at over \$10 million contracted the disease. There is one set of projects and one stand-alone project in this area.

- UQ-47A and UQ-75A are focused on the causes and prevention of laminitis respectively. While it is too early to assess the output of the second project, potentially the output is excellent. Information from the first project is allowing cost savings, having highlighted that some preventative measures are of no value. The project UNE-62A, which described in the nutrition classification is considering the impact of grain feeding on laminitis and is related to UQ-75A.
- HAN-1A is an early project which investigated the link between grain feeding and laminitis. The product Founderguard — a food supplement — was the output of the project. This product is now widely used in the industry. RIRDC did not provide funding for the patent application as the expected return from the share of royalties was below the requested funding.

Respiratory disease

There are a large number of projects related to respiratory disease.

- CSK-1A investigated a respiratory disease syndrome that affects humans. It found that the disease is transferred by flying foxes and not by horses travelling. Further study into the disease and its impact on humans is being undertaken but is not funded by RIRDC. The project was valuable in that it pre-empted a ban on horse movement that would have been

costly to the racing industry and to exports of horses. This project would be interesting to evaluate.

- UM-29A conducted the epidemiology of rhodococcus equi (rattles) in foals. USA-6A is working on diagnosis and protection against the bacteria. It occurs naturally in soil and not all strains are dangerous. Foals have the highest risk of infection. A follow-on project is proposed and the output is expected to be good.
- US-23A and US-24A investigated strangles for the purpose of developing a vaccine. The vaccine seems unlikely to be developed, but useful information on the fact that horses can be carriers and not be affected was generated. The benefit of this information is difficult to assess. A follow-on project may be funded.
- There are four projects which have examined exercise related pulmonary haemorrhage. One set, UQ-38A and UQ-73A, has focused more on diagnosis of the problem of bleeding into the lungs with exercise and developing a technique to drain blood from the lungs. A test has been developed, but it is too early to assess its effectiveness. The second set, UM-35A and UM-36A, has focused more on understanding the causes of the problem. A follow-on project has been funded.

Identification of diseases for vaccine development

There are several sets of projects that have investigated respiratory diseases in horses. All can be considered as a follow-on from US-25A, which identified respiratory disease as a major factor in wastage. The geographical spread reflects the possibility that the causes may differ around the country. It also meets an objective of developing research skills in a number of different institutions. Many of the projects have assisted in funding PhD students. The projects all investigate what is causing respiratory disease in horses. They are at the identification stage, although a few have moved to developing diagnostic tests. At this stage, none have outputs that have impacted on animal health.

- US-33A and US-41A have investigated viral respiratory diseases and bacterial respiratory diseases respectively in New South Wales horses. They have had a major impact in identifying that non-infectious respiratory disease is a major problem in racehorses, which was previously unknown. A companion project, yet to be commenced, will investigate non-infectious respiratory disease. These are all preliminary studies which are building blocks for future research.
- US-53A is a related project in that it looks at ways of assessing diseases in horses. This project is important in translating technology for objective assessment of respiratory function for use in the field.
- UM-23A and UM-40A investigate viral respiratory diseases in Victoria with the aim of developing diagnostic tests and ultimately vaccines. Tests for several diseases have been developed but at present there is no known treatments for them. However, identification of each disease is important.
- UMU-22A conducts a similar investigation in Western Australia.

Other projects on respiratory disease

There are two projects that have a slightly different focus.

- US-58A conducted a survey to identify if equine influenza is present in Australia. It found that it was not. This finding is valuable to the industry as the presence of the disease could have restricted horse movements across borders and export activities.
- SAR-14A reviews what is known about the air quality in stables and transportation to identify whether environmental factors are influencing respiratory disease. A publication of the findings is forthcoming. This project is expected to be of considerable use to the industry.

Other viruses and diseases

- There are two projects that have investigated herpesvirus for the purpose of developing a vaccine. This virus causes abortion in mares which, when it hits, can have a devastating effect. For example, in 1978 the 20 per cent abortion rate cost the stud industry an estimated \$20 to \$30 million. UMA-14A developed a mouse model for the virus, providing a new research technique. This project was also supported by Australian Research Council funds as basic science research. UMA-15A is concentrated on developing a vaccine and it appears that it will be successful. However, there are several problems that raise doubts about the impact of the vaccine. First, there are several vaccines already available. Second, because the problem does not arise often, studs may not consider it economic to vaccinate their mares unless the cost was modest.
- MS967-44 funded a workshop on rotavirus, which is a devastating disease in foals. The workshop demonstrated the value in getting all the major researchers and representatives from the various groups in the industry together to pool knowledge. However, the workshop found that the costs of further research and control of the disease were not warranted by the potential savings. The impact of this is cost saving. This would be of interest to evaluate as it would highlight how preliminary workshops of this nature can assist in making economic decisions to maximise the value of the R&D dollar.
- UMU-18A investigates the absorption of immunoglobins and their effects on the neonatal immune system. The project has not produced a final output.
- Two projects, UQ-59A and UQ-71A, have developed a technique for testing anti-inflammatory drugs using the eyes from dead horses. While it is too early to assess the outputs, the latter project is testing a wide range of drugs used as anti-inflammatories in other species for their applicability to horses. One drug — pirfenidone — has been identified as being useful. An assessment of the projects would need to evaluate the effectiveness of the range of drugs currently available, and the likely costs and relative effectiveness of the new range that might become available. It would be relatively complex to evaluate.
- Project UM-30A supported a PhD student to investigate identification of different worm parasites in horses. The project would be of greater value if separate treatments were available for the different worms. As it stands, it has little impact on the industry, but it is important as a development tool.

Tissue and bone repair

- UMU-17A tested some topical treatments that had the potential to increase the rate of wound healing. They proved to be ineffective. While the pay-off from this finding is relatively small — costs saved in further R&D — the gains if the project had found a topical treatment which accelerated healing would have been very large as this is a major problem for horses which imposes a cost on the industry in terms of days of work lost.
- BSG-1A provided assistance in the commercialisation of a product that promotes tissue growth and repair in older horses. While the product is of value to the industry, particularly breeders, the role of RIRDC in assisting registration of the product for commercial sale is not clear.
- US-52A follows up a lead from US-25A and investigates the impact of training on tendons. While it improved the understanding of the biology of tendons, a second stage has not been funded.

Reproduction

Most of the projects in this classification have focused on improving the ovulation timing of mares.

- UA-36A was a preliminary investigation of the effectiveness of melatonin on improving cycling. It was found not to be effective. The impact of the project has avoided costs being incurred by further research.
- Two projects, GVE-1A and GVE-2A, looked at techniques for improving timing of ovulation. GVE-1A did not have an output, while GVE-2A tested a compound used in the United States which was found not to be effective in delaying ovulation. An evaluation would need to assess the benefits of improved timing, which would be complex.
- GEH-1A demonstrated that four out of five products which are available commercially and one not yet available, but in which there is interest, are not effective in maintaining pregnancy in mares. If these products are widely used, this finding has substantial potential for cost savings. The cost saving should be relatively easy to evaluate, but the benefits in terms of increased pregnancy success rates is more complex to evaluate.
- UQ-43A investigates the reasons for early embryonic loss. It is too early to assess the output of this project.

Nutrition

There are three main sets of projects and one stand-alone project.

- The stand-alone project, MS978-30, is a review of the literature on nutrition programs. It has been helpful in developing a global view.

Pasture feeding

There are substantial cost savings in pasture feeding. On average, cut fodder and grain feed costs around \$2000 per year per horse. If horses can get adequate nutrition from pasture, the cost savings are substantial. Thus, this set and the next set of projects are closely related. This set

concentrates more on selecting and growing appropriate pastures. A workshop on pasture nutrition was an early step in the process.

- UNE-31A was a survey of agronomic practices on thoroughbred farms. This survey identified the cost savings of pasture feeding.
- DAV-105A and the follow-on project DAV-118A provided information on pastures in a handbook and further research into improved pastures respectively. The book has had considerable national and international interest with three reprints of the book, and both projects are considered to be excellent.
- UCS-22A is related in that it looks at what horses like to eat. It is too early to assess the output of this project.
- DAV-156A is a drought feeding bulletin which provides advice on pasture feeding and supplementary requirements during drought periods. The booklet will be delivered later in 1999 and will be an important resource for all areas of the horse industry. Evaluation of the project will be difficult as the uptake of the advice would need to be assessed by survey and its value will differ with the region and the activities of those adopting the information.

Nutrition requirements

There are several projects that have investigated nutrition requirements at different stages in the life cycle.

- UQ-45A and UQ-72A have substantially improved understanding of growth and development in young horses. Exactly how this information has been used has yet to be established.
- UCS-4A also looked at nutrition demands in young horses, but failed to deliver.
- UWS-13A follows on from the workshop and a book is about to come out on feeding standards. This is expected to be of considerable value to the industry.

Grain feeding

- UNE-62A is being conducted in conjunction with GRDC to better understand the dimensions of grain feeding horses. One of these dimensions is the relationship to laminitis, but nutrition provision relative to requirements is also investigated. The output is expected to be good.

Environment

- PTP-3A and PTP-12A have led to the publication of a book on maintaining horses on small properties in urban areas. The first project conducted a survey of the literature and found that very little information was available. The second project produced a book which covers both animal health and environmental aspects. This book should be of considerable value to individual horse owners.

Racing

There are two sets of projects pertaining explicitly to racing.

- TGT-1A and PTP-5A reviewed turf species and devices to assess racetrack going respectively. The cost of returfing a racetrack is substantial and it is done every five to seven years. Yet there is little known about the links between turf going and animal health. The output of the projects is judged as good. However, the impact of the projects is uncertain because of the nature of the industry and the individual approaches followed by racetrack managers.
- PTP-6A and PTP-9A are an attempt to improve the coordination and adoption of research findings by racetrack managers. These projects provide funding for track managers' conferences. A handbook for track managers is expected to result. These projects are an input into improving the adoption of outputs of projects such as TGT-1A and PTP-5A.

Horsemeat

The projects in the horsemeat classification are fairly old. No new projects are being pursued in this classification in the equine project. They are included for the sake of completeness.

- UQ-3A and UQ-46A both examine toxicity in horsemeat and its a danger to human health. The focus of both projects was on developing tests to identify the presence of the toxin. Such tests are now being conducted to ensure continued access to export markets. The value of these tests depends on the probability that the export markets would be closed and the value of the export trade.
- AQIS-1A examined the impact of road transport on the biochemical and physical status of horsemeat. The main concern was its effect on the meat. The output of the project is unknown.
- UQ-28A identified the problem of melanoma on gray horses and the effect of this on meat quality. There are few gray horses, so the problem is unlikely to be of a considerable scale. The output of the project is unknown.

Evaluation

Table 6.4 summarises these sets and which projects should be evaluated together. The expected outputs from the projects are indicative of the outcome, provided information can be disseminated and is widely adopted. Given the diverse and widely distributed nature of the industry, this is difficult to assess without further investigation.

There are two main types of project in the program, which are both difficult to assess.

- First, there are projects that seek to find out more about a problem. Epidemiological studies and basic investigations fall into this group, as do the projects seeking an unknown solution (as with many of the vaccine projects). On an individual basis, these projects are high risk in that the probability of success is low. But the pay-off of success is very high. In an evaluation these projects should be considered together. The epidemiological studies help to narrow down the field and improve the probability that the follow-on project will have a valuable output if successful. Most of the animal health and reproduction projects fall into this category, with the notable exception of the handbook on wastage and exercise related health.

