

AUSTRALIAN EGG
CORPORATION LIMITED



Australian Egg Corporation Limited
Submission to the
Productivity Commission Inquiry
into
Rural Research and Development
Corporations

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Abbreviations

AECL	Australian Egg Corporation Limited
ACEP	Australian Council of Egg Producers
AEIA	Australian Egg Industry Association
AEMC	Australian Egg Marketing Council
AGM	Annual General Meeting
AHA	Animal Health Australia
AICD	Australian Institute of Company Directors
APL	Australian Pork Limited
ASIC	Australian Securities & Investments Commission
ASX	Australian Stock Exchange
AWBC	Australian Wine & Brandy Corporation

AWI	Australia Wool Innovation
BCR	Benefit Cost Ratio
CBA	Cost Benefit Analysis
CCRDC	Council of Rural Research and Development Corporations
CPI	Consumer Price Index
CRC	Co-operative Research Centre
CRDC	Cotton Research & Development Corporation
CSA	Chartered Secretaries Australia
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Dairy Australia
FRDC	Fisheries Research & Development Corporation
FSANZ	Food Standards Australia New Zealand
FWPA	Forest & Wood Products Australia
GRDC	Grains Research & Development Corporation
HAL	Horticulture Australia Limited
ICC	Industry Consultative Committees
IEC	International Egg Commission
IOC	Industry-Owned Corporation
IP	Intellectual Property
LiveCorp	Australian Livestock Export Corporation
LRS	Levies Revenue Service
MLA	Meat & Livestock Australia
NGO	Non-Government Organisation
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
PC	Productivity Commission
RDC	Research and Development Corporation
RD&E	Research, Development and Extension
RIRDC	Rural Industries Research Development Corporation
ROI	Return On Investment
SFA	Statutory Funding Agreement
SME	Small to Medium-sized Enterprise
SRDC	Sugar Research & Development Corporation

1. Introduction

The Australian Egg Corporation Limited (AECL) is pleased to make the following submission to the Productivity Commission (PC) Inquiry into rural Research and Development Corporations (RDCs). This submission should be read in conjunction with the submission made by the Council of Rural Research and Development Corporations (CRRDC). The submission follows the structure of the PC Issues Paper and addresses the key areas of interest to the egg industry.

2. Executive Summary

AECL is a public non-listed company, which commenced operations on 1 February 2003. The company is Australian egg producer-owned and undertakes marketing, RD&E and policy services for the benefit of stakeholders who contribute financially to the AECL business. AECL is a strong supporter of the current Research and Development Corporation (RDC) model and believes ongoing Government investment in egg RD&E is critical to the continued vibrancy and sustainability of the egg industry.

Egg industry RD&E achieves significant public benefits which would not be possible if Government was to scale back funding. Public benefits were produced across several research clusters including salmonella and public health, cannibalism control, consumer sensory research and ullage audit solutions development and implementation.

Independent evaluation shows that 72% of AECL R&D project investments have delivered benefits for egg producers and 65% have also delivered outcomes for the Australian community. Most RD&E investments have been directed toward outcome-oriented projects that can be used in, or are associated with egg production with a project total of 68% targeting animal health and/or welfare issues. Market support and supply chain projects have generated an average cost benefit ratio of 12.6. That is, for every dollar invested by AECL, the egg industry and the broader community receive \$12.60 in return over an agreed timeframe.¹

The egg industry is facing a number of challenges which make the need for good science all the more critical. These challenges include declining public support for rural RD&E and increasing non economic pressure on the industry in terms of scrutiny by animal rights activists. Compounding these challenges is the increased cost of service provision from research institutions, scientists and contractors/consultants. Government support for a vibrant industry specific RDC is critical to respond to these challenges.

¹ AgEconPlus (2008) AECL R&D Program Evaluation, stage 1 and 2 analysis

AECL is a model of good corporate governance and is committed to efficiency and cost effective operations. Recent benchmarking data prepared by AECL indicates AECL's corporate cost amount to approximately 8.5% of revenue, as compared to the industry average of 22.7%. AECL is committed to increasing its efficiency and has investigated opportunities to project to share overheads and co-locate with other RDCs.

AECL has close ties with the egg industry and is well positioned to ensure research findings are implemented at all stages of the production chain. This gives RDCs like the AECL an advantage over other research bodies such as universities and the CSIRO which may not have the benefit of these close links to industry.

AECL believes that while the current RDC model is not in need of significant change, it could be enhanced in the following ways:

- **Recommendation One:** A new funding model be implemented to increase the commitment, transparency, measurability and accountability of real public benefit flowing from R&D matching funds from Government.
- **Recommendation Two:** Government to streamline and more clearly enunciate the process for RDCs to apply for R&D levy increases to enhance operating efficiency and the delivery of an appropriate business case.
- **Recommendation Three:** Government funding for rural RD&E be increased to compensate for increased financial pressure faced by the industry and in recognition of the public good achieved by this funding.
- **Recommendation Four:** RDCs to report against an agreed set of governance principles such as either the OECD Principles of Corporate Governance or the Australian Stock Exchange (ASX) corporate governance standards to improve transparency, accountability and compliance within the sector.
- **Recommendation Five:** RDCs to report on the methods and processes used to set executive salaries in annual remuneration reports.
- **Recommendation Six:** All RDCs which perform an industry representation role to ensure appropriate arrangements are in place (as in the AECL) to avoid any real or perceived conflict of interest.

3. Egg Industry Profile

The Australian egg industry is a small but dynamic, market-responsive industry within Australia's agri-food sector. The domestic industry's Gross Value of Production (GVP), at farm-gate, in 08/09 was A\$413 million with the gross value of production at market totalling A\$1.539 billion during 2009. In total, there were 309 egg farms as at June 2009 which

carefully managed in excess of 20 million hens as at December 2009 with a production total of 345 million dozen eggs based on a lay rate of approximately 23 eggs per month. Egg production occurs across all Australian states and territories.

The Australian egg industry is characterised by a small number of hatcheries supplying a larger number of egg producers with day-old chicks for rearing or pullets as point-of-lay birds. Currently, there are 14 commercial hatcheries with the top 4 representing over 96% of hatchery production and the top 50 egg producers representing nearly 80% of national egg production.

The Australian egg industry is an important contributor to the domestic economy and local communities in terms of GVP, employment, Small to Medium sized Enterprise (SME) viability and food safety/security. For these reasons alone, it is crucial that the Australian egg industry prospers and remains viable into the future.

New South Wales, including the ACT, and Queensland are the largest egg producing jurisdictions with each possessing 31% and 27% respectively of the nation's layer flock with Victoria possessing 25%. The remaining states and one territory contain smaller populations of the national layer flock with Western Australia constituting 9%, South Australia and the Northern Territory 7% and Tasmania representing 1% of the national flock.

A 'typical' egg producer

The 'typical' egg producer is a small family-run farm with around 15,000 hens. Most egg producers sell their eggs at the farm-gate and distribute to local corner shops, cafes, greengrocers, butchers, restaurants, farmers markets or a combination of these. The typical egg producer is unable to get the volume discounts for feed, day-olds or pullets and egg packaging which may otherwise be available to larger egg producers. Egg producers are time poor with either a husband and wife team or with one partner working a job and the other running the business. Most egg producers will employ casual labour for egg collection, grading, packing and distribution.

The egg industry faces considerable emotional scrutiny of its production methods, driven by animal rights, not economic, scientific or productivity issues. AECL is committed to responding to this scrutiny to ensure the industry is able to present consumers with information to make informed purchasing decisions and equip egg producers to better assess their individual operating and investment decisions. The emergence of a three tiered marketing approach whereby eggs from different production systems are separately labelled and marketed is a response to these different market demands. The three main production systems used are cages, barns and the open-range respectively termed cage, barn-laid, and free range. As per

the government-endorsed Model Code of Practice for the Welfare of Animals – Domestic Poultry the following definitions are used:

- Cage systems: Birds in cage systems are continuously housed in cages within a shed.
- Barn systems: Birds in barn systems are free to roam within a shed which may have more than one level. The floor may be based on litter and/or other material such as slats or wire mesh.
- Free range systems: Birds in free-range systems are housed in sheds and have access to an outdoor range.

Market research and extension activities are therefore a critical part of the activities undertaken by AECL to respond to these non-economic pressures and ensure the ongoing viability and sustainability of the egg industry.

Aside from the birds themselves, the major inputs into egg production are fixed assets such as housing, which incorporate feeding and watering systems, as well as egg collection, manure collection, environmental control systems, storage facilities and grading/packing machines. Variable costs include stock feed, vaccines, labour, packaging and other costs associated with distribution and sales. An industry profile and 'schematic' of the supply/demand chain is at Appendix 1.

4. About AECL

AECL was established under the Egg Industry Service Provision Act 2002 (the Act) and was registered with the Australian Securities & Investments Commission (ASIC) during November 2002. AECL is principally funded through a Laying Chicken statutory levy and a Promotion statutory levy collected under the Act.

The Promotion levy has not changed since commencement of AECL in February 2003 and is currently 32.5 cents per chick purchased for egg production and is levied on egg producers for egg marketing and promotion purposes. Disbursements of this levy represent approximately 67% of total AECL gross revenue.

The Laying Chicken levy has been in place since 1990 and was initially set at 5.75 cents per chick purchased. It increased to 6.9 cents in 1993 and again to 7.2 cents in 1998. A further increase to its current level of 10 was endorsed by the egg industry and the Australian Government during late 2009. An increase to 13.5 cents per chick purchased has recently been approved by the Minister, with a Bill currently before Parliament to give effect to this decision. The Laying Chicken levy is levied for agreed Research, Development & Extension (RD&E) activities. The Australian Government contributes financially to AECL through

matching RD&E investments and is therefore a large stakeholder. Disbursements of this levy in 09/10 represented 15% of total AECL gross revenue.