6.4 Initial assessment of potential outcomes by RIRDC funding

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
ACI-4A	Horseshoe levy economic analysis consultancy	II	Industry	Industry development	ACI-4A AHI-1A	Too early
AHI-1A	An assessment of the extent, nature and source of support for an R&D levy for the Australian horse industry	I	Industry	Industry development	ACI-4A AHI-1A	Too early
AQIS-1A	Road transport of horses for slaughter: the relationship between biochemical and physical status and mode of transport	I	Horsemeat	Horsemeat	Stand-alone	Low
BSG-1A	Effect of equine somatotropin on tissue growth and repair in horses	I	Industry	Animal health - tissue and bone repair	Stand-alone	Medium
CSK-1A	A study of acute equine respiratory syndrome — a new virus disease of horses, also known to infect humans	I	Industry - human health	Animal health - respiratory disease	Follow-on not funded by RIRDC	High
DAV-105A	Pasture management technology transfer for the horse industry	III	Industry - pasture feed	Nutrition - pastures	DAV-105A DAV-118	High
DAV-118A	Improved pastures: more than just grass for horses to exercise on?	II	Industry - pasture feed	Nutrition - pastures	DAV-105A DAV-118	Too early
DAV-156A	Drought feeding information bulletin for the horse industry	III	Industry - pasture feed	Nutrition - pastures	DAV-118 UCS-22A DAV-156A	Medium
DPI-11A	Workshop R&D needs	I	R&D	Industry development	DPI-7A DPI-11A	High
DPI-7A	Scope and research needs	I	Industry	Industry development	DPI-7A DPI-11A	High
FLP-1A	Learning within the horsemeat industry	I	Industry	Industry Development - training	FLP-1A HOW-2A Follow-on project (FLP-2A)	High
GEH-1A	Further studies on abilities of progestagens to maintain pregnancy in mares	I	Industry	Reproduction	GVE-1A GVE-2A GEH-1A	High
GVE-2A	Delaying ovulation in cycling mares	II	Industry	Reproduction	GVE-1A GVE-2A GEH-1A	Medium
HAN-1A	Prevention of diet induced laminitis in horses	I	Industry	Animal health - laminitis	Stand-alone	Medium
HOW-1A	Evaluation of the provision of training programs for the horse industry in Australia	I	Industry	Industry Development - training	FLP-1A HOW-2A Follow-on project (FLP-2A)	High
MS967-44	Workshop to consider the development of a rotovirus vaccine for horses	I	Industry	Animal health - viruses and diseases	Stand-alone	High
MS978-30	Equine Nutrition Research Review — Professor Frank Annison	I	Industry	Nutrition	Stand-alone	Medium

Continued on next page

6.4 Initial assessment of potential outcomes by RIRDC funding Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
PTP-12A	Horses and land use on small properties	III	Industry	Environment	PTP-3A PTP-12A	Medium
PTP-3A	Sustainable land use for depastured horses	II	Industry	Environment	PTP-3A PTP-12A	High
PTP-5A	Review of devices currently available for assessing racetrack conditions	II	Racing	Racing	TGT-1A PTP-5A PTP-9A PTP-6A	High
PTP-6A	1997 Racecourse Managers' Conference	III	Racing	Racing	TGT-1A PTP-5A PTP-9A PTP-6A	High
PTP-9A	1998 Racecourse Managers' Conference	III	Racing	Racing	TGT-1A PTP-5A PTP-9A PTP-6A	High
SAR-14A	Literature review on air quality and air quality during transport - project and printing	I	Industry	Animal health - respiratory disease	Follow-on proposed	Too early
TGT-1A	Assessment of turf species composition and maintenance of grass racetracks in Australia. as an indicator of surface quality for horse racing	I	Racing	Racing	TGT-1A PTP-5A PTP-9A PTP-6A	High
UA-36A	Establishing the application of malatonin implants in the horse	II	Industry	Reproduction	Stand-alone	Low
UCS-18A	Information service for the horse industry	I	Industry	Industry development - communication	Stand-alone	Low
UCS-22A	Pasture intake and selectivity by grazing horses	II	Industry - pasture feed	Nutrition - pastures	Stand-alone	Too early
UM-17A	Reducing wastage in Australian thoroughbred horses from birth to 18 months: improving the quality and quantity	I	Racing	Animal health - wastage	Stand-alone	Low
UM-23A	Diagnosis of equine virus diseases using polymerase chain reactions and development of a blood test and vaccine for equine rhinovirus	I	Industry	Animal health - respiratory disease	US-25A UM-23A UM-40A	High
UM-29A	Molecular epidemiology of rhodococcus equine	I	Industry	Animal health - respiratory disease	UM-29A USA-6A	Medium
UM-30A	Molecular diagnosis of equine parasitism	I	Industry	Animal health - viruses and diseases	Stand-alone	Low
UM-35A	Quantitative changes in surfactant protein A and surfactant phospholipids in exercise induced pulmonary haemorrhage	I	Industry	Animal health - respiratory disease	UM-35A UM-36A HOR98-18	Low
UM-36A	Methods of quantitative assessment for intra-pulmonary blood accumulation in racehorses with EIPH	I	Industry	Animal health - respiratory disease	UM-35A UM-36A HOR98-18	Too early
UM-40A	Epidemiology of equine rhinovirus type 2 (ERhV2)	II	Industry	Animal health - respiratory disease	US-25A UM-23A UM-40A	Medium

Continued on next page

6.4 Initial assessment of potential outcomes by RIRDC funding Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
UMA-14A	Development of a recombinant vaccine against equine herpesvirus 1 (equine abortion virus) and equine herpesvirus 4	II	Industry	Animal health - viruses and diseases	UMA-14A UMA-15A	High
UMA-15A	Improved vaccine strategies for management of equine herpesvirus diseases	II	Industry	Animal health - viruses and diseases	UMA-14A UMA-15A	Too early
UMU-17A	The effect of topical TGF-B on wound healing in horses	I	Industry	Animal health - tissue and bone repair	Stand-alone	Low
UMU-18A	Studies of the intestinal absorption of immunoglobulins and the effects of passive immune status on the functional development of the equine neonatal immune system	I	Industry	Animal health - viruses and diseases	Stand-alone	Low
UMU-22A	Identification of infectious respiratory disease in horses as a basis for better management of cases	I	Industry	Animal health - respiratory disease	Stand-alone	Too early
UNE-31A	Survey of agronomic practices on thoroughbred horse stud farms	II	Studs	Nutrition	Led to pasture projects	Medium
UNE-62A	Safe and effective grain feeding for horses	II	Industry	Nutrition - grain, Animal health - laminitis	HAN-1A UNE-62A	Too early
UQ-28A	A study of the grey horse melanoma with special reference to prevalence tumour structure and biology and associated pigment	I	Horsemeat	Horsemeat	Stand-alone	Medium
UQ-38A	To investigate the aetiopathogenesis of exercise-induced pulmonary haemorrhage (EIPH) in horses	I	Industry	Animal health - respiratory disease	UQ-38A UQ-73A	Low
UQ-3A	Toxicity from Indiofera toxins	I	Horsemeat	Horsemeat - human health	Stand-alone	Medium
UQ-43A	The influence of season on follicular dynamics and the relationships with endocrinology and oviduct physiology in the mare	I	Industry	Reproduction	Stand-alone	Too early
UQ-45A	Nutrition of grazing broodmares, their foals and young horses	II	Industry	Nutrition - requirements	UQ-45A UQ-72A	Medium
UQ-46A	Assessment and prevention of toxicity from indospicine contaminated horsemeat	II	Horsemeat	Horsemeat - human health	Stand-alone	Medium
UQ-47A	Investigations into the cause and prevention of equine laminitis	I	Industry	Animal health - laminitis	UQ-47A UQ-75A	High
UQ-59A	Control of intraocular inflammation by topically-applied nonsteroidal anti-inflammatory drugs (NSAIDS)	II	Industry	Animal health - viruses and diseases	UQ-59A UQ-71A	Medium
UQ-71A	Novel anti-inflammatory drugs to treat inflammatory diseases in horses	II	Industry	Animal health - viruses and diseases	UQ-59A UQ-71A	Medium
UQ-72A	Nutrient intake and growth of young horses	II	Industry	Nutrition - requirements	UQ-45A USC-4A UQ-72A UWS-13A	Medium

6.4 Initial assessment of potential outcomes by RIRDC funding Continued

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
UQ-73A	Repeatability and reliability of Brochoalveolar Lavage (BAL) in the horse	II	Industry	Animal health - respiratory disease	UQ-38A UQ-73A	Too early
UQ-75A	The pathogenesis and prevention of equine laminitis	II	Industry	Animal health - laminitis	UQ-47A UQ-75A UNE-62A	High
US-23A	Studies on M-protein of streptococcus equine: composition and role in host defence	I	Industry	Animal health - respiratory disease	US-23A US-24A	Low
US-24A	Studies on the host-parasite interactions in disease induced by Streptococcus equi subsp. equi	I	Industry	Animal health - respiratory disease	US-23A US-24A Possible follow-on	Low
US-25A	Identification and characterisation of causes of wastage in the Australian horse racing industry	I	Racing	Animal health - wastage	Handbook follow-on projects	High
US-31A	Production of an equine research newsletter	III	Industry	Industry development - communication	US-31A US-42A US-50A	High
US-33A	Viral respiratory disease in racehorses: incidence and contribution to wastage	I	Industry	Animal health - respiratory disease	US-25A US-33A US-41A	High
US-41A	Bacterial respiratory disease in racehorses: incidence, aetiology and contribution to wastage	I	Industry	Animal health - respiratory disease	US-25A US-33A US-41A	High
US-42A	Production of an equine research newsletter and internet website	III	Industry	Industry development - communication	US-31A US-42A US-50A	High
US-45A	A research review of causes and prevention of developmental orthopaedic disease in young horses	I	Industry	Animal health - wastage	US-25A US-45A Workshop	Medium
US-50A	Communication and information programs for the horse industry	III	Industry	Industry development - communication	US-31A US-42A US-50A	High
US-52A	Biomechanical and biochemical response of equine superficial flexor tendon to training and injury	II	Industry	Animal health - tissue and bone repair	US-25A US-52A	Low
US-53A	Respiratory ventilation and tracheal sounds in horses with airway disease	II	Industry	Animal health - respiratory disease	US-25A US-53A	Medium
US-58A	Serological Investigation of equine influenza in Australia	I	Industry	Animal health - respiratory disease	Stand-alone	High
US-69A	Workshop on the future of farriery	II	Farriery	Industry development	Stand-alone	Medium
US-73A	Scone Forum - Equine Research Seminar for Breeders, Owners, Trainers & Veterinarians	I	R&D	Industry development - communication	Stand-alone	High
US-77A	Training and fitness in athletic horses	II	Industry	Animal health - exercise related	Stand-alone	Too early

6.4 Initial assessment of potential outcomes by RIRDC funding Continued

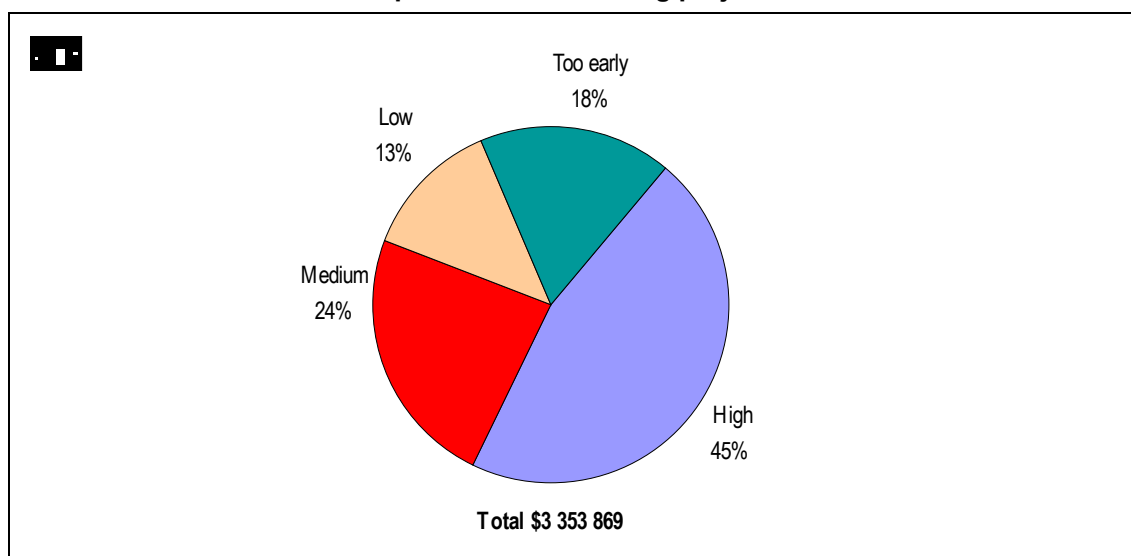
<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
USA-6A	Diagnosis of and protection against infections caused by rhodococcus equine	II	Industry	Animal health - respiratory disease	UM-29A USA-6A	Medium
USC-4A	Improved nutrition of young horses (nutrition planning)	II	Industry	Nutrition - requirements	UQ-45A USC-4A UQ-72A UWS-13A	Medium
UWS-13A	Australian feeding standards (NRC) project	II	Industry	Nutrition	From workshop on pasture nutrition	High

Data source: Program managers and CIE assessment.

- Second, are the communication and extension projects, which seek to get information out into the industry. As mentioned previously, the value of communication products in terms of their impact is difficult to assess. Little is known about adoption rates within the more concentrated sectors of the industry — such as racing and studs — and still less about adoption in the pony clubs and by individual horse owners. Veterinarians may be the best source of information on adoption of different practices. A current project (FLP-1A) will examine the impact of the newsletter and website.

Chart 6.5 summarises the outcomes by the share of RIRDC funding.

6.5 Initial assessment of completed and continuing projects



Data source: Program managers assessment.

Recommendations for evaluation

Most of the project sets are difficult to evaluate. There are three projects sets that are suitable for evaluation in this round.

- GHE-1A tested commercial products that were marketed as aids for maintaining pregnancy. This evaluation should be relatively easy if the main benefits are potential cost savings. It is more difficult to assess the value of increased rates of successful pregnancies.

- UQ-75A and the lead up project UQ-47A could be evaluated in terms of actual benefits from cost savings from avoiding ineffective treatments. An *ex ante* evaluation of potential benefits would require an assessment of the costs that laminitis currently imposes on industry.
- A evaluation of a set of projects focused on vaccine development — for example, UMA-14A and UMA-15A, and US-23A and US-24A may provide future guidelines for assessing which vaccines are likely to have the greater pay-off. Important issues are the likely commercial costs of the vaccine relative to the benefits. The issues of the value of the research in related areas and the actual or potential development of vaccines in other countries should also be considered.

7.Fodder Industry Program

Overview

Background

The Australian fodder crop industry is estimated to be worth about \$750 million in sales at the farm gate, including fodder produced for own farm consumption. An additional \$250 million is added through processing. Processing consists mainly of compaction of fodder into compact bales or pellets for export. Lucerne hay and meal are the main exports, with the main types of fodder produced being lucerne, clover, pasture and cereal straw.

Eighty per cent of production is used on-farm, mainly for dairy and beef. The remaining 20 per cent is exported and sold as feed for dairy, beef cattle feedlots and off-farm horses. Exports account for less than 10 per cent of the value of production, with Japan being the major destination. Exports to east Asia and the feedlot industry in Australia provide the greatest potential for growth in demand.

Production is concentrated in Victoria and New South Wales, although there is substantial production in other states. It is estimated that 20 000 producers on 46 000 properties produce around 1.2 million tonnes of hay and other fodder products a year.

Research and development activities

RIRDC has been involved with research into fodder crops since its inception in 1992. The annual budget is around \$150 000.

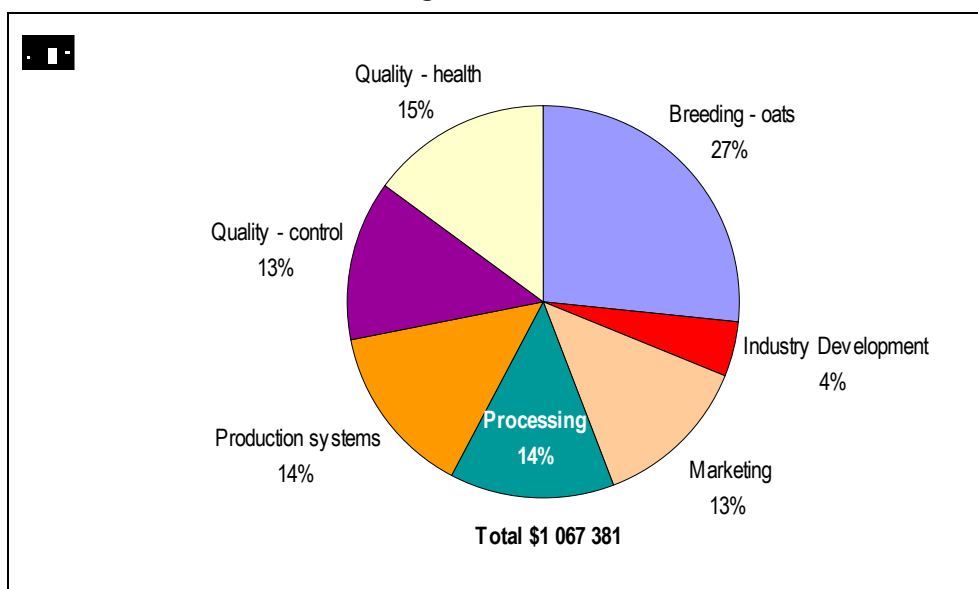
Prior to RIRDC, the R&D effort was largely uncoordinated, with no formal industry organisation. In 1997 the Australian Fodder Industry Association (AFIA) was formed, with seed money provided by RIRDC. The possibility of imposing a levy is currently being explored. This would increase the funding available for R&D in the industry.

A five year plan for R&D was developed in 1998. New R&D projects generally fall into one of six categories:

- new markets and products;
- plant breeding and germplasm evaluation;
- plant nutrition, disease, weed, pest and micro-organism management;
- quality standards;
- industry communication and information flows; and
- R&D program management, monitoring and review.

Chart 7.1 summaries the projects by the five year plan categories. The main areas of RIRDC funding to date are breeding, quality and production systems — which encompass plant nutrition, and disease, weed and pest management.

7.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

List of projects

Table 7.2 lists the projects that have been identified in the fodder crops program. Projects that are currently underway or have been approved are included in the listing. A start and finish date are provided where available. As far as possible the total cost of the project has been estimated (sum of the annual dollar amounts, not discounted) to give a rough indication of the relative size of the projects. The cost includes contributions from the industry to the research institution as well as RIRDC funding.

7.2 Completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
AFC-1A	Australian fodder industry development project (phase II)	1/02/96	30/07/96	15 000	15 000
AFC-2A	AFIA second annual conference	1/08/97	31/08/97	5 000	5 000
ALC-1A	Development of haymarket		1988		Too old
ALC-2A	Haymarket product evaluation: lucerne hay		1989		Too old
CSA-3A	Screening methods for monitoring corynetoxin contamination of Australian produce	2/02/98	31/12/99	199 640	79 508
CSJ-1A	Objective specification of the quality of hays and fodder	1/07/95	30/09/97	445 919	65 095
DAN-88A	Haymaker: new extension technology for lucerne management	1/07/93	30/06/97	304 145	85 511
DAV-104A	A uniform objective system for quality description of Australian fodder products	1/07/95	31/03/98	205 464	73 670

Continued on next page

7.2 Completed and continuing projects Continued

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
DAV-11A	Development of near infrared reflectance spectroscopy for measurement of feed and forage quality in southern Australia		1987		Too old
DAW-28A	Development of exports of oaten hay to Japan — alternative shipping methods		1993/94	291 130	105 430
DAW-64A	Market research and development of fodder product exported to far east Asia	1/07/95	30/09/97	31 955	31 955
KAK-1A	The Australian fodder industry — the need for self-funding background and options paper	13/01/97	10/03/97	4 000	4 000
KAK-2A	An assessment of the extent, nature and source of support for a R&D levy for the Australian fodder industry	1/10/97	31/07/98	38 700	19 500
KDI-6A	A publication on fodder systems for Australian farming		1993/94	158 000	68 000
MS978-51	ANZFA consultancy - industry report on corynetoxins: a toxicological review		1997/98	2 000	2 000
MS978-53	Five year plan workshop		1997/98	4 122	4 122
SAR-2A	Establishment of annual ryegrass toxicity (ARGT) testing services and protocols for the Australian export hay industry	5/07/96	31/05/98	452 685	68 585
SAR-5A	National coordination workshop for annual ryegrass toxicity	1/02/97	28/02/97	9 500	9 500
SAR-8A	Development of disease resistant, high yielding oat cultivars with enhanced quality for hay production	1/01/98	31/12/00	498 670	132 231
UM-3A	Improving quality of export lucerne hay		1992		Too old
UQ-25A	Microbial inoculants for hay		1995	597 549	103 081
UQ-82A	Field testing microbial inoculants for hay preservation	1/07/98	30/06/00	196 000	42 000
US-1A	Title unknown — objectives in database			30 493	9 000
UWA-30A	Sulla and other forage species for southern Australia	1/06/95	30/06/98	431 193	153 193

Source: RIRDC database, compendiums.

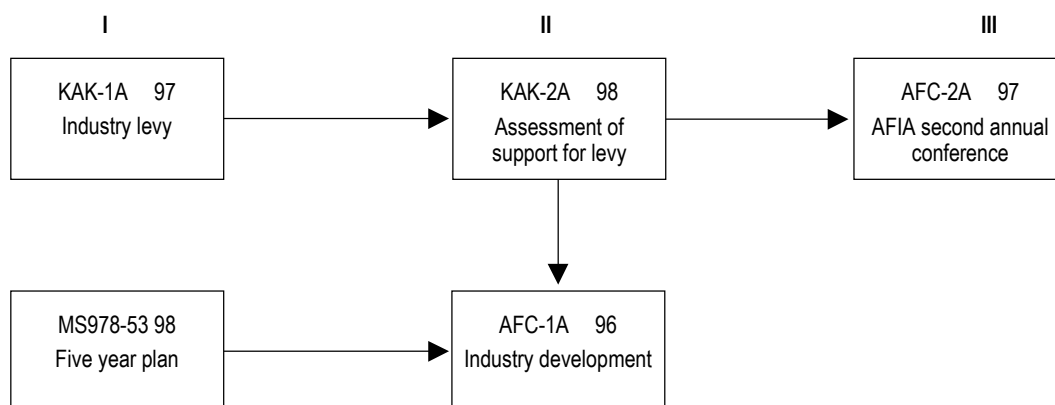
Project sets and initial evaluation

Chart 7.3 sets out the projects in sets for evaluation. Projects can be evaluated individually, or in small or large sets. Where projects are joined by an arrow, they should be evaluated together, or at least part of the cost of the preceding projects allocated against the benefit flows from the following projects.