The principal stakeholders of AECL are levy-paying egg producers who distribute a range of egg products to the Australian market and the Australian Government who matches expenditure on agreed R&D projects/activities. AECL has an agreed 3-year Strategic Plan which facilitates the company's cooperative work with supply chain partners and external service providers to achieve the objectives and strategies for the benefit of all stakeholders.

AECL is the second smallest RDC and has limited resources relative to other RDCs in larger and therefore better-resourced industries. For example, AECL has an annual operating budget of approximately \$6 million and the next smallest RDC is Australian Pork Limited (APL) with an annual operating budget of approximately \$20 million. As a small RDC, AECL is particularly vulnerable to market fluctuations and pressure from non-economic forces, making ongoing Government investment critical.

The egg industry's R&D portfolio, managed by AECL since its inception in February 2003, has supported 130 projects with a total expenditure of \$21 million (including projects commissioned by the former egg industry's portfolio manager, RIRDC), since 2000. AECL, and RIRDC before them, have contributed 44% of the funds for these projects while others, including research institutions, have made up the balance.

Of every \$1 million invested in the egg industry R&D portfolio, egg producers have contributed approximately \$500,000 and the Australian Government, through matching levy payments, has contributed the balance. For an outlay of approximately \$4.4 million, the egg industry has been able to manage a \$21 million egg R&D portfolio.

AECL has allocated R&D investments under nine major headings demonstrated in Figure 1 below. The most significant areas of investment have been:

- Flock health and disease management (37%);
- Feed availability and nutrition (25%); and
- Hen husbandry and welfare (16%).

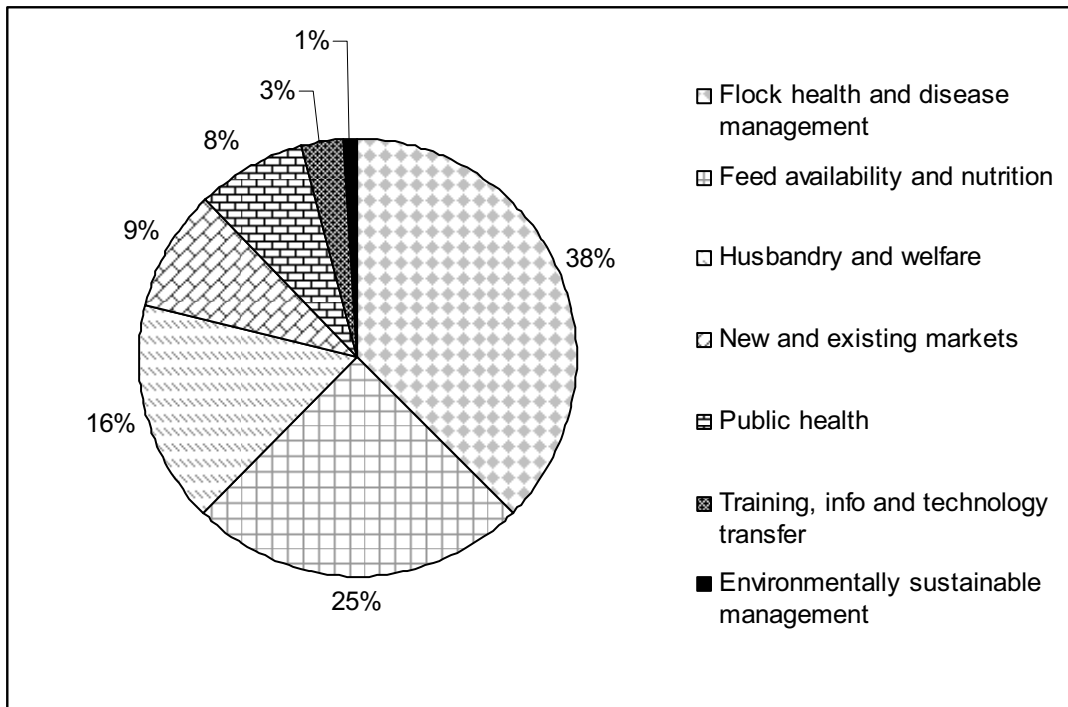


Figure 1: AECL R&D Investment Categories
 Source: AgEconPlus Pty Ltd analysis of AECL database

5. Rationale for Government Funding Support

AECL believes the significant public benefits flowing from egg RD&E coupled with the inability of the private sector to compensate for any scaling-back makes a compelling case for sustained Australian Government support. AECL believes Government funding needs to be maintained at current levels (as a minimum) and that an increase would be beneficial to the community, which includes the egg industry.

5.1 Non-Economic Pressure

The market for eggs is distorted by non-market forces, with intense scrutiny by animal welfare organisations, animal rights activists and consumer advocates. Independent market research conducted by AECL shows that a high proportion of consumers associated cage production with hen cruelty and lack of hygiene, see Figure 2. Consumers also tended to overestimate the level of density in cage egg production and had a more negative perception of the larger egg producers.² AECL needs to be adequately resourced to maintain an R&D portfolio of robust and repeatable science to respond to these concerns to ensure the ongoing viability of the egg industry.

Other concerns include food safety and the link between outbreaks of Salmonellosis in the community and eggs. According to R&D undertaken by AECL, while some food safety links

² Industry perceptions research study, Julie Dang & Associates Pty Ltd, March 2010.

are justified, others are not due to the poor handling, storage and processing of eggs that is practiced done post-farm gate.

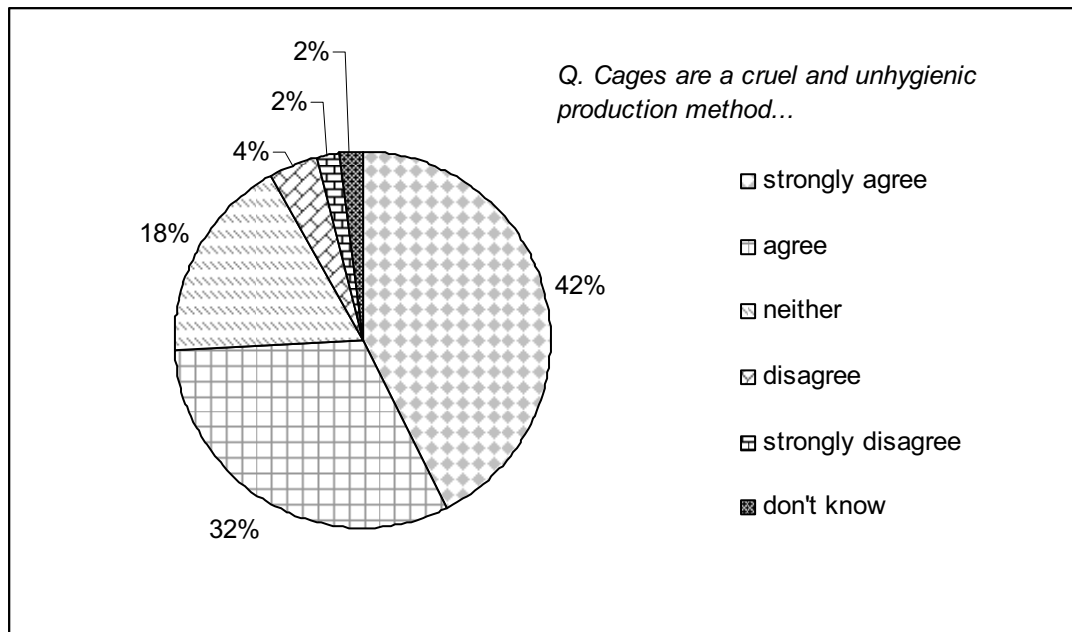


Figure 2: High level of consumer association between hen cruelty and lack of hygiene
 Source: Industry perceptions research study, Julie Dang & Associates Pty, Ltd, March 2010.

The impact of animal welfare on this non-economic pressure is also evident in that eggs are the only product which displays production methods on packaging for consumers (ie. all eggs are clearly labelled as being produced under the cage, barn or free range methods). Consumer concern about animal welfare has therefore had a very real impact on the egg industry which is yet to be seen to the same degree in other industries.

Crikey Coverage

The level of scrutiny faced by the egg industry is demonstrated in recent coverage by *Crikey* which criticised proposed changes by AECL whereby the number of free range birds per hectare may increase and the inclusion of beak trimming maintained. This demonstrates difficulty associated with introducing scientifically justified improvements in this environment.
 Source: *Crikey*, 23 June 2010
<http://www.crikey.com.au/?p=147765#com>

5.2 Existence of Market Failure

The small and geographically disparate nature of the egg industry makes it near impossible to generate adequate R&D funds without Government investment and extremely difficult for the private sector to step in and replace the current investment provided by Government:

- o *The nature and dispersal of RD&E program benefits are such that a private investor would not profit from supplying them (LRS, 2007).*

Historic and structural changes to egg industry marketing, including the demise of state-based egg boards, has compounded this situation resulting in limited, if any, RD&E programs being

conducted by industry stakeholders, especially RD&E programs with a substantial public benefit.

Industry-agreed RD&E priorities are concerned with flock health research, exotic disease management, environmental stewardship, building egg demand, food safety, animal welfare, the egg supply chain, training/extension, information exchange, technology transfer and so on. These RD&E priorities require large-scale investment, generate sector-wide benefits, are diffuse in nature and make a positive contribution to the Australian community through ongoing productivity growth leading to sustainable industry development and community benefit.

Should Government funding be withdrawn or reduced, egg industry priorities would need to be reassessed and, in time, an inability of the industry to fund critical priorities would threaten the productivity and sustainability of egg production in Australia having a direct impact on communities and the role eggs can play in addressing a number of key social health and nutrition issues.