7.3 Classification of projects for evaluation

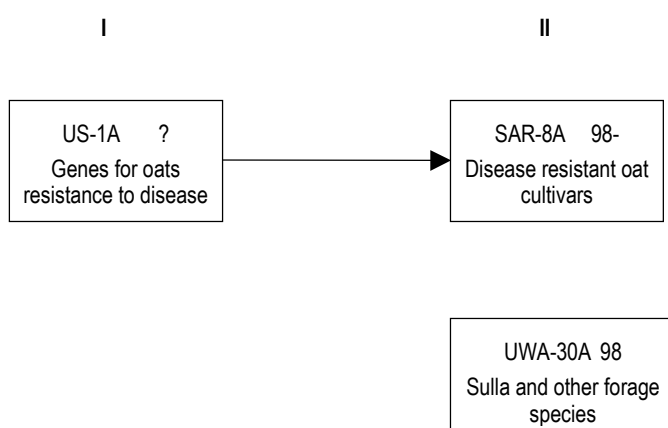


Industry development



On-farm production

Breeding



Continued on next page

7.3 Classification of projects for evaluation Continued



On-farm production cont

Other

I

II

III

DAN-88A 97
Haymaker irrigation
technology

KDI-6A 93/94
Publication on fodder
systems

Processing

Pre-harvest treatment

I

II

III

UQ-25A 95
Developing microbial
inoculants

UQ-82A 98-
Field testing microbial
inoculants

Shipping

I

II

III

DAW-28A 93/94
Packing and shipping
to Japan

AMT-1A
Systems to reduce
shipping costs

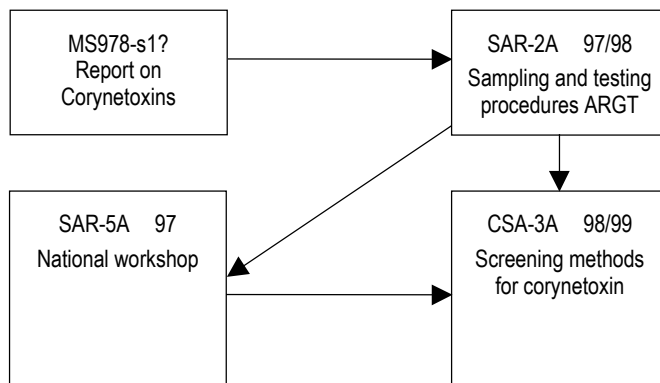
Continued on next page

7.3 Classification of projects for evaluation Continued

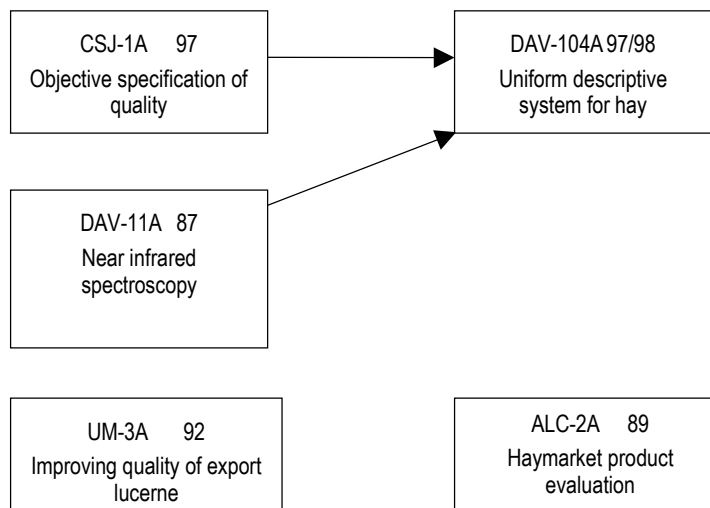


Quality

Health issues



Quality: control



Distribution and Marketing

Marketing



Industry development

The projects in the industry development classification can be mapped into programs 5 and 6 in the five year plan. There are two sets of projects and one stand-alone project.

- The five year plan (MS978-53) sets out a more structured approach to selecting R&D projects. This review should provide additional information for developing the R&D strategy. The benefits of a more structured approach to R&D are difficult to evaluate except through a long term evaluation of the program. One of the needs identified in the plan is additional funding through an industry levy. This led to KAK-2A, which assesses support for a levy.
- Two projects (AFC-1A and KAK-1A) have been instrumental in developing the industry organisation (AFIA). AFC-2A is a follow on from these projects. A newsletter has commenced and field days conducted. These are thought to have had a good impact on the industry by improving professionalism and by the distribution of information to raise productivity and quality. The actual impact is difficult to assess, requiring a survey to estimate awareness and adoption of new information.
- Investigation of the appropriateness and support for an industry levy has been conducted in project KAK-2A.

Production

There are two projects that have fairly wide applicability in terms of developing and providing information on production systems. Each can be considered to be stand-alone.

- DAN-88A pulled together best practices for irrigated haymaking production systems. The focus was on the optimal use of irrigation. This project is judged to have had a good impact. Adoption is mainly around Tamworth, where the project was undertaken. Assessment of the net benefit would be relatively easy for the region given the availability of adoption information. The information is potentially applicable elsewhere and the Murray Darling Basin Commission has adopted the approach to promote water conservation in the Namoy-Peel catchment.
- KDI-6A provided funding for a publication on fodder systems. It synthesised the results of research in a previously well received format. Kondinian, who produce these publications for a number of crops, may have conducted market research to assess the penetration of the publication and its impact. In such a situation, evaluation would be relatively simple. It is judged that the project has had a good pay-off.

Breeding programs

There are two breeding programs that can be identified in the set of projects. Breeding programs are the second of the priority areas for R&D identified in the five year plan.

- The breeding program for oats has one old project (US-1A) and one commenced last year (SAR-8A). The focus of both is on disease resistant cultivars. The impact would be to raise yields by reducing loss and to reduce the need for, and hence costs of, other forms of disease control. The output of the first project is not known and it is too early to assess the potential for the second. It is felt that there is a low probability of success and the cost of the program is high.

- A breeding program (UWA-30A) has been focused on developing Sulla and other forage species that are relatively salt resistant. Several new varieties have been identified, but there is some problem about property rights over selection when applying for plant variety rights (PVR). The commercial varieties are currently at the stage of multiplying up to commercial quantities. The adoption rate is thought to be limited and the outcome reasonable. An evaluation would need to address the issue of the benefit flows from limited access to new varieties through the PVR process.

Processing

Baling and pellets

In fodder crops it is relatively difficult to separate processing from farm production as much of the processing (baling) is performed on-farm.

- Two projects (UQ-25A and UQ-28A) have developed and field tested microbial inoculants that, when sprayed on the hay, helps the maturing of the hay and reduces baling time. The adoption of the technology is uncertain, but the outcome may be good.

Shipping

One project investigated reducing costs of shipping.

- DAW-28A explored shipping requirements for Japan as part of examining marketing requirements (discussed below).

Quality

Health risks from consumption

There is one clear set of projects that have been driven by concern over health risks. These projects fit under the third priority for R&D in the five year plan.

- There is a set of projects on corynetoxins (arising from ARG1 bacteria). These projects arose from the death of some cattle in Japan from contaminated feed from Australia. SAR-2A developed simple tests to convince the Japanese to allow Australian fodder back into the market. The impact was good in terms of avoid losses. The other projects (SAR-5A, MS 978-51 and CSA-3A) have flowed on from the identification of the problem. The final project in this set is focused on identifying and refining tests for the toxin. The results could have wide applicability across the grain industry. The GRDC is putting \$250 000 a year into research on the toxin in wheat. The benefits flow from the early identification of the problem and tests to prevent market loss. Assessment of the potential benefits is relatively difficult, but of considerable interest.

Control and standards

Quality standards are the fourth priority area in the five year plan.

- The projects CSJ-1A and DAV-104A have developed a set of standardised tests to describe the quality of hay in terms of end-user requirements. There is a potential benefit to producers of this standardisation, but it also imposes additional costs.
- The project DAV-11A developed techniques — near infrared spectroscopy — that may have been used in this standardisation. If so, the costs of this project should be added to the total cost.
- Project ALC-2A developed a descriptive system of quality evaluation. This was used in the development of Haymarket (ALC-1A). Whether there has been any flow on, or Haymarket continues is not known.
- Quality control of product for export was examined in UM-3A. The output of this project is unknown.

Marketing

Marketing is the first of the priority areas identified in the five year plan. Marketing projects are generally difficult to evaluate when they are concerned with the collection of information on potential markets and their marketing procedures. The first set of projects fall into this area, the second, stand-alone project does not.

- DAW-28A and DAW-64A both explored market potential and requirements — the former in Japan, the latter in the Far East. Neither appear to have had much impact. The former may have been a catalyst to commercial exports from Western Australia.
- ALC-1A developed a clearing house for the marketing of hay. If still in operation, this would make an interesting evaluation to assess the benefits of such centralised markets.

Evaluation

Table 7.4 summarises the expected outputs and outcomes from the projects. Most of the project sets end at stage II except for the marketing projects. For a number of the sets, it is too early to be able to identify explicit outcomes flowing from the projects. This means that evaluation would be largely ex-ante in the sense of predicting the benefit flows. What is known is the success or otherwise of the project to deliver the promised outputs. The initial assessment at the project level concentrates on what outputs might deliver rather than an assessment of actual outcomes from the project sets.

7.4 Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Product</i>	<i>Classification</i>	<i>Related projects</i>	<i>Initial assessment</i>
AFC-1A	Australian fodder industry development project (phase II)	I	Industry	Industry development	AFC-1A KAK-1A KAK-2A MS978-53	Medium
AFC-2A	AFIA second annual conference	II	Industry	Industry development	AFC-1A AFC-2A	Medium
ALC-1A	Development of haymarket	II	Industry	Marketing	Stand-alone	Low

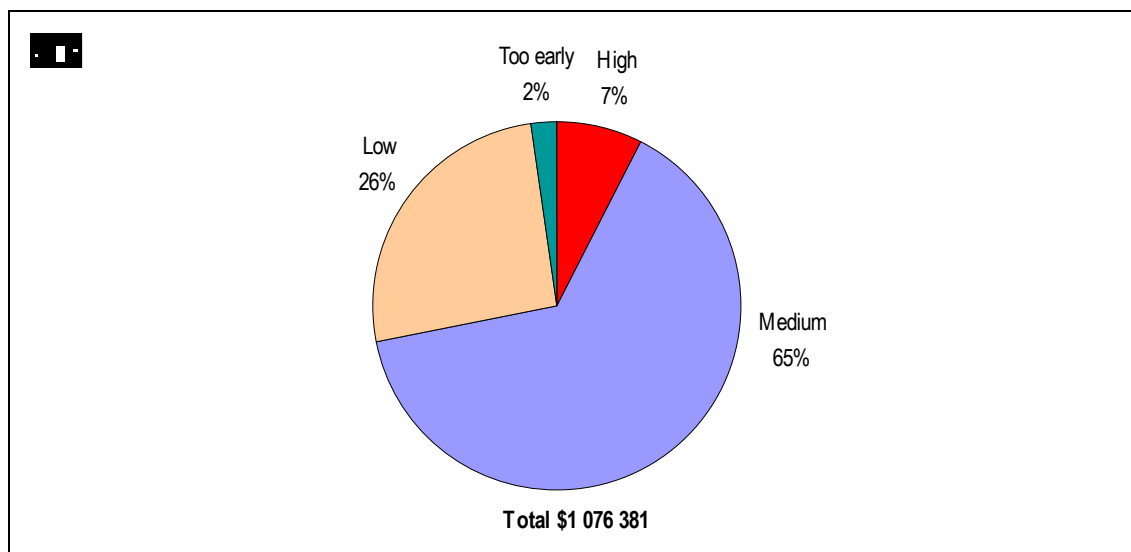
Continued on next page

7.4 Initial assessment of completed and continuing projects

Project no.	Project title	Stage	Product	Classification	Related projects	Initial assessment
ALC-2A	Haymarket product evaluation: lucerne hay	II	Lucerne	Quality - control	Stand alone	Input to ALC-2A
CSA-3A	Screening methods for monitoring corynetoxin contamination of Australian produce	II	Industry - spillovers	Quality - health	MS978-51 SAR-2A SAR-5A CSA-3A	High
CSJ-1A	Objective specification of the quality of hays and fodder	I	Industry	Quality - control	CSJ-1A DAV-11A DAV-104A	See DAV-104A
DAN-88A	Haymaker: new extension technology for lucerne management	III	Industry - irrigation	Production systems	Stand alone	Medium
DAV-104A	A uniform objective system for quality description of Australian fodder products	II	Industry	Quality - control	CSJ-1A DAV-11A DAV-104A	Medium
DAV-11A	Development of near infrared reflectance spectroscopy for measurement of feed and forage quality in southern Australia	I	Industry	Quality - control	CSJ-1A DAV-11A DAV-104A	See DAV-104A
DAW-28A	Development of exports of oaten hay to Japan — alternative shipping methods	I	Industry - exports	Shipping Marketing	Stand alone	Low
DAW-39A	To attend 5th International Oat Conference	na	Oats	na	na	na
DAW-64A	Market research and development of fodder product exported to far east Asia	I	Industry - exports	Marketing	Stand alone	Low
KAK-1A	The Australian fodder industry — the need for self-funding background and options paper	I	Industry	Industry development	AFC-1A KAK-1A KAK-2A MS978-53	See KAK-2A
KAK-2A	An assessment of the extent, nature and source of support for a R&D levy for the Australian fodder industry	I	Industry	Industry development	AFC-1A KAK-1A KAK-2A MS978-53	Unknown
KDI-6A	A publication on fodder systems for Australian farming	III	Industry	Production systems	Stand alone	Medium
MS978-51	ANZFA consultancy — industry report on corynetoxins: a toxicological review	I	Industry - spillovers	Quality - health	MS978-51 SAR-2A SAR-5A CSA-3A	See CSA-3A
MS978-53	Five year plan workshop	I	Industry	Industry development	AFC-1A KAK-1A KAK-2A MS978-53	Medium
SAR-2A	Establishment of annual ryegrass toxicity (ARGT) testing services and protocols for the Australian export hay industry	II	Industry - spillovers	Quality - health	MS978-51 SAR-2A SAR-5A CSA-3A	See CSA-3A
SAR-5A	National coordination workshop for annual ryegrass toxicity	I	Industry - spillovers	Quality - health	MS978-51 SAR-2A SAR-5A CSA-3A	See CSA-3A
SAR-8A	Development of disease resistant, high yielding oat cultivars with enhanced quality for hay production	II	Oats	Breeding – oats	US-1A SAR-8A	Low
UM-3A	Improving quality of export lucerne hay	I	Lucerne - export	Quality – control	Stand alone	?
UQ-25A	Microbial inoculants for hay	II	Hay	Processing	UQ-25A UQ-82A	See UQ-28A
UQ-82A	Field testing microbial inoculants for hay preservation	II	Hay	Processing	UQ-25A UQ-82A	Medium
US-1A	Title unknown — objectives in database	I	Oats	Breeding – oats	US-1A SAR-8A	See SAR-8A
UWA-30A	Sulla and other forage species for southern Australia	I	Forage – southern Australia	Breeding - new product	Stand alone	Medium

Source: Program managers and CIE assessment.

7.5 Initial assessment of potential outcomes by RIRDC funding



Data source: Program managers and CIE assessment.

Overall, the assessment is that most of the projects will deliver or hope to deliver good outcomes. Where a project is a critical input into a set, they are given the assessment of the output for the final project in the set. The industry is highly fragmented so the total impact will depend critically on dissemination of information in an accessible and appealing form.

Chart 7.5 summarises the likely outcomes by budget allocation. The outcomes are indicative only. They will depend on the adoption rates, impact on market prices and costs, as well as on the profitability of alternative products.

Recommendations for evaluation

There are three project sets that are suitable for evaluation.

- SAR-2A as a stand-alone, in terms of the benefits to maintaining exports. This is a relatively simple evaluation.
- The corynetoxin set, which has considerable potential benefit to both the fodder crop and grain industries. This would be a complex evaluation that would need to explore the marginal benefits to additional research in the area as well as spillover benefits. It should also provide additional information on market sensitivity (export and domestic) to the issue.
- DAN-88A, on irrigation technology, is a relatively simple project to evaluate if confined to the impact on the project region. Estimation of possible spillover benefits is more complex. It is a topical issue and evaluation may help promote the knowledge generated in the project.

8. Pasture Seeds Program

Overview

Background

The Australian pasture seed industry is estimated to be worth around \$35 million at the farm gate in sales of certified seed. Only temperate legumes are currently certified — lucerne, clovers, medics and serradella. In addition, there is a substantial market in uncertified seed — perennial grasses and sub-tropical grasses. There is no available estimate of the value of sales of uncertified seed, but exports in 1995-96 were around \$14 million. Even if 60 per cent of uncertified seed produced is exported the total value of the industry is at least \$58 million, excluding seed produced for own farm consumption.

Over 60 per cent of lucerne seed and 20 per cent of clover seed is exported, with Asia being the main market, at least prior to the Asian crisis. Substantial quantities of fescue and ryegrass (perennial grasses) are also exported. Export value in 1995-96 exceeded \$30 million. Domestic demand is derived from demand for fodder crops — predominantly for beef cattle feedlots, dairy and horses — and improved pasture for grazing.

The main area of production of lucerne and clover seed is in South Australia, but there are seed growers in all states and territories. Victoria produces the largest share of perennial grasses, and north-eastern New South Wales and Queensland the sub-tropical grasses. Northern Territory produces a variety of tropical and sub-tropical grasses. Seventy-five per cent of lucerne seed is grown under irrigation.

Research and development activities

RIRDC has been involved with research into pasture seeds since its inception in 1992. The annual budget is around \$350 000, and to date over \$3.5 million have been committed to R&D in the industry by RIRDC and its predecessor ASRRC.

Industry contributions come from a levy on certified seed. An expansion of the levy base to perennial grasses and tropical and sub-tropical grasses is currently being examined.

A five-year plan for R&D was developed in 1996. Seven objectives were specified to guide selection of R&D projects. These objectives are to:

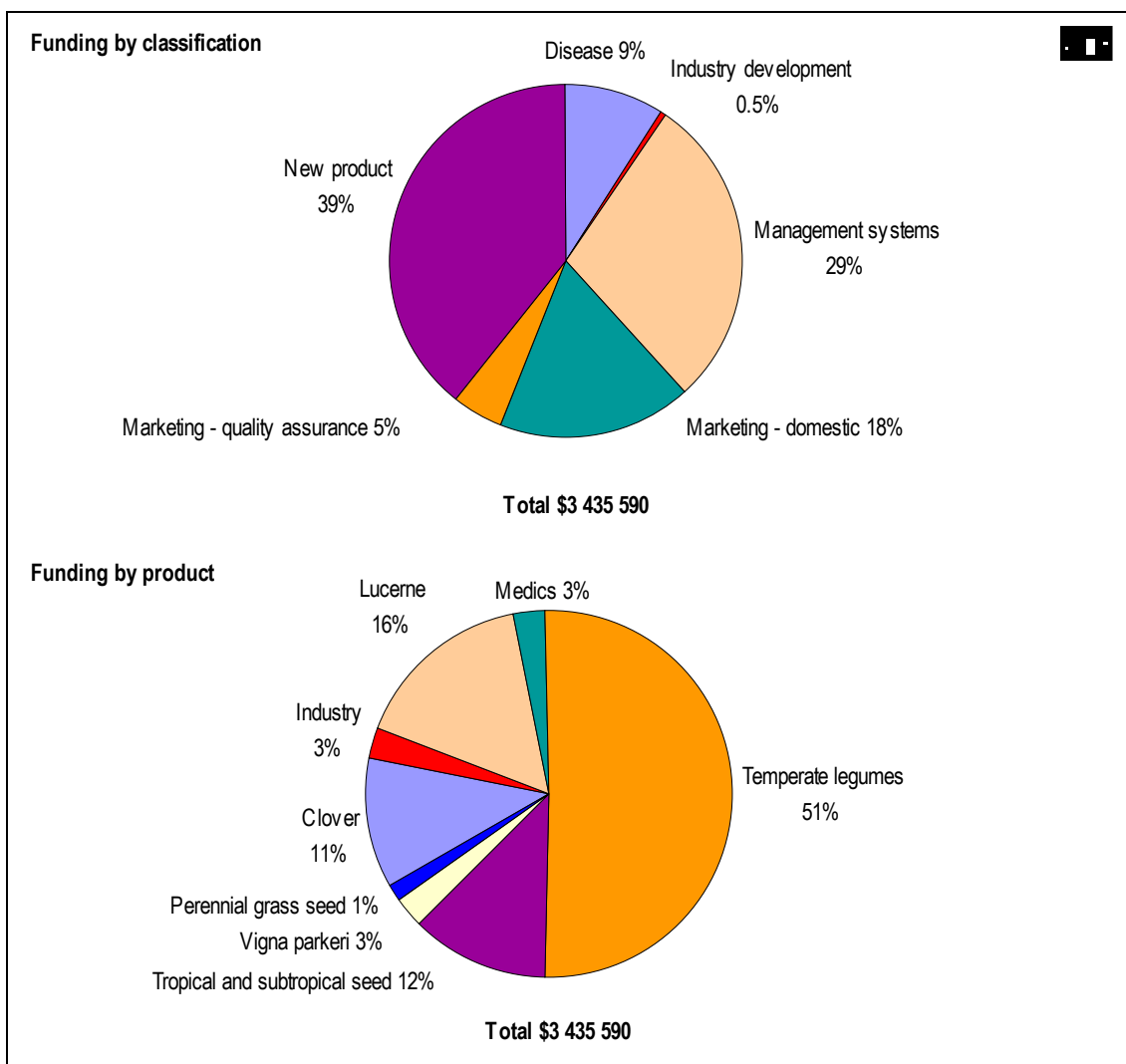
- develop export and import replacement opportunities;
- improve the availability of technical and economic information;
- improve production efficiency;
- address environmental issues which impact on the industry;
- improve communication in the industry;
- develop systems which support industry quality assurance and self regulation; and

- investigate the opportunities for a broader seeds program.

These categories do not provide natural categories for evaluation. In particular, some of the activities are focused on promoting domestic demand by providing technical information to seed users. We have suggested an alternative sets of categories for the purpose of evaluation.

- Industry development incorporates the objective of a broader seeds program, but also general communication and dissemination of technical information to seed growers that is not specifically related to particular R&D projects.
- Production includes a number of subcategories of R&D, the impact of which should be to improve production efficiency, and/or improve quality. The sub categories are:
 - disease, in particular the management of disease,
 - pest control,
 - weed control, and
 - management systems.
- New products includes R&D on seeds not previously grown in Australia as well as native seeds. Projects on breeding, selecting and growth and production trials are included in this category. Most of the projects in this category meet the objective of developing export and import replacement opportunities.
- Marketing encompasses all projects that focus on stimulating demand. There are several categories:
 - domestic marketing is predominantly information provision to improve the demand for seeds through increasing the use of improved pastures in Australia — many of these projects fall into the technical and communication category, but some are focused on developing the production systems, and
 - export marketing is research mainly on export market requirements and opportunities and facilitation of exporting — these projects generally are included in the developing export and import replacement objective. However, projects that focus on quality assurance for export markets, are also included here.