5.3 Public Benefits of Egg Industry RD&E

Government support for egg industry RD&E is worthwhile due to the substantial public benefit flowing from this investment, including benefits to human health and nutrition, animal welfare and food safety.

Public good has the following key characteristics:

- *First, the use of a public good by one person generally does not affect the ability of others to use it. This is described as being 'non-rival'. Non-rivalry means that one person's benefit does not reduce the benefit available to others, hence encouraging 'free riding' by individuals who realise that they can benefit from production of the good as long as somebody else is paying for the good (LRS, 2007).*
- *Second, it is not possible to prevent others from using it. This is described as non-excludability. Non-excludability means that there is no effective way of excluding individuals from the good, once it comes into existence (thereby creating the 'free rider' problem). Lack of excludability discourages individuals from producing a good, no matter how much others value it (LRS, 2007).*

In light of this, AECL would encourage the Productivity Commission to adopt a holistic perspective when considering the issue of public and private good, rather than a purely economic stance.

AECL commissioned an independent evaluation by AgEconPlus Pty Ltd of both the complete research portfolio and a Cost Benefit Analysis (CBA) of four project clusters.³ The evaluation examined:

1. The scale and scope of the returns levy payers, hatcheries and egg producers, received on the Laying Chicken levy funds they contribute to AECL;
2. The scale and scope of returns to the Australian public (net benefit) or Government-matched funds invested in the egg industry through AECL; and
3. The capacity and incentive for the egg industry to invest in egg-related R&D in the absence of the existing levy and matching dollar contribution by the Australian Government.

The evaluation reveals that 72% of R&D project investments have delivered benefits for levy payers and 65% have also delivered outcomes for the Australian community. The evaluation also shows that most RD&E investments have been directed toward outcome-oriented projects that can be used in, or are associated with, egg production. A project total of 68% has targeted animal health and/or welfare issues.

Welfare of Laying Eggs in Cages

AECL conducts ongoing R&D to improve egg industry knowledge about hen welfare. An example is the recent research, currently underway, investigating the use and adoption of nests for laying hens by closely studying and analysing hen behaviour.

Projects have also been completed in both basic research and extension with 25% of projects targeting vaccine development and 6% targeting egg producer education and training.

Market support and supply chain projects have generated an average cost benefit ratio of 12.6. That is, for every dollar invested by AECL, the egg industry and the broader community receives \$12.60 in return over an agreed timeframe.

³ AECL R&D Program Evaluation, stage 1 and 2 analysis, AgEconPlus Pty Ltd, 2008

According to the science to date, if investment in any of these areas succeeds in changing consumer attitudes towards Australian eggs, for example, then egg industry and community (and participants in the supply chain) will benefit.

In the Australian egg industry, examples of non-excludable public goods include RD&E into human dietary issues associated with egg consumption, environmental stewardship and the egg industry's carbon footprint, hen welfare, building egg demand, enhancing the supply chain/egg distribution system and generic food safety initiatives.

Egg Nutrition Roundtable Report for Health Professionals

In July 2009, a group of Australian healthcare professionals gathered to review available research on the nutritional contribution of eggs and their recommended weekly consumption.

The roundtable examined many of the myths about eggs, including the relationship between eggs and serum cholesterol, coronary heart disease and fat content.

The roundtable looked at the benefits of egg consumption at different life stages (such as for expectant mothers, children and adolescents, adults and older Australians) and disease states.

The benefits of egg consumption for a range of health conditions were also considered, including obesity, eye diseases such as macular degeneration, diabetes and coronary heart disease.

These findings provide consumers with greater clarity and confidence about the health benefits of eggs and the role eggs can play in preventing or alleviating many social health conditions.

This is partly due to the perceived homogeneity of hens and eggs among supply chain customers and the ultimate consumer, the commoditisation of egg production and the uniform animal husbandry practices within production systems associated with raising laying hens.

Much of the egg industry's RD&E investment is directed at public good research in a cross-industry and collaborative fashion, the benefits of which cannot be captured by any one egg producer investing on their own.

5.4 Case Study: Salmonella Public Health Cluster

The strength of public benefits from egg industry RD&E can be found in AECL's research into the prevention and detection of Salmonella. An independent evaluation conducted by AgEconPlus Pty Ltd⁴ found that the benefits received by the Australian community through improved health outcomes associated with the Salmonella control cluster, on its own, has been sufficient to justify public investment in the total R&D portfolio.

AECL's investment of R&D levies in the salmonella public health R&D cluster has resulted in:

- Knowledge from a baseline survey of the prevalence of salmonella in Australian layer flocks and the infection pathways between the laying hen and the egg;

⁴ AECL R&D Program Evaluation, stage 1 and 2 analysis, AgEconPlus Pty Ltd, 2008

- Assurance that the virulent salmonella form, *S. Enteritidis*, which is highly problematic in Europe and the USA, has limited prevalence in Australia;
- Improved awareness, monitoring and control strategies for *S. Enteritidis*;
- A new diagnostic test that is able to distinguish non-virulent from virulent salmonella strains;
- A dose response model that is able to assess the impact of food industry practices on the occurrence of salmonella in eggs and egg products; and
- A national risk assessment for eggs and egg products the recommendations from which have been incorporated into new National Food Standards, subsequent state legislation and egg industry food safety programs.

These outcomes have contributed to a reduction in food borne illness due to egg consumption. Outcomes from this cluster of research have been taken up by FSANZ and incorporated into Australia New Zealand Food Standard 2.2.2 and also shaped the National Food Safety Standard for Eggs and Egg Products. Subsequently state-based food authorities have implemented Australia New Zealand Food Standard 2.2.2 through state-based legislative responses and overseen the implementation of food safety programs in egg businesses and the supply chain where this has been warranted (for example Food Safety Scheme for Eggs and Egg Products in Queensland and the Egg Food Safety Scheme under development in NSW as part of the new NSW Food Act).

Research implementation will result in a reduction in food borne illness in Australia due to egg consumption.

<i>Key Parameter</i>	<i>Net Present Value (5% discount rate)</i>	<i>Benefit Cost Ratio (1:x)</i>	<i>Internal Rate of Return</i>
Food Safety program 'life' of 5 years	\$6 million	1.37	154%
Food Safety program 'life' of 15 years	\$15 million	1.43	156%
Food Safety program 'life' of 20 years	\$18 million	1.43	156%

Figure 3: Cost Benefit Analysis, Salmonella Control in Eggs for Public Health Benefits

Source: AgEconPlus Pty Ltd analysis

AECL's work in Salmonella provides a strong example of the public benefits associated with egg industry RD&E. More information on this research cluster is at Appendix 2.

5.5 Case Study: Cannibalism Control in Layers – Diet, Microbes and Fibre

AECL has also conducted research into cannibalism, the behaviour where birds start pecking or eating flesh of other birds. This was a major problem for the Australian layer industry. Prior

to the commencement of this study, mortality from cannibalism in some strains ranged from 10% to 20%, depending on the production system and management strategies employed (Cumming *et al.*, 1998). The objectives of this project were to:

- Examine the interaction between diet composition and the incidence of cannibalism;
- Investigate the effect of gut microbial status on cannibalism in layers; and
- Develop dietary strategies to minimise cannibalism in laying hens.

Dietary strategies that reduce cannibalism in layers reduce flock morbidity and mortality and enhance the sustainable position of egg producers.

Outputs from the project include four publications in the Australian Poultry Science Symposium and one publication in the Journal of Applied Poultry Research.

The research has shown that layers reared under dim light and supplied with a diet containing high-insoluble dietary fibre, such as low cost rice hulls, decreased the incidence of cannibalism mortality, whereas brightly lit sheds and a diet containing high soluble dietary fibre increased the incidence of pecking leading to cannibalism. Increased digesta passage rate seems to result in birds feeling hungry quicker and as a consequence, birds spend more time feeding and less time pecking. A mash diet form was more effective in reducing cannibalism than the pelleted form.

The project has shown that a high-insoluble fibre diet, a mash style mix and dim shed lighting reduces cannibalism in layers. Figure 4 below provides a cost benefit analysis of this project.

Key Parameter	Net Present Value (5% discount rate)	Benefit Cost Ratio (1:x)	Internal Rate of Return
Low lift in mortality rate of 0.5% 60% research adoption	\$8 million	24	220%
Mean lift in mortality rate of 1.5% 80% research adoption	\$43 million	117	1083%
High lift in mortality rate of 2.0% 100% research adoption	\$58 million	159	1468%

Figure 4: Cost Benefit Analysis, Cannibalism Control in Layers

Source: AgEconPlus Pty Ltd analysis

5.6 Case Study: Egg – Consumer Sensory Research

This R&D cluster analysis addresses a single egg producer levy funded project delivered by Colmar Brunton, David McKinna *et al* and the University of Sydney between February and October 2006.

The project's aim was to improve consumer perceived egg quality and consistency as a means of increasing consumer satisfaction and thus provide a framework for differentiating eggs, attracting a price premium for superior eggs and in so doing enable and facilitate the growth and development of the Australian egg industry. The project cost benefit analysis is in Figure 5 below.

Key Parameter	Net Present Value (5% discount rate)	Benefit Cost Ratio (1:x)	Internal Rate of Return
Low sales branded product (10% production, 36 producers)	\$12.7 million	13.64	153%
Mean sales branded product (30% production 72 producers)	\$41.8 million	23.60	266%
High sales branded product (40% production 100 producers)	\$55.7 million	23.70	291%

Figure 5: Cost Benefit Analysis, Consumer Sensory Research Findings

Source: AgEconPlus Pty Ltd analysis

Key research outcomes include benefits to the:

- Egg industry by increased profit through sale of differentiated lines with improved yolk colour;
- Egg Supply Chain (transport through retail) by retention of current margins as consumers 'switch' some consumption from private-label to branded product; and
- Australian consumers by ensuring eggs consistently meet their quality and functional requirements.