8.1 Main areas of RIRDC funding



Data source: RIRDC database, compendiums.

In chart 8.1 the classification of projects is shown for the five year plan objective and divided into the classification used for evaluation sets and the product focus of the R&D. The shares are based on the RIRDC funds expended and committed for the projects.

As can be seen in chart 8.1, lucerne, and clover and subclover have attracted the major portion of the funding to date. Considerable focus has been on production systems and also on developing new products. Marketing and weed control are clearly also important areas.

List of projects

Table 8.2 lists the projects that have been identified in the pasture seeds program. Projects that are currently under way or have been approved are included in the listing. A start and finish date are provided where available. As far as possible the total cost of the project has been estimated (sum of the annual dollar amounts, not discounted, to give a rough indication of the relative size

of the projects. The cost includes contributions from the industry to the research institution as well as RIRDC funding.

8.2 Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
ARM-1A	Review of weed control in lucerne medics and subclover seed crops		1995	39 400	35 400
BRR-1A	Support for a conference on herbicide resistant crops and pastures		1995	2 000	2 000
CMS-1A	Strategies to successfully establish and manage a dryland lucerne stand		93/94	148 000	79 000
CSP-5A	The Australian collection of rhizobium strains for temperate legumes	1/07/94	30/06/97	277 281	153 027
DAN-163A	Development of new alternative legumes and appropriate weed control technology	1/12/97	30/06/02	509 015	241 648
DAN-75A	Lucerne seed check: a management support system		1997	216 935	32 890
DAN-76A	Developing an agronomic package to maximise profitability of subclover seed crops		1997	83 226	28 519
DAQ-148A	Improved handling of chaffy grass seeds	1/07/93	31/03/98	543 181	409 658
DAS-31A	Development of export markets for cold tolerant annual medics		93/94	171 176	101 776
DAS-32A	Alfafa mosaic virus survey in lucerne and medic seed and development of rapid tests		97/98 cont	248 851	51 446
DAS-33A	Control of rhizoctonia burr rot of subterranean clover		93/94	115 129	61 429
DAV-106A	A model for expansion of the Australian domestic temperature pasture seed market	1/07/95	30/09/98	234 270	54 419
DAV-144A	Improved seed production: 'Towards 1.5 tonnes'	1/07/97	30/06/00	289 653	76 500
DAV-94A	Management of Phytophthora root rot in subterranean clover for a viable pasture seeds industry	1/07/94	31/12/97	283 190	116 290
DAW-36A	Developing effective rhizobial inoculants for lucerne in WA		93/94	41 603	21 438
DAW-50A	Development of alternative pasture legumes for use in medium rainfall agricultural regions with untapped subsurface water	1/07/93	30/06/97	353 910	118 999
DAW-60A	On-farm evaluation of the adaptation, distribution and potential value of lucerne in Western Australia	1/07/94	30/06/97	66 180	25 680
DEB-1A	Evaluating and managing lucerne seed wasp in lucerne seed crops	1/08/98	31/07/01	43 700	17 600
FAR-1A	Development of strategies to control annual ryegrass in perennial grass seed crops	30/07/91	30/12/95	47 900	27 900
HS-1A	The development of a more effective harvesting method for shaw creeping Vigna (Vigna parkeri)	1/07/95	31/03/00	40 780	5 600
IPB-1A	Evaluation of lucerne varieties for seed yield and strategies to enhance seed productivity	1/07/98	30/09/01	301 500	69 000
KDI-7A	Pasture establishment and management publication		1997	270 300	57 300
MS967-36	Pasture seeds five year plan		1996	3 399	3 399
MS967-47	Tropical and subtropical seeds R&D workshop	1/06/97	30/06/97	6 009	6 009
SAR-10A	Development of a bacterial wilt test to facilitate the export of lucerne seed	1/07/97	30/06/99	176 966	89 339
SAR-11A	Improved irrigation practice and crop diversification for the irrigated pasture seed industry	1/10/97	30/09/01	562 000	333 000
SBS-1A	Seed production of Vigna parkeri	1/01/97	31/12/99	121 260	91 260
SED-2A	Developing management systems for European varieties of white clover for multiplication in Australia and re-export	1991	1994/95	228 545	136 610
SED-3A	Development of varieties of four species of fodder legumes for sowing — seed export	1/07/91	30/06/94	333 933	176 526
SED-4A	Nationwide survey of consumer demand for temperate pasture seeds		1992	59 800	52 500
SED-6A	Alternative seed certification schemes in Europe and USA for adoption in Australia		93/94	31 200	28 700
SED-8A	Development of varieties of six species of fodder legumes for sowing-seed and hay export	1/07/95	30/06/99	462 000	215 500
STL-1A	Support for native grass seeds meeting		1996	6 000	3 000

Continued on next page

8.2 Initial assessment of completed and continuing projects Continued

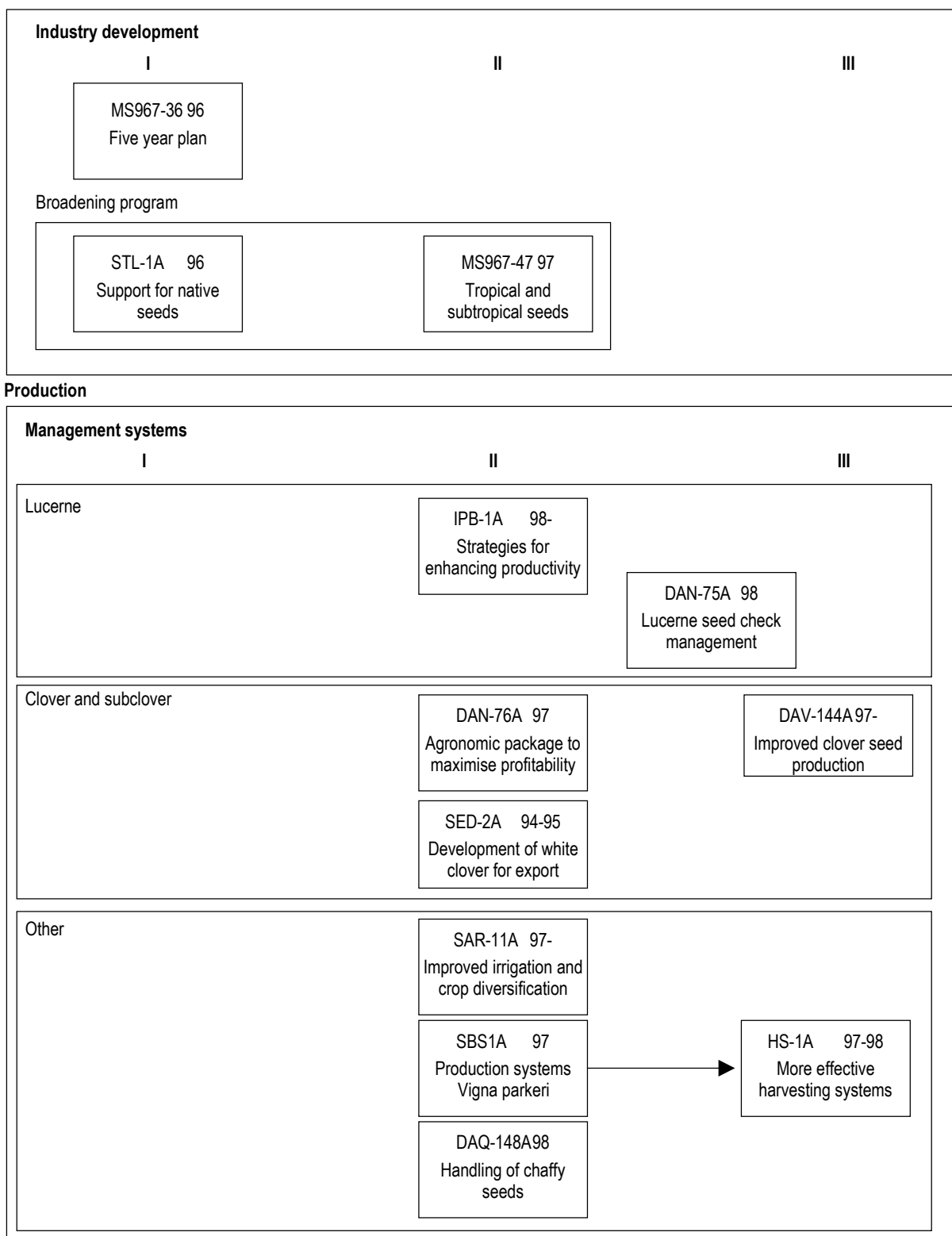
<i>Project no.</i>	<i>Project title</i>	<i>Start</i>	<i>Finish</i>	<i>Total cost</i>	<i>RIRDC cost</i>
				\$	\$
UA-24A	Survey to determine demand factors in pasture legume seed usage in Australia		93/94	18 615	8 890
UA-27A	Herbicide failure and the need for integrated weed management in legume pasture seed crops		1997	72 771	65 971
US-75A	Occurrence and severity of 'lucerne yellows' disease in lucerne seed crops	1/07/98	30/11/99	21 651	7 827

Source: RIRDC database, compendiums.

Project sets and initial evaluation

Chart 8.3 sets out the projects in sets for evaluation. Projects can be evaluated individually, or in small or large sets. Where projects are joined by an arrow they should be evaluated together, or at least part of the cost of the preceding projects allocated against the benefit flows from the following projects.

8.3 Classification of projects for evaluation



Continued on next page

8.3 Classification of projects for evaluation Continued

Production cont			
Disease			
I	II	III	
Lucerne			
US-75A 98- Occurrence of lucerne yellows	Follow on		
DAS-32A 98- Survey and tests Alfafa mosaic virus			
Clover and subclover			
DAV-94A 97 Management of Phytophthora root rot	DAS-33A 93-94 Control of rhizoctonia burr rot		
Pest control			
I	II	III	
Lucerne			
	DEB-1A 98- Lucerne seed wasp		

Continued on next page

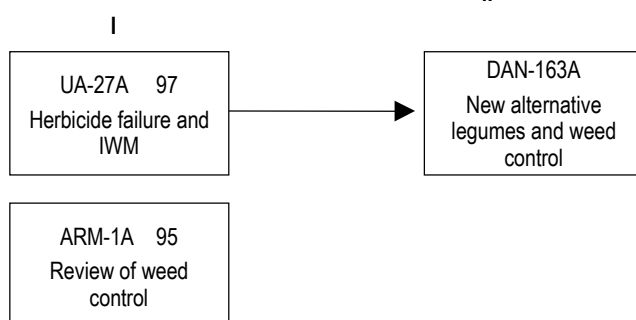
8.3 Classification of projects for evaluation Continued



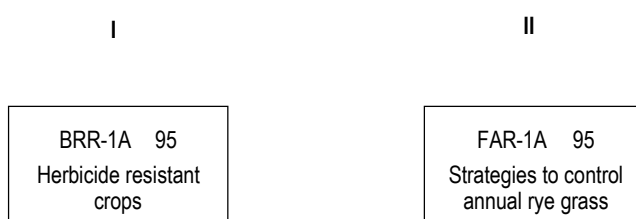
Production costs

Weed control

Legumes

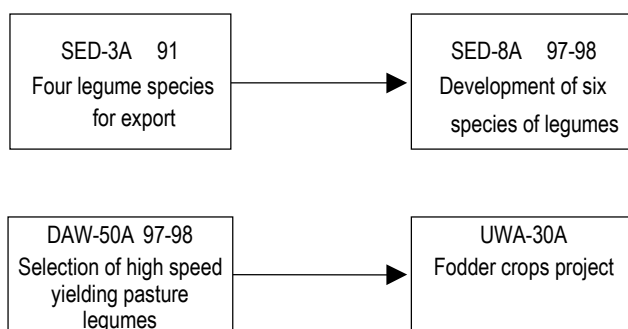


Other



New products

Legumes

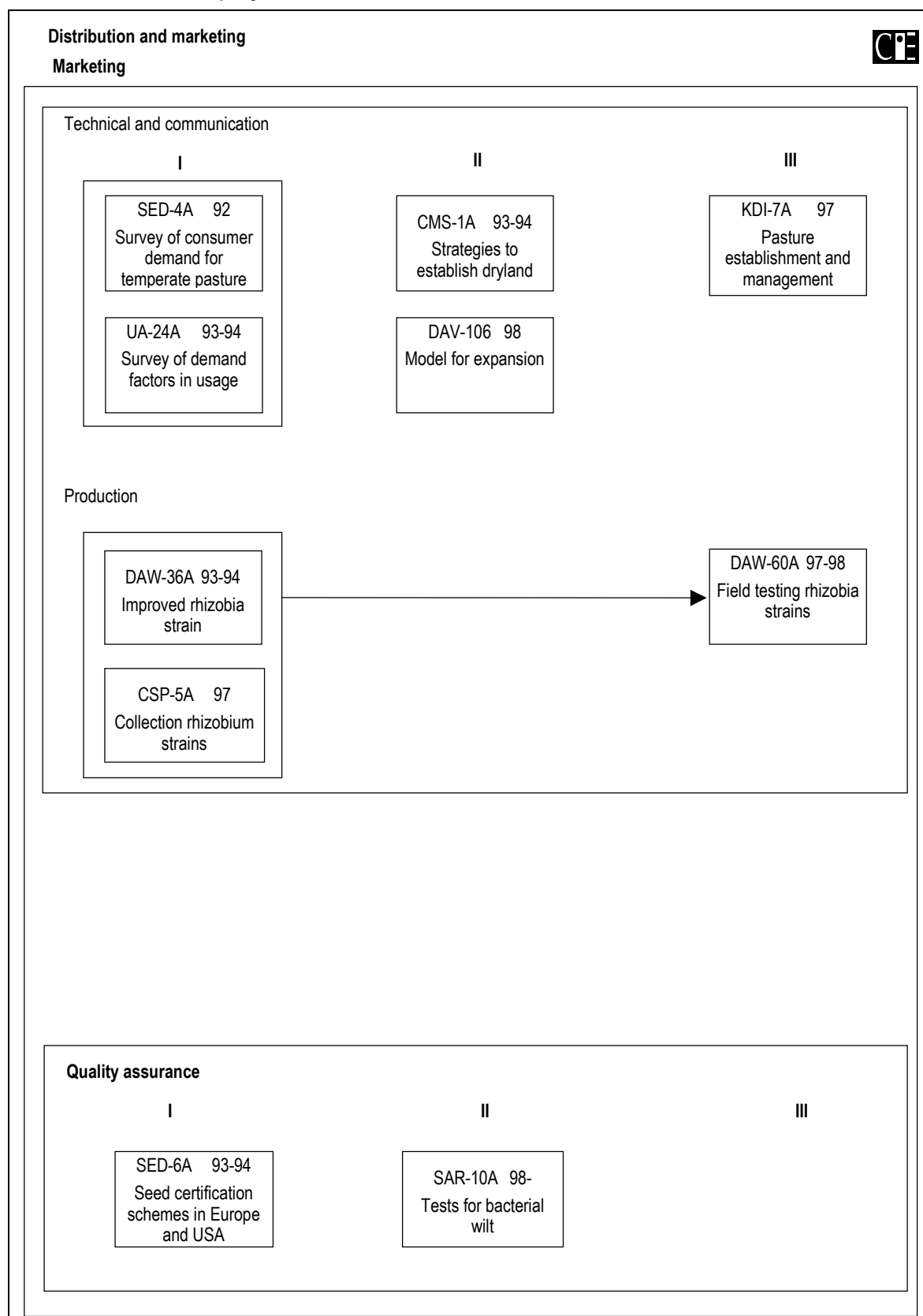


Cold tolerant medics



Continued on next page

8.3 Classification of projects for evaluation Continued



While some projects have a general industry focus, most impact directly only on the particular product. The main products are lucerne, clover and medics within the temperate legume

category, reflecting the source of industry funding. The projects are allocated into sub-sets along product lines within each classification.

Industry development

Three projects fall clearly in the category of industry development. Evaluation of these types of industry development projects is difficult as the impact is diffuse and usually indirect.

- The development of the five year plan (MS967-36) should guide R&D to provide improved outcomes for the industry. It is not clear that the plan has had any particular impact on decision making.
- Two projects, a workshop on tropical and subtropical seeds (MS967-47) and support for a meeting on native seeds (STL-1A), focused on improving information on these types of seeds. The output is assessed as fairly low.

Production

Management systems

There are five projects which fall into this classification. They focus on improving production systems to raise productivity. Where the projects have had a quantifiable output and adoption rates are known or can be easily estimated, the impact of the projects is relatively easy to assess as a supply side effect. The impact of individual projects can be difficult to assess where projects with similar objectives occurred, so assessment as a set may be desirable. The sets are defined along product lines.

- There are two projects that focus on lucerne production. IPB-1A is the development of production systems, including the selection of high performance varieties. It is too early to assess the outputs of this project. DAN-75A is a technical and communication project that aims to increase adoption of improved management practices. Its impact is uncertain. Both these projects fall under the export and import replacement objective as lucerne seed is a major export.
- SAR-11A develops improved management practices for irrigated seed production, predominantly lucerne seed. This project has environmental objectives as well as production objectives. It is too early to assess the output of the project.
- The two projects DAN-76A and DAV-144A should be assessed together as the latter builds on the work in the former which developed a system to improve the profitability of clover and subclover seed production. It is too early to assess the output of the second project and the first is seen as an input rather than providing stand-alone outputs.
- The project SED-2A also focuses on developing management systems for clover. The focus of the project is on white clover for export.
- SBS-1A investigates seed production systems for *Vigna parkeri*. This seed is thought to have potential for export and import replacement. This project has been delayed by drought so the output is uncertain.

Other production

There are two projects that investigate other aspects of production. Both have environmental objectives.

- DAQ-148A develops better methods for handling chaffy grass seeds. These seeds are important for establishing pasture in dry areas with poor soil. The output of the project is assessed as low.
- HS-1A follows on from SBS-1A in that it develops harvesting systems for *Vigna parkeri*.

Disease

- There are two disease projects for lucerne. DAS-32A is a scoping study of the Alfalfa mosaic virus. It provides information on the extent of the virus, which is an input into future R&D decisions rather than an output with a separate impact. US-75A is a scoping study of lucerne yellows disease. Like the previous project, it is an input rather than stand-alone output. A follow-on project is proposed. Neither project can easily be evaluated as stand-alone project.
- For clover there are two stand-alone projects investigating control of disease. DAS-33A focuses on control of rhizotonia burr rot. The output is assessed as good. DAV-94A explores the management of *Phytophthora* root rot. The output of this project feeds into a proposed follow-on project rather than having stand-alone value.

Weed control

- There are three projects that investigate weed control in temperate legumes. ARM-1A reviewed weed control. It would have been an input into the other projects, but it also had a final output, which has been assessed as good. UA-27A investigates herbicide failure and the development of alternative weed management systems. This project is assessed as good. DAN-163A explores weed control systems for some of the new legumes being developed. It is too early to assess the output.
- The project on control of ryegrass in perennial seed crops (FAR-1A) is unlikely to have an output due to unfortunate circumstances.
- BBR-1A supported a conference on herbicide resistant crops. It falls under the communication objective. The impact of such improvement in knowledge is difficult to assess.

Pest control

There is one project on pest control.

- DEB-1A investigates management lucerne seed wasp. It is too early to assess the output.

New products

There are three sets of projects that have concentrated on developing new products, These projects satisfy the objective of export and import replacement.

- SED-3A and the follow-on project SED-8A have developed a number of new legumes suitable for export. The output is assessed as good, with plant breeding rights on six or seven varieties. An evaluation of the impact should be relatively easy if sales figures are available.
- DAW-50A selected high yielding seed legumes. While not clearly as successful as the first set, the output is assessed as good. New varieties have yet to be commercialised and field trials are being conducted in UWA-30A, a project in the fodder crops program.
- Two projects DAS-20A and DAS-31A have focused on developing cold tolerant annual medics. Little information is available on DAS-20A. The outcome of the two projects is assessed as good. The subsequent value of production in export markets is unknown.

Marketing

Technical and communication

A number of projects have focused on increasing demand for seed by improving the information available to fodder crop improved pasture producers. By assisting these producers to increase the productivity in these activities, the demand for seed should increase. All these projects are reasonably complex to evaluate as they require estimating the derived demand relationship.

- SED-4A and UA-24A are market research projects on the consumers of seed. These aim to improve seed producers' understanding of demand and also to provide background for tailoring information campaigns to increase demand. The outputs of both projects are assessed as good. Both would be quite complex to evaluate and difficult to evaluate alone.
- CMS-1A developed strategies to establish dryland lucerne. The output was assessed as good.
- DAV-106A is similar to CMS-1A and is assessed as good.
- KDI-7A is a publication on pasture establishment and management. It has been well received and has sold over 3000 copies, so is the outcome assessed as good.
- DAW-60A follows on from DAW-36A in field testing and extension work on rhizobia strains. This improved fungi raises productivity in pasture growth and adoption will encourage expansion of improved pastures. The outcome is assessed as good.
- CSP-5A is a stand-alone project related to DAW-36A in that funding was provided to catalogue and preserve a collection of rhizobia strains that would otherwise have been destroyed. This preserves information for future use.

Quality assurance

- Tests for bacterial wilt are being developed in SAR-10A. These tests have strategic value as the toxins produced by the bacteria are dangerous, and discovery of the bacteria may threaten to close export markets.
- SED-6A investigated seed certification schemes in other countries. It is considered an important source of information in discussions on the further development of seed certification schemes in Australia.

Evaluation

Table 8.4 summarises the expected outputs and outcomes from the projects.