More information is provided at Appendix 2.

5.7 Case Study: Ullage Audit, Solutions Development and Implementation

This R&D cluster analysis addresses the causes of ullage in the supermarket supply chain and the formulation and implementation of solutions.

Ullage is concerned with breakage of eggs and damage to their packaging from the grading floor, through transportation, to the distribution centre, to back of store and in retail display.

The cost of ullage right through the supply chain, including at retail Point-Of-Sale (POS) is borne by egg producers economically and consumers in terms of potential food safety. Supermarkets and other supply chain participants make claims on egg producers for the number of eggs that have been ullaged (wastage).

Eight main causes of ullage were identified, they were:

- Condensation weakening outer cartons;
- Upsizing eggs without upsizing cartons;
- Back of store storage from incorrect store ordering;
- Pallets stacked too high;
- Egg boxes not handled as fragile;
- Different shaped outer boxes making pallets difficult to stack;
- Already damaged egg cartons used during the grading process; and
- Damaged product due to grading floor machine errors.

Due to previous research undertaken, the resultant ullage and more importantly, cracked eggs, can have a significant food safety outcome through the provision of cracked eggs being retailed and sold to consumers. Cracked eggs and 'leakers', are an effective source of contamination if the eggs are not handled and used correctly. A cost benefit analysis for the project is provided in Figure 6 below.

Key Parameter	Net Present Value (5% discount rate)	Benefit Cost Ratio (1:x)	Internal Rate of Return (%)
Low ullage rate reduction 0.25%	\$2.3 million	0.79	0%
Mean ullage rate reduction 0.5%	\$4.7 million	1.59	37%
High ullage rate reduction 1%	\$9.4 million	3.18	123%

Figure 6: Cost Benefit Analysis, Ullage Audit, Solutions Development & Implementation

Source: AgEconPlus analysis

This R&D project benefited:

- Egg producers, because the cost of ullage through the supply chain is borne by egg producers and a reduction in ullage rates has an egg producer cost saving.
- Consumers, as the removal of cracked and broken eggs from the supply chain reduces the risk to human health from egg consumption.

These four case studies demonstrate some of the public benefits stemming from AECL RD&E and the rigorous evaluation process in measuring NPV, BCR and the Internal Rate of Return. More information on these four case studies is provided at Appendix 2.

5.8 Proposal to Increase Transparency of Public Benefits

AECL believes the RDC model could be improved by enhancing the commitment, transparency, measurability and accountability of the public benefit investment in RD&E by the RDCs. In light of this, AECL proposes a new model for managing Government RD&E matching contributions to make it easier to link Government funding to a public benefit.

Separately identifying a distinct public benefit from investments in RD&E can be complex, as there will often be an associated benefit to the industry or private businesses who are all part of the community and public benefit test.

The model proposed by AECL will provide greater clarity and transparency on the public benefit ROI Government receives for its investment in RD&E and will provide an assurance to Government that its investment is benefiting the broader community, not just industry sectors. A range of metrics will also be available at any time to determine the investments being made in public good type projects or program areas as a suite of outcomes being achieved on a continual basis. Government involvement will also be enhanced and evident as a key stakeholder on the investment of matching-dollars being invested. The proposed model is outlined and described in Figure 7 below.

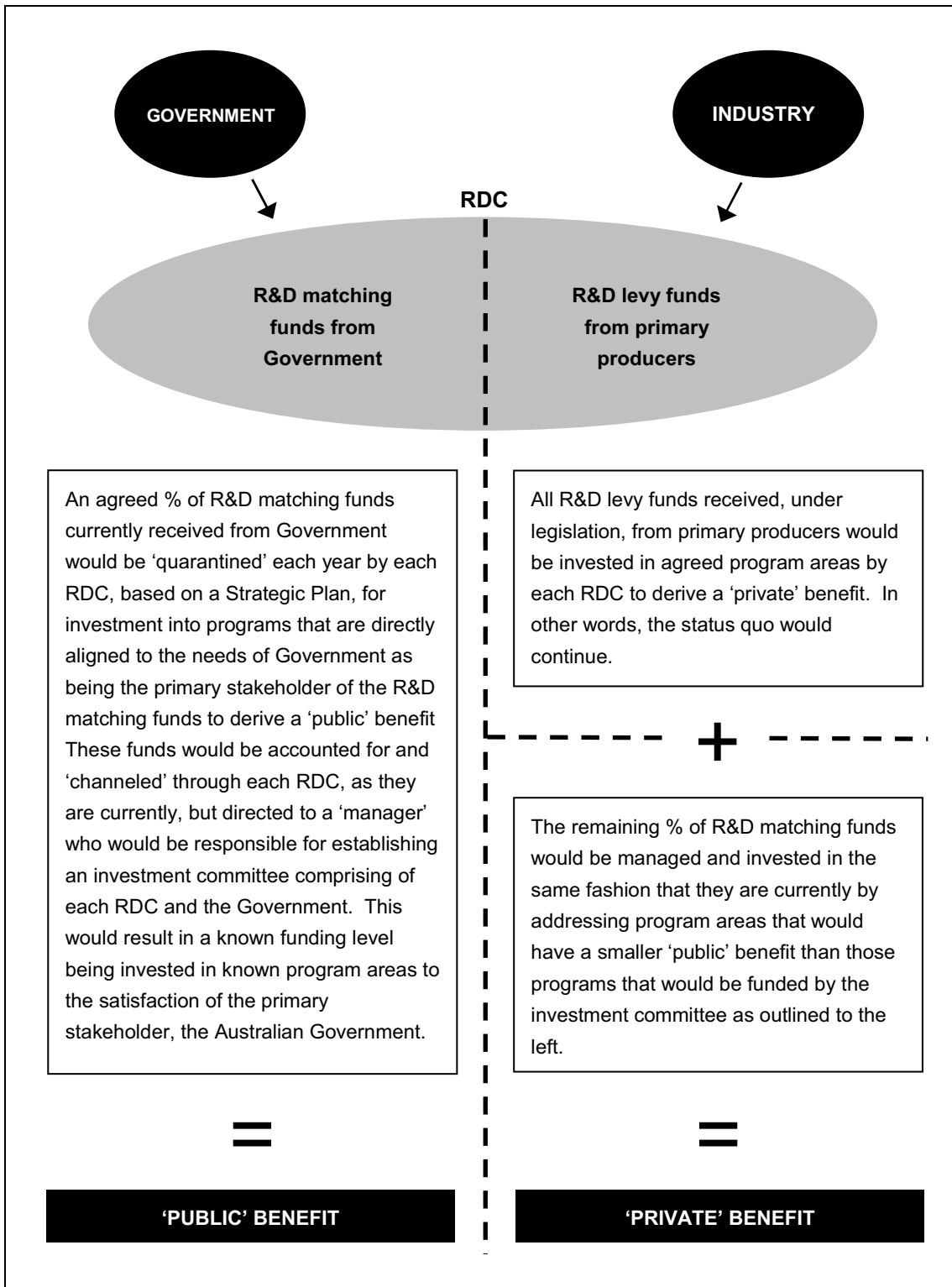


Figure 7: AECL model for the investment of R&D matching funds from Government

This enhanced model would have the dual benefit to Government of increasing both the commitment from RDCs, the transparency in how R&D matching funds from Government are invested and managed and the measurability or accountability of the real public benefit flowing from this investment. AECL believes this reform could enhance the current RDC model and

requests the Productivity Commission consider this base model when preparing its recommendations to Government.

Recommendation One: A new funding model be implemented to increase the commitment, transparency, measurability and accountability of real public benefit flowing from R&D matching funds from Government.

6. Is the RDC Model Fundamentally Sound?

AECL believes the RDC model is well equipped to respond to the changing needs of the egg industry and community and to ensure research findings are implemented on-farm and throughout the supply/demand chain.

6.1 Effective Extension and Strategy

The RDC model has an advantage over other research models (such as the provision of R&D funds for rural research directly to universities, the CSIRO, state departments, etc) in that RDCs have very close links to industry and their stakeholders and are able to ensure research findings are adopted and implemented on-farm and throughout the supply/demand chain. This is becoming a more critical function for RDCs as the traditional extension function fulfilled by state departments diminishes. See Appendix 6.

As an industry-dedicated RDC, AECL is able to provide a holistic framework for the future of RD&E, as seen in AECL's Strategic Plan. The Strategic Plan provides a 'guiding light' for the intent, mission, strategies and outcomes expected to be delivered through the principle investment of R&D and promotion levy funds for the period 2009-13. The AECL Strategic Plan is formulated with input from egg producers and other company stakeholders such as the Australian Government using an inclusive and consultative approach and is reviewed by the AECL Board on an annual basis. An outline of the process the AECL undertakes in developing its strategic plan is at Appendix 4. Other research bodies would not be in a position to take this strategic and industry-focused approach forward thereby limiting the development and extension of the research outcomes.

6.2 Cost Effective Evaluation of Research

RDCs such as the AECL are pro-active in conducting cost effective evaluation which is commensurate to the size of their R&D portfolio to ensure research findings are incorporated into future research for the benefit of industry and the community. AECL regularly evaluates and measures returns on its RD&E, as demonstrated in the detailed evaluation of RD&E projects conducted by AgEconPlus Pty Ltd at Appendix 2. AECL also conducts a monthly ROI evaluation of its promotion levy expenditure, which represents over 50% of company revenue, through a model developed by the University of Melbourne and contained in the report titled

Optimal Egg Marketing Under Changing Market Structures.⁵ Please see Appendix 3 regarding the model's methodology. AECL is committed to ongoing improvements to its project evaluation, noting that the extent of the evaluation required depends on the size of the overall research investment.

6.3 Benefits of Industry-Owned Corporation model

AECL believes the Industry-Owned Corporation (IOC) model strikes an appropriate balance between ensuring accountability to Government while protecting the independence of the organisation. As an IOC, AECL is subject to a Statutory Funding Agreement (SFA) with Government which includes rigorous reporting and accountability requirements. AECL believes that the IOC model provides an extra level of accountability and governance due to its reporting under the SFA and also, the Corporations Act 2001 administered by ASIC.

AECL's status as an IOC enables it to maintain a degree of separation from Government and can deliver open, frank and independent feedback to Government on a range of issues. It also enables AECL to provide public comments about relevant issues, which is an integral part of the role of an industry organisation. A statutory body is not in a position to do this. Ultimately, open and frank feedback is necessary for good public policy outcomes. The current status of AECL ensures efficiency levels are high and the ability to promote innovation within the egg industry is, by and large, not limited in any way. It's highly unlikely this would be the case if there was a move away from IOCs and towards statutory authorities.

6.4 'Hub and Spoke' Model

To drive efficiencies in the future management of RD&E in the egg industry, AECL, in close consultation with the poultry meat sector and the Poultry Co-operative Research Centre (CRC) have developed a 'hub & spoke' model as part of the national RD&E strategy in the poultry industries.

Under the 'hub and spoke' model a central coordinating research institution is appointed which has been assessed to have the best resources (people and/or facilities) to undertake and coordinate input into the research discipline being engaged for most of the research priorities. The central coordinating research institution will not have sole responsibility for this research priority nor will it receive guaranteed project funding at the expense of other institutions. Rather it will be the coordinating central hub of a 'hub and spoke' system that is able to draw in and nurture capacity in supporting research centres or spokes to the research discipline.

The 'hub and spoke' model is superior to a centre of excellence approach based on a single research institution. A centre of excellence approach risks disenfranchising potentially

⁵ Freebairn, Goddard, Griffith and Shank (2004) *Optimal Egg Marketing Under Changing Market Structures: A report for the Australian Egg Corporation Limited*

valuable supporting institutions. The 'hub and spoke' model will ensure a measure of competitive tension between research institutions, with the potential for hub replacement following review and will therefore ensure quality research outcomes in a competitive, cost efficient environment. The 'hub and spoke' approach will avoid duplication, unify and coordinate research efforts for the Australian poultry industries helping to ensure maximum return for the invested dollar.

The RDC model thus enables close links between research institutions and industry, providing significant benefits over other centre of excellence-type research models.

6.5 Proposal to Improve Efficiency of the RDC Model

AECL recently received Ministerial approval to increase levies from 7.2 cents to 13.5 cents and a Bill is now before Parliament to give effect to this decision. Having recently successfully applied for an increase in the Laying Chicken levy, AECL is aware of the onerous requirements associated with applying for such an increase and believes this process could be streamlined to achieve cost efficiencies for both Government and RDCs.

Recommendation Two: Government to streamline and more clearly enunciate the process for RDCs to apply for R&D levy increases to enhance operating efficiency and the delivery of an appropriate business case.

7. Need for Industry Specific RDC

AECL believes it is critical and paramount that there be an egg industry-specific RDC to ensure the ongoing vibrancy, viability and sustainability of this unique sector.

7.1 Unique Needs of the Egg Industry

The Australian egg industry is unique when compared with other parts of the agricultural sector. Egg producers focus exclusively on egg production and are less likely to engage in a range of enterprises on-farm unlike other livestock or cropping farming businesses. Therefore, the needs of each egg producer are very unique given the tapestry of R&D issues that need to be addressed in this sector.

The egg industry also experiences significant pressure from animal welfare activists where the industry's R&D needs are quite specific. The health benefits of eggs are also subject to much confusion and debate, and it is critical the egg industry is able to conduct RD&E to clarify this confusion. The ongoing viability of the industry depends to a large extent on the egg industry's ability to conduct effective and specific RD&E to respond to these issues in a consultative fashion with its stakeholders.

The Australian egg market is also unique in that it is domestically focused and does not have the range of overseas purchasers found in other agricultural industries. AECL is essentially marketing to a small number of large domestic purchasers (primarily the major Australian supermarkets), which leaves the egg industry more vulnerable to market fluctuations and pressure from non-economic forces. Having a limited number of large scale purchasers can make it difficult for egg producers to gain a fair price for their product. As a result, R&D focuses on-farm and throughout the supply chain.

The egg industry is unique in that there is a very short production chain from the farm to the consumer. Unlike meat, grains and other products, eggs do not require processing before they are ready for retail. This short production chain also means the outcomes of egg industry R&D have a more direct benefit to consumers and the public than other more prolonged production systems.

Conducting R&D through RDC's ensures a greater degree of involvement and support from egg producers. AECL has access to relevant contacts at various stages of the production chain and can ensure researchers have access to the samples and information they need in an expeditious and market-focussed manner. Other research institutions do not enjoy this direct access to the egg industry and may find it difficult to access appropriate research participants and support from egg producers.

The link between the R&D portfolio of AECL and the industry's substantial marketing program, funded through the Promotion levy, is also critical to ensure the R&D portfolio remains market-focussed and relevant to the needs of egg producers and the community.

For these reasons, it is important that the egg industry continues to have a dedicated, specific RD&E and representative body to ensure its unique needs are protected and the trusted services to egg producers is maintained.

7.2 Support by the Egg Industry

AECL has the support of its members and other industry stakeholders. AECL encourages regular feedback from its members and other stakeholders. In a consultation conducted as part of its 3-year Performance Review in 2006, AECL received overwhelmingly positive feedback, with 81% of participants rating AECL's performance as either 'excellent' or 'above average'. Only 19% rated AECL as average or below average. This review process and others allow AECL to engage in a direct dialogue with its stakeholders and address any concerns they may have on an ongoing basis.

AECL also seeks regular feedback and program direction from egg producers through the establishment and operation of 5 Industry Consultative Committees (ICCs), which provide a link between AECL management and industry practitioners/consultants. ICCs enable AECL to make informed program decisions and to engage with the egg industry in a way that other research institutions are not able to. A copy of AECL’s consultation calendar is at Appendix 5, further demonstrating AECL’s commitment to extensive and regular stakeholder engagement. Additionally, AECL has 5 Expert Groups which are made up of professionals in their respective field of research. Please see Figure 8 below.

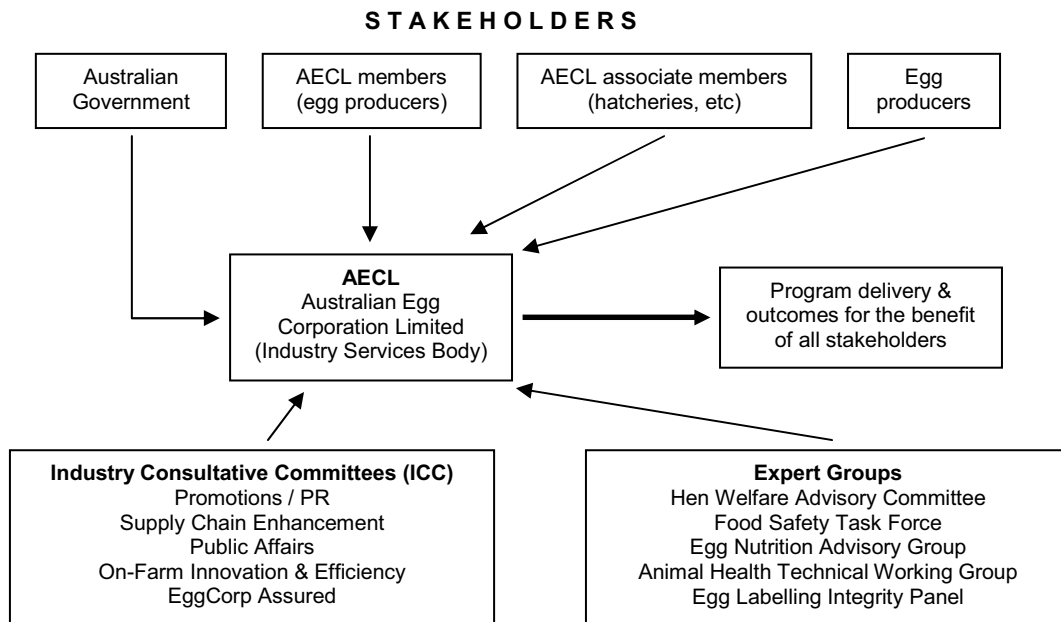


Figure 8: AECL stakeholder and consultation model

8. Funding Level Issues

The Productivity Commission Issues Paper examines the level of funding currently provided to RDCs and whether current funding levels are appropriate. For its part, AECL is facing increased financial pressure due to reduced public funding, increased research costs and reduced research talent pool. In this context, AECL believes there is a need for increased Government funding to maintain a vibrant and responsive egg RD&E sector.

8.1 Reduced Public Funding

Australia’s investment in rural RD&E, as a percentage of Australian agricultural GDP, has declined from 4.1% in the mid-1970s to 2.9% in 2005. Appropriate levels of national research, regional development and local extension are critical to ensure the ongoing productivity growth and sustainable development of the Australian egg industry in providing a secure and healthy food source for the Australian community.

There has been a decline in public investment or government funding of research institutions resulting in a greater percentage of projects that need to be funded on a full 'cost recovery basis' from the point of view of the research institution or research provider. State departments of primary industries' in Victoria, Queensland and New South Wales have all closed poultry research facilities and scaled back on related resources (people and capital infrastructure) over the last 5 years. Most recently, \$12 million has been cut from rural RD&E in the NSW 2010-11 Budget. The Department of Primary Industries in Victoria has also indicated that it will no longer support research for poultry. Additionally Queensland's primary poultry research station at Redland Bay has now closed. The CSIRO has also had to slash \$63 million from its annual budget and has partially closed Food Science Australia (FSA), its food research division. Please see Appendix 6.

8.2 Ability to Leverage Funds

AECL believes Government support is critical in that it provides a catalyst for investment from other sources. An evaluation of AECL's R&D portfolio in 2008 by AgEconPlus Pty Ltd found that for every dollar invested by AECL, others (including research institutes) had invested \$1.30.⁶ Government investment acts as a stable core to attract investment from the private sector and research institutions and without this investment, AECL believes other RD&E revenues would also diminish over time.

8.3 Increased Research Costs

Compounding this reduction in funding is the increased cost of service provision from research institutions, scientists and contractors/consultants which has increased at a similar, if not higher, rate than the Consumer Price Index (CPI) which is deemed to be a conservative deflator for the costs associated with RD&E.

Universities and state departments of primary industries are requesting infrastructure support from research purchasers such as AECL, to ensure there is ongoing capacity to undertake poultry research. The University of Sydney, Camden Campus, and the University of Queensland, Gatton Campus, have requested additional support recently from the egg industry.

Research institutions are now starting to demand 100% of Intellectual Property (IP) rights resulting in less income that AECL can commercially generate through the receipt of royalties that may be created from completed R&D projects.

8.4 Reduced Research Talent Pool

There has been a contraction in the 'pool' of research talent in key science disciplines required by the egg industry, including animal health and welfare, and this has resulted in AECL

⁶ Based on 130 RD&E projects managed by AECL with a total expenditure of \$21 million, including projects commissioned by RIRDC since 2000, AgEconPlus (2008) *AECL R&D Program Evaluation, stage 1 and 2 analysis*.

becoming a 'price taker' for the scarce research resources that remain. That is, AECL has less ability to seek competitive tenders when employing specialist research or science skills.

This is compounded by most state governments either removing any extension service associated with poultry production or scaling-back resources to be part-time. The Department of Industry & Investment in New South Wales (formerly the Department of Primary Industries) has not renewed a full-time poultry extension officer while the Department in Victoria has now made redundant the sole poultry researcher/extension officer in Victoria.

8.5 'Immature' Barn and Free Range Markets

The cage production method is well established in Australia, while the barn, free range and specialist methods of production are relatively new. These latter methods can be considered 'immature' industries that have been established in response to community demands, presenting their own challenges and their own need for RD&E which are distinct from more established production methods. These methods have developed in response to consumer pressure regarding animal welfare and there is a need for ongoing Government support to assist these new segments of the egg industry.

8.6 Case for Additional Public Funding

Given the declining public investment and increased research costs, AECL believes there is a need to increase Government investment in egg industry RD&E. As the second smallest RDC, AECL is particularly vulnerable to financial pressure flowing from cost fluctuations, public pressure on cage egg production systems and the need to address confusion on the health benefits of eggs.

AECL has recently received Ministerial approval for a levy increase from 7.2 to 13.5 cents per bird, which has assisted to relieve funding pressure. However, this levy increase has simply brought AECL's R&D revenue in line with CPI increases and has not compensated for the other RD&E funding pressures AECL and the egg industry faces. Additional funding would enable AECL to conduct further RD&E into emerging issues and bring additional benefits to the community and the egg industry.

AECL acknowledges the difficulty faced by Government in identifying additional funding for rural RD&E in the current economic climate however AECL believes a modest increase would greatly assist in ensuring an egg industry that is vibrant and innovative into the future.

Recommendation Three: Government funding for rural RD&E be increased to compensate for increased financial pressure faced by the industry and in recognition of the public good achieved by this funding.

9. Good Corporate Governance

AECL is a model of good corporate governance and is committed to conducting its business in a way that is open and accountable to all stakeholders. AECL's governance arrangements constitute a best practice model which can be drawn on by other RDCs.

9.1 AECL Corporate Governance Standards

AECL is a public company limited by guarantee and as a result, is not listed on the Australian Stock Exchange (ASX). AECL has, however, developed its framework for corporate governance in line with the 'Principles of Good Corporate Governance and Best Practice Recommendations' as developed by the ASX Corporate Governance Council. AECL would support moves to enhance governance and reporting compliance across RDCs more broadly and believes it provides a model of good governance which could be replicated in other RDCs.

9.2 Best Business Practices

AECL, as an organisation, adopts best business practice including adherence with relevant Australian Standards and leading organisational management models. Key aspects include:

- Adherence to all relevant Australian accounting standards.
- Development and adoption of a strategic plan covering a period of 3 to 5 years.
- Development and implementation of a risk management plan in accordance with Australian standards.
- Development and implementation of a fraud control plan.
- Development and implementation of an intellectual property management plan.
- Development and compliance with annual operation plans.
- Measurement of organisational performance against specified strategic actions/outcomes and annual key performance measures.
- Adoption of best practice in human resource and diversity management.
- Adoption of best practice in managing compliance with legislative and regulatory practice.

Recommendation Four: RDCs to report against an agreed set of governance principles such as either the OECD Principles of Corporate Governance or the Australian Stock Exchange (ASX) corporate governance standards to improve transparency, accountability and compliance within the sector.

10. Effective AECL Board

AECL has an efficiently functioning, candid and collaborative Board, with directors contributing a diverse range of skills in compliance with the Statutory Funding Agreement (SFA) requirements.

AECL Board functions include:

- Setting company policies;
- Approving major strategies, plans and budgets;
- Responding to management recommendations on major initiatives, including significant investments, capital and funding proposals, senior appointments, executive remuneration and succession plans, financial results, performance against plans, and issues relating to internal controls and the management of risk;
- Approving significant capital expenditure;
- Ensuring the company acts legally and responsibly on all matters and that the highest ethical standards are maintained; and
- Ensuring the company operates within the requirements of the Statutory Funding Agreement (SFA) with the Australian Government.

The AECL Board carries out its functions in accordance with the Australian Institute of Company Directors (AICD) Code of Conduct and its directors have qualifications and memberships that include AICD and Chartered Secretaries Australia (CSA).

10.1 Board Skills

The AECL Board comprises up to four 'elected' directors, and up to a maximum of three 'specialist' directors, one of whom is the Managing Director. Specialist directors are appointed by the AECL Board to ensure a balance of skills and expertise in accordance with the criteria set out in the Statutory Funding Agreement (SFA) between the Australian Government and AECL.

AECL believes this mixture of Board directors from the egg industry and other professions relevant to the accountabilities and operations of the Board brings the best possible range of skills to the AECL board, for the benefit of the egg industry and the community. AECL would advise against reforms requiring RDC boards to be entirely skills-based, as this would risk

inhibiting the close ties that industry RDCs currently enjoy. AECL is committed to ensuring it has an appropriately skilled, professional board and believes this is best achieved through a mix of independent and industry directors.

10.2 Executive and Board Remuneration

Remuneration for AECL executives is determined by the AECL Board, who are accountable to AECL members at each General Meeting including the Annual General Meeting (AGM). Total remuneration for all non-executive directors has been set in the AECL Constitution at a maximum of \$150,000 per annum. Aggregate AECL Board remuneration can only be increased with the consent of AECL members at a General Meeting. AECL's Constitution also provides for non-executive directors to be paid additional remuneration where they perform services outside the scope of the ordinary duties of an AECL director and these payments are disclosed.

AECL takes a market-based approach to executive remuneration and ensures executives are adequately remunerated to attract and retain talent. AECL uses benchmarking data from executive search firms, NGO executive salary standards and the Not-For-Profit Association to monitor its executive remuneration and can confirm AECL executive salaries are responsive to these reports.

AECL can confirm that executive remuneration has not been raised as an issue at any AECL General Meeting since the inception of AECL. The AECL Board would be responsive to such concerns if they were to emerge.

Recommendation Five: RDCs to report on the methods and processes used to set executive salaries in annual remuneration reports.

11. Separation of RDC and Representative Body Role

Commensurate with the size of the egg industry, AECL performs a dual role as both the egg industry's RDC and industry representative body. AECL has arrangements in place to ensure an appropriate distinction between its RDC and representative body functions to avoid any real or perceived conflict of interest and accountability in program areas.

The reason AECL performs these two roles can be linked to the historic development of the organisation. Up until 2003, the Australian egg industry was represented by the Australian Egg Industry Association (AEIA) through the provision of voluntary levies from a number of stakeholders. The role of the AEIA was to formulate policy and correspond with governments on behalf of hatcheries and egg producers regarding issues and challenges faced by the egg

industry and its stakeholders. The AEIA was formed in 1993 which became the newly-merged entity combining the resources and membership from the Australian Council of Egg Producers (ACEP) and the Australian Egg Marketing Council (AEMC) which had respectively represented the production and marketing areas of the egg industry at a national level since the early 1960s. In February 2003, AECL commenced and on 30 June 2003, the AEIA was unincorporated and ceased to exist in its previous form. AECL now owns the AEIA trading name and fulfils some of the functions previously undertaken by the AEIA.

AECL is committed to ensuring these two functions are performed with integrity and an appropriate degree of separation. A separate name and separate funding have been retained by AECL to manage lobbying activity with the potential to stray into agri-politics. AECL has not had the need to use the resources of AEIA or the trading name since the inception of AEIA.

Recommendation Six: All RDCs which perform an industry representation role to ensure appropriate arrangements are in place (as in the AECL) to avoid any real or perceived conflict of interest.

12. Administrative Efficiency

The Productivity Commission Issues Paper raises the issue of streamlining and reducing RDC operating costs. AECL is an administratively efficient organisation with low operating costs and is committed to effective co-ordination of 'back office' functions and collaboration of research outcomes with other RDCs.

12.1 Low Operating Costs

AECL has relatively low operating costs, particularly given its size as the second smallest RDC. AECL is committed to enhancing efficiency and regularly reviews its administrative costs and overheads. Annual benchmarking⁷ developed by the AECL indicates that AECL's corporate cost amount is approximately 8.5% of revenue, as compared to the industry average of 22.7%. Please see Figure 8.

⁷ These figures are indicative only, and are based on figures reported in publicly available documents, such as annual reports, of other RDCs.

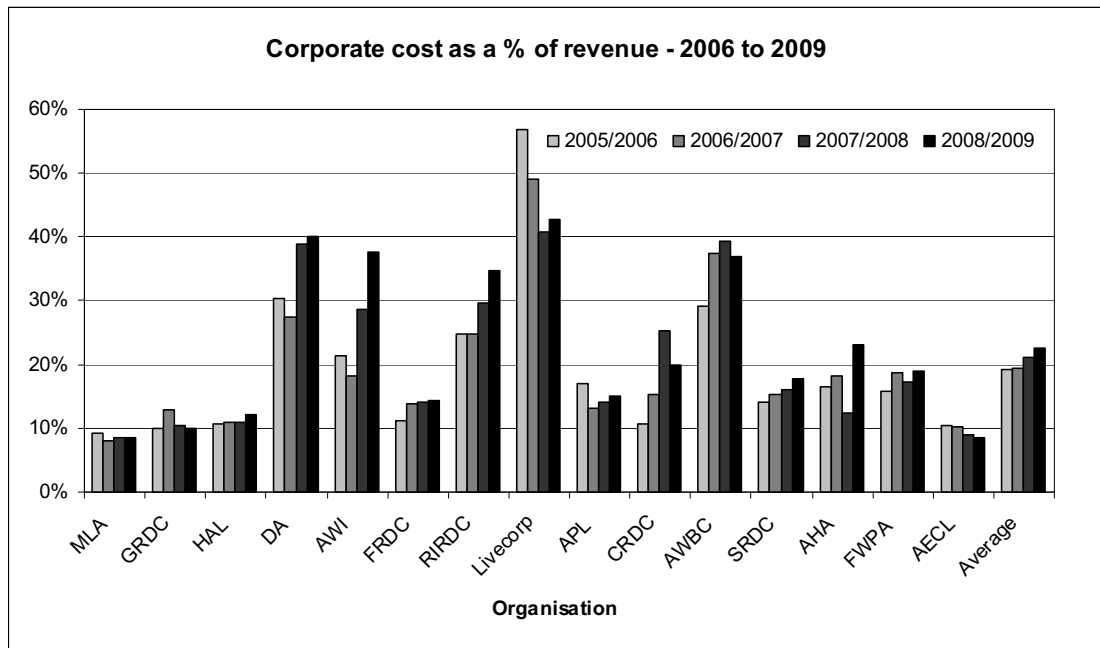


Figure 8: AECL Corporate Costs as Percentage of Revenue, 2006-09

Source: AECL Analysis

AECL has a corporate cost of \$71,414 per staff member, which is the second lowest of all RDCs and well below the industry average of \$235,109. Please see Figure 9.

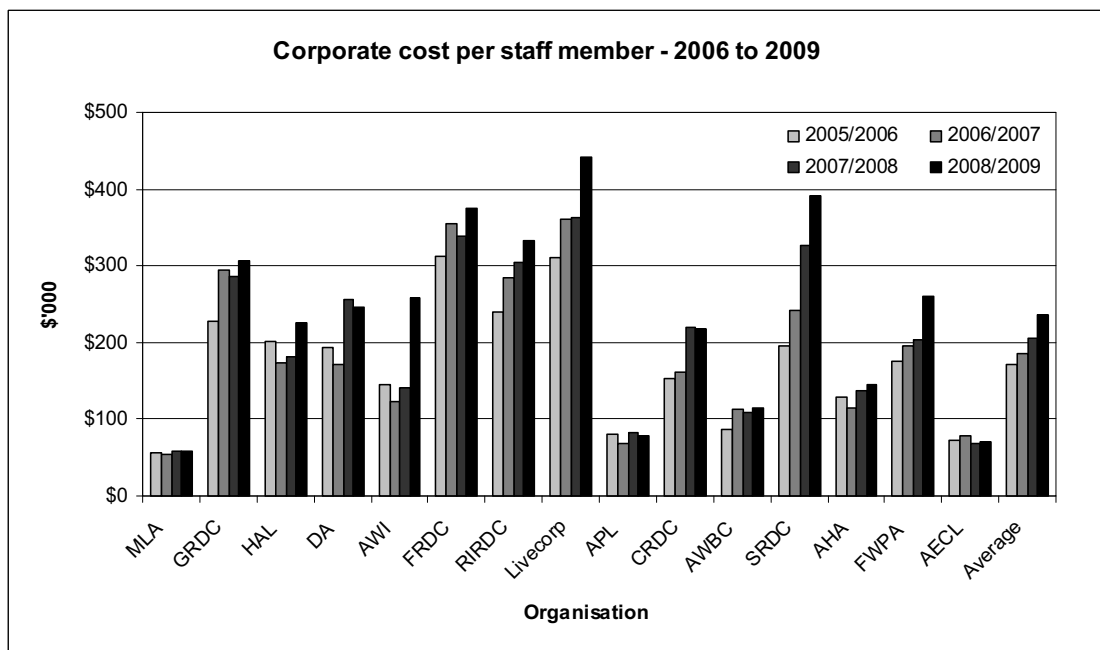


Figure 9: Corporate Costs per Staff Member, 2006-09

Source: AECL Analysis

These results showcase the relative efficiency of AECL, especially given it is a small RDC not enjoying the economies of scale of the larger RDCs. Appendix 7 provides for more information on AECL's operating costs.

AECL has initiated a project with other RDCs to reduce a necessary 'back office cost and is working with RDCs on other opportunities to further reduce costs associated with administration. See Appendix 8 for more details. Canberra-based RDCs, have considered co-locating in order to save on overheads and AECL has considered co-locating with Sydney-based RDCs. However, AECL considers that this option would not be feasible in the short term due to existing commercial lease commitments as the financial costs would outweigh any additional benefits.

12.2 Effective Co-ordination and Collaboration

AECL is committed to collaborating and sharing information with other RDCs. AECL is a core partner in the Poultry Cooperative Research Centre (CRC), which was established in July 2003 as a joint venture between Australia's leading poultry research, education and industry organisations and the Australian Government. The CRC helps maintain and enhance the egg industry's investment in R&D as it relates to hen nutrition, bird health, hen welfare and the environment for community benefit and food safety and quality. The CRC has allowed AECL to leverage funds and collaborate effectively with other industry partners. The CRC has a long term R&D focus and is addressing the following priorities in the egg industry:

- Nutrition and gut physiology – enhanced quality and productivity using novel approaches to digestive physiology and metabolism of poultry;
- Poultry health – sustainable poultry health through discovery, development and application of emerging biotechnology; and
- Welfare and environment – improved management of poultry welfare and the environmental impact of poultry production.

AECL also maintains links with relevant overseas bodies and is an active member of the International Egg Commission (IEC), which has over 450 members from 55 countries with a focus on co-operation to ensure a progressive global egg industry is sustained. The current chairman of the IEC is a director of AECL, strengthening these ties with the international community. More details of AECL's collaboration with other RDC's are at Appendix 8.

Feedgrain Partnership – Sorghum

AECL is collaborating with several other RDCs in a project aiming to increase the value and yield of sorghum as a feed ingredient via gene regulation. This will ensure the egg industry's access and security to cost efficient feed sources into the future. The project runs from 2008/09 – 2010/11 and is led by the Grains RDC. AECL is contributing \$6,000 to this project which also involves Australian Pork Ltd, Meat and Livestock Australia and Dairy Australia.

12.3 Lack of Incentive to Merge AECL into another RDC

Given AECL's low administrative costs and effective collaboration with other research organisations, there would be little financial saving to Government in merging AECL with another RDC.

If AECL's RD&E function were merged with another RDC, AECL would continue to operate as an industry representative body funded by promotion levy arrangements and would continue to incur its current costs and overheads. An amalgamation of this kind would be unlikely to lead to any saving or increased efficiency to the egg industry and would decrease the effectiveness of egg industry RD&E due to its departure and separation from the market-based portfolio undertaken by AECL and funded by the promotions levy.

13. Conclusion

AECL believes current RDC arrangements in the egg industry are effective and responsive to the needs of the community which includes the egg industry. Given the high level of industry support for AECL, the level of professionalism and commitment to good governance within the organisation, AECL believes egg industry RD&E does not require significant change, but could benefit from minor improvements, including:

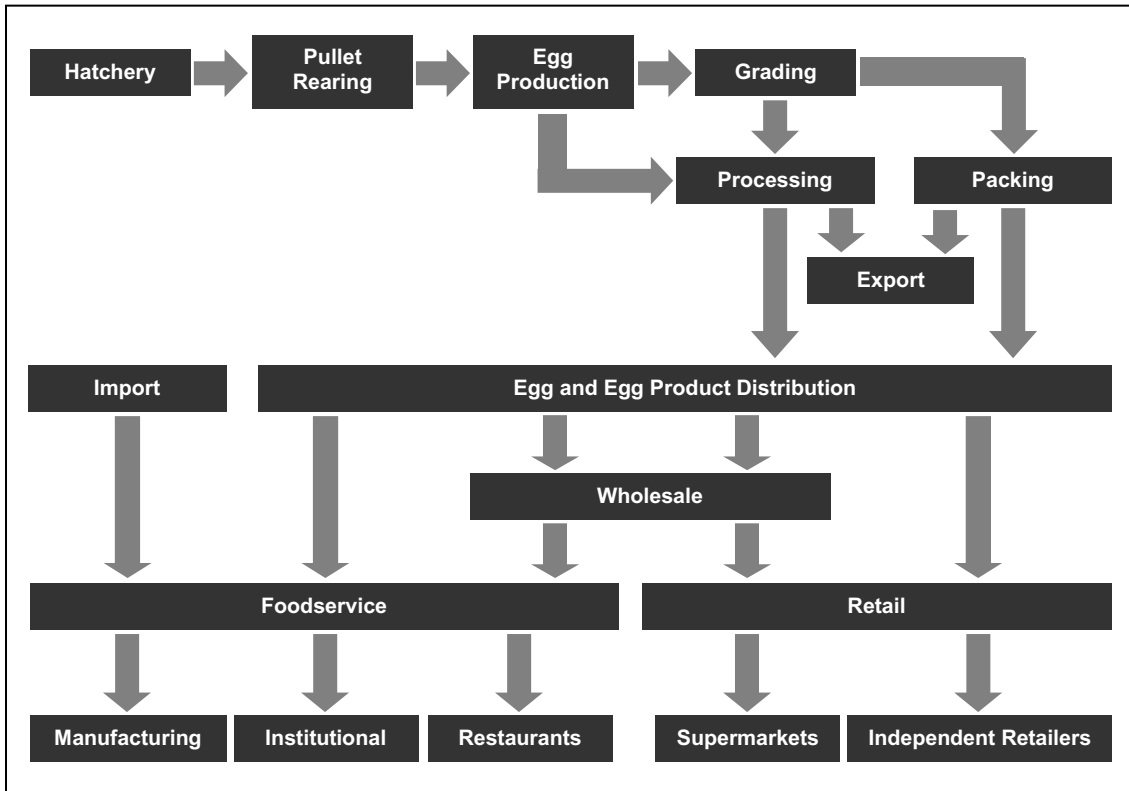
- **Recommendation One:** A new funding model be implemented to increase the commitment, transparency, measurability and accountability of real public benefit flowing from R&D matching funds from Government.
- **Recommendation Two:** Government to streamline and more clearly enunciate the process for RDCs to apply for R&D levy increases to enhance operating efficiency and the delivery of an appropriate business case.
- **Recommendation Three:** Government funding for rural RD&E be increased to compensate for increased financial pressure faced by the industry and in recognition of the public good achieved by this funding.
- **Recommendation Four:** RDCs to report against an agreed set of governance principles such as either the OECD Principles of Corporate Governance or the Australian Stock Exchange (ASX) corporate governance standards to improve transparency, accountability and compliance within the sector.
- **Recommendation Five:** RDCs to report on the methods and processes used to set executive salaries in annual remuneration reports.
- **Recommendation Six:** All RDCs which perform an industry representation role to ensure appropriate arrangements are in place (as in the AECL) to avoid any real or perceived conflict of interest.

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Appendix 1: Industry Overview

Production – Australia:	345 million dozen eggs - 2009 (Source: Australian Egg Corporation Limited)		
Flock size:	20.119 million hens (inc. pullets) - as at 31 December, 2009 (Source: Australian Egg Corporation Limited)		
State flock percentages:	NSW/ACT	31%	
	Queensland	27%	
	Victoria	25%	
	WA	9%	
	SA/NT	7%	
	Tasmania	1%	
	(Source: Australian Bureau of Statistics, cat. no. 7121)		
Number of egg farms:	309 - as at 30 June, 2009 (Source: Australian Bureau of Statistics, cat. no. 7121)		
Gross value of production at farm gate:	\$413m per annum - 2008/09 (Source: Australian Bureau of Statistics cat no. 7503)		
Retail prices (average):	\$4.43 per dozen - December quarter, 2009 (Source: Australian Bureau of Statistics, cat no. 6403)		
Gross value of production at market:	\$1.539b - 2009 (Source: Australian Egg Corporation Limited)		
Grocery/retail sales value:	\$465.8m - 2009 (Source: AZTEC)		
Grocery/retail sales volume:	113.701m dozen - 2009 (Source: AZTEC)		
Grocery/retail production market share 2009:		volume	value
	Cage eggs:	63.5%	49.5%
	Free range eggs:	26.6%	37.3%
	Barn-laid eggs:	7.6%	9.1%
	Organic eggs:	2.2%	4.1%
	(source: AZTEC)		
Grocery/retail branding market share 2009:		volume	value
	Private-label/generic labels:	55.3%	42.8%
	Proprietary labels:	44.7%	57.2%
	(source: AZTEC)		
Grocery/retail pack size market share 2009:		volume	value
	6 (half dozen) pack:	10.8%	15.4%
	10 pack:	2.2%	3.4%
	12 pack:	84.5%	78.5%
	15 pack:	1.5%	1.5%
	other pack sizes:	1.0%	1.2%
	(Source: AZTEC)		
Grocery/retail pack weight market share 2009:		volume	value
	<= 350g:	9.9%	14.3%
	351g - 600g	18.8%	20.0%
	601g - 700g	63.2%	55.9%
	701g - 800g	4.9%	6.3%
	>= 801g	3.2%	3.5%
	(Source: AZTEC)		
Egg product exports – 2009: (FOB equivalent)		volume	value
	Shell eggs	165mt	A\$1.568m
	Egg pulp/liquid	412mt	A\$0.957m
	Egg powder	<1mt	A\$0.003m
	(Source: Australian Bureau of Statistics)		
Egg product imports – 2009: (CIF equivalent)		volume	value
	Eggs preserved/cooked	1,010mt	A\$2.503m
	Egg powder	639mt	A\$5.431m
	Egg pulp/liquid	377mt	A\$1.182m
	(Source: Australian Bureau of Statistics)		



Appendix 2: Public Benefits of Egg Industry RD&E

Extract from AgEconPlus (2008): AECL RD&E Program Evaluation, Stage 1 and 2 Analysis.

Cluster 1: Salmonella Control in Eggs for Public Health Benefits

Cluster identification

This cluster analysis addresses five egg research and development projects funded through the egg producer levy, they are – UQ-19E, DAV-146A, CIF-1A, SAR-42A and SAR-47.

Table 3.1 R&D Projects included in the Salmonella Public Health Cluster

ID	Project Title	Project Period
UQ-19E	The significance of <i>Salmonella</i> , particularly <i>Salmonella</i> Infantis (SI), to the Australian egg industry.	1994-1996
DAV-146A	International review of <i>Salmonella</i> Enteritidis (SE) epidemiology and control policies.	1999-2000
CIF-1A	Rapid detection of virulent <i>Salmonella</i> in egg and poultry products.	2000-2003
SAR-42A	A <i>Salmonella</i> quantitative risk assessment model for the egg industry.	2002-2003
SAR-47	National food safety risk profile of eggs and egg products.	2004

Source: AECL Project Database

The cluster has a contiguous and consistent research theme built around understanding *Salmonella* in the Australian egg industry, developing detection and risk management tools and applying these tools to minimise the risk to public health from egg consumption.

It is noted upfront that a clean fresh egg without a cracked shell is naturally a safe food (NSW Food Authority 2005) and that there are 67.543 million dozen shell eggs sold at retail each year (AC Nielsen research). Project descriptions need to be considered in light of this information.

Cluster Description and the Problem Being Addressed

Project objectives, outputs and outcomes are described for each of the five projects in the *Salmonella* public health cluster.

UQ-19E The significance of Salmonella, particularly Salmonella Infantis, to the Australian egg industry (2002).

Survey based research completed between 1991 and 1993 established the freedom of Australian poultry flocks from virulent *Salmonella* Enteritidis of the type causing significant public health problems in Europe and the USA. Nevertheless this survey work revealed a variable but overall significant carriage rate in Australian layers of a range of salmonellae with potential to cause human disease. Thus this project (UQ-19E) was initiated to investigate the significance of one particular problematic salmonellae, *Salmonella* Infantis (SI), to the Australian egg industry.

Salmonella Infantis, associated with the egg and especially the chicken meat industry, has been of significant public health concern in many countries, and remains so in some regions. Due to its previously observed dominance in layer flocks and in raw egg products in south-east Queensland, it was considered to be of potential significance to the Australian egg industry, with regard to egg-borne transmission to humans and the likely public health consequences.

By conducting appropriate surveys to monitor *Salmonella* Infantis prevalence, vital information was acquired through this project to help assess the status of Australian layer flocks. Application of molecular techniques enabled good discrimination between *Salmonella* Infantis isolates for epidemiological purposes, providing information on the existing relationships between isolates of this serovar from similar and different environments.

The research showed that *Salmonella* Infantis was able to penetrate the eggshell and grow in some cases within the contents of the egg, thereby stressing the importance of removing faecal material from the surface of the egg to maintain safe and good food handling practices along the egg production environment. Experimental infection of layer hens completed as part of the project demonstrated that trans-ovarian transmission is less likely to occur than eggshell penetration.

Implementation of the study's findings through channels such as the industry's QA program Egg Corp Assured has resulted in a decreased risk of consumers contracting salmonella from Australian eggs. The study has also resulted in recognition of the need for additional knowledge on risk pathways for *Salmonella* infection between bird and egg destined for human consumption.

DAV-146A: International review of Salmonella Enteritidis (SE) epidemiology and control policies (2000).

In Europe and the USA, *Salmonella* Enteritidis (SE) is a major threat to public health and is responsible for a lack of consumer confidence in the quality and safety of egg production. The absence of *Salmonella* Enteritidis from Australian poultry provides significant commercial opportunities for the Australian industry. In 2000 when this research was completed, *Salmonella* Enteritidis has been detected only once in an Australian backyard poultry flock and was transmitted, in this instance, through overseas human-acquired infection. Subsequently there have been reports of SE detection in South East Queensland but SE has not been responsible for any reported cases of Salmonellosis in Australia.

The ever-increasing rate of overseas travel along with *Salmonella* Enteritidis' prevalence in many overseas countries means that Australian layer flocks are increasingly susceptible to SE