8.4a Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Product</i>	<i>Five year plan objective</i>	<i>Classification</i>	<i>Spillovers</i>
ARM-1A	Review of weed control in lucerne medics and subclover seed crops	Temperate legumes	Production	Weed control	Environment
BRR-1A	Support for a conference on herbicide resistant crops and pastures	Industry	Communication	Weed control	
CMS-1A	Strategies to successfully establish and manage a dryland lucerne stand	Lucerne	Technical and communication	Marketing - domestic	Environment - dryland salinity
CSP-5A	The Australian collection of rhizobium strains for temperate legumes	Lucerne	Production	Marketing - domestic	
DAN-163A	Development of new alternative legumes and appropriate weed control technology	Temperate legumes	Production	Weed control	
DAN-75A	Lucerne seed check: a management support system	Lucerne	Technical and communication	Management systems	
DAN-76A	Developing an agronomic package to maximise profitability of subclover seed crops	Subclover	Production	Management systems	
DAQ-148A	Improved handling of chaffy grass seeds	Tropical and subtropical seed	Environmental	Production	Environment
DAS-31A	Development of export markets for cold tolerant annual medics	Medics	Export and import replacement	New product	
DAS-32A	Alfafa mosaic virus survey in lucerne and medic seed and development of rapid tests	Lucerne, medics	Production	Disease	
DAS-33A	Control of rhizoctonia burr rot of subterranean clover	Clover	Production	Disease	
DAV-106A	A model for expansion of the Australian domestic temperature pasture seed market	Lucerne	Technical and communication	Marketing	
DAV-144A	Improved seed production: 'Towards 1.5 tonnes'	Clover	Production	Management systems	
DAV-94A	Management of Phytophthora root rot in subterranean clover for a viable pasture seeds industry	Clover	Production	Disease	
DAW-36A	Developing effective rhizobial inoculants for lucerne in WA	Lucerne	Production	Marketing - domestic	
DAW-50A	Development of alternative pasture legumes for use in medium rainfall agricultural regions with untapped subsurface water	Temperate legumes	Export and import replacement	New product	Environment
DAW-60A	On-farm evaluation of the adaptation, distribution and potential value of lucerne in Western Australia	Lucerne	Technical and communication	Marketing	Environment
DEB-1A	Evaluating and managing lucerne seed wasp in lucerne seed crops	Lucerne	Production	Pest control	

Continued on next page

8.4a Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Product</i>	<i>Five year plan objective</i>	<i>Classification</i>	<i>Spillovers</i>
FAR-1A	Development of strategies to control annual ryegrass in perennial grass seed crops	Perennial grass seed	Production	Weed control	
HS-1A	The development of a more effective harvesting method for shaw creeping Vigna (Vigna parkeri)	Vigna parkeri	Environmental	Production	
IPB-1A	Evaluation of lucerne varieties for seed yield and strategies to enhance seed productivity	Lucerne	Export and import replacement	Management systems	
KDI-7A	Pasture establishment and management publication	Industry	Technical and communication	Marketing - domestic	
MS967-36	Pasture seeds five year plan	Industry	Other	Industry development	
MS967-47	Tropical and subtropical seeds R&D workshop	Tropical and subtropical seed	Broadening program	Industry development	
SAR-10A	Development of a bacterial wilt test to facilitate the export of lucerne seed	Lucerne	Export and import replacement	Marketing - quality assurance	
SAR-11A	Improved irrigation practice and crop diversification for the irrigated pasture seed industry	Temperate legumes	Production	Management systems	Irrigated seed
SBS-1A	Seed production of Vigna parkeri	Vigna parkeri	Export and import replacement	Management systems	
SED-2A	Developing management systems for European varieties of white clover for multiplication in Australia and re-export	Clover	Export and import replacement	Management systems	
SED-3A	Development of varieties of four species of fodder legumes for sowing seed export	Temperate legumes	Export and import replacement	New product	
SED-4A	Nationwide survey of consumer demand for temperate pasture seeds	Temperate legumes	Technical and communication	Marketing - domestic	
SED-6A	Alternative seed certification schemes in Europe and USA for adoption in Australia	Industry	Quality assurance	Marketing - quality assurance	
SED-8A	Development of varieties of six species of fodder legumes for sowing seed and hay export	Temperate legumes	Export and import replacement	New product	
STL-1A	Support for native grass seeds meeting	Industry	Communication	Industry development	
UA-24A	Survey to determine demand factors in pasture legume seed usage in Australia	Temperate legumes	Technical and communication	Marketing - domestic	
UA-27A	Herbicide failure and the need for integrated weed management in legume pasture seed crops	Temperate legumes	Production	Weed control	
US-75A	Occurrence and severity of 'lucerne yellows' disease in lucerne seed crops	Lucerne	Production	Disease	

Source: Program managers and CIE assessment.

8.4b Initial assessment of completed and continuing projects

<i>Project no.</i>	<i>Project title</i>	<i>Stage</i>	<i>Related projects</i>	<i>Initial assessment</i>
ARM-1A	Review of weed control in lucerne medics and subclover seed crops	I	Stand alone	Medium

BRR-1A	Support for a conference on herbicide resistant crops and pastures	I	Stand alone	Low
CMS-1A	Strategies to successfully establish and manage a dryland lucerne stand	III	Stand alone	Medium
CSP-5A	The Australian collection of rhizobium strains for temperate legumes	II	DAW-36A DAW-60A CSP-5A	Medium
DAN-163A	Development of new alternative legumes and appropriate weed control technology	II	DAN-76A DAN-163A	Too early
DAN-75A	Lucerne seed check: a management support system	II	Stand alone	Medium
DAN-76A	Developing an agronomic package to maximise profitability of subclover seed crops	II	DAN-163A DAV-144A	Medium
DAQ-148A	Improved handling of chaffy grass seeds	II	Stand alone	Low
DAS-31A	Development of export markets for cold tolerant annual medics	II	DAS-20A DAS-31A	Medium
DAS-32A	Alfalfa mosaic virus survey in lucerne and medic seed and development of rapid tests	I	Stand alone	Medium
DAS-33A	Control of rhizoctonia burr rot of subterranean clover	II	Stand alone	Medium
DAV-106A	A model for expansion of the Australian domestic temperature pasture seed market	II	Stand alone	Medium
DAV-144A	Improved seed production: 'Towards 1.5 tonnes'	II	DAN-163A DAV-144A	Too early
DAV-94A	Management of Phytophthora root rot in subterranean clover for a viable pasture seeds industry	II	Follow on required	Too early
DAW-36A	Developing effective rhizobial inoculants for lucerne in WA	II	DAW-36A DAW-60A CSP-5A	Medium
DAW-50A	Development of alternative pasture legumes for use in medium rainfall agricultural regions with untapped subsurface water	I	DAW-50A UWA-30A (Fodder crops project)	Low
DAW-60A	On-farm evaluation of the adaptation, distribution and potential value of lucerne in Western Australia	II	DAW-36A DAW-60A CSP-5A	Medium
DEB-1A	Evaluating and managing lucerne seed wasp in lucerne seed crops	II	Stand alone	Too early
FAR-1A	Development of strategies to control annual ryegrass in perennial grass seed crops	II	Stand alone	No output
HS-1A	The development of a more effective harvesting method for shaw creeping Vigna (Vigna parkeri)	II	SBS-1A HS-1A	Too early
IPB-1A	Evaluation of lucerne varieties for seed yield and strategies to enhance seed productivity	II	Stand alone	Too early
KDI-7A	Pasture establishment and management publication	III	Stand alone	Medium
MS967-36	Pasture seeds five year plan	I	Stand alone	Low
MS967-47	Tropical and subtropical seeds R&D workshop	II	MS967-47 STL-1A ZZZ-78A	See STL-1A
SAR-10A	Development of a bacterial wilt test to facilitate the export of lucerne seed	II	Stand alone	Strategic value
SAR-11A	Improved irrigation practice and crop diversification for the irrigated pasture seed industry	II	Stand alone	Too early
SBS-1A	Seed production of Vigna parkeri	II	SBS-1A HS-1A	Delayed by drought
SED-2A	Developing management systems for European varieties of white clover for multiplication in Australia and re-export	II	Stand alone	Medium

Continued on next page

8.4b Initial assessment of completed and continuing projects

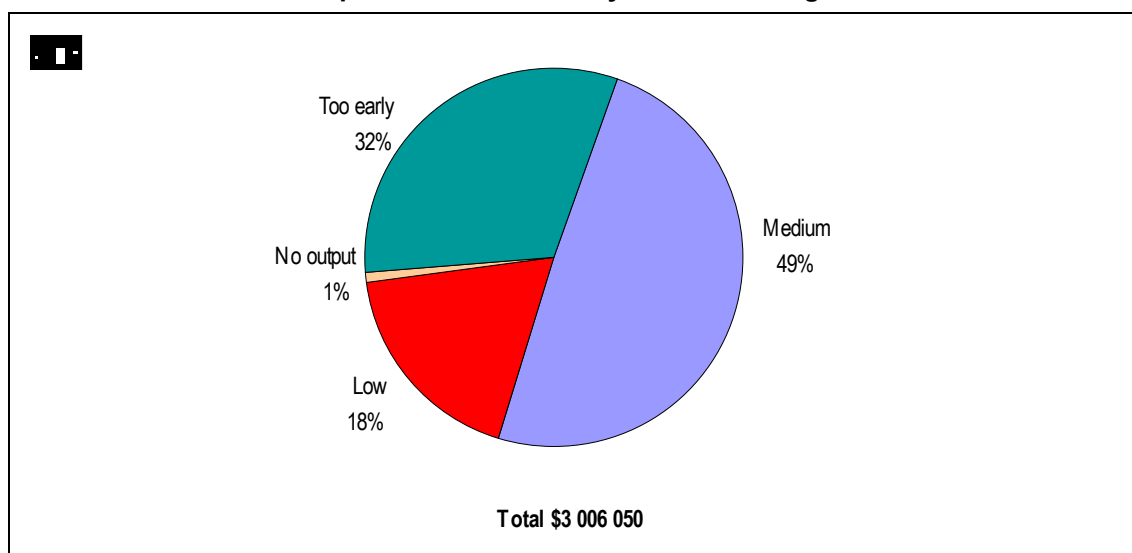
<i>Project no</i>	<i>Project title</i>	<i>Stage</i>	<i>Related projects</i>	<i>Initial assessment</i>
SED-3A	Development of varieties of four species of fodder legumes for sowing seed export	II	SED-3A SED-8A	Medium
SED-4A	Nationwide survey of consumer demand for temperate pasture seeds	I	SED-4A UA-24A	Medium
SED-6A	Alternative seed certification schemes in Europe and USA for adoption in Australia	II	Publication	Medium
SED-8A	Development of varieties of six species of fodder legumes for sowing seed and hay export	II	SED-3A SED-8A	Medium
STL-1A	Support for native grass seeds meeting	I	MS967-47 STL-1A ZZZ-78A	Low
UA-24A	Survey to determine demand factors in pasture legume seed usage in Australia	I	SED-4A UA-24A	Medium
UA-27A	Herbicide failure and the need for integrated weed management in legume pasture seed crops	II	Stand-alone	Medium
US-75A	Occurrence and severity of 'lucerne yellows' disease in lucerne seed crops	II	Follow on expected	Too early

Source: Program managers and CIE assessment.

Overall, the assessment is good with few projects not having met their objectives. Chart 8.5 summarises the expected outcomes if adoption is high and current prices and costs maintained.

The value of the outputs in terms of their impact is largely difficult to assess. Little is known about adoption rates within the industry and still less about adoption in the improved pastures and fodder crops which are the domestic market for seed. Supply, at least of lucerne seed, is limited by production constraints, due mainly to better alternative crops. This suggests that projects focused on reducing the unit of production are important for industry survival. To the extent to which seed prices are impacted by quality, or higher priced seed can be targeted, projects in these areas will also be important.

8.5 Initial assessment of potential outcomes by RIRDC funding



Data source: Program managers and CIE assessment.

Recommendations for evaluation

Most of the project sets are difficult to evaluate. There are three project sets that are suitable for evaluation in this round.

- SED-3A and SED-8A should be relatively easy to evaluate given the commercialisation of the new varieties developed in the projects.
- DAS-33A should be a relatively easy project to evaluate if information on the extent and cost imposed by the disease is available.
- SAR-10A is an interesting project to evaluate as it has strategic value. It would be in the mid-range of complexity, requiring the development of an understanding of the substitution between seeds and other crops in production, and between different seeds and seed sources in consumption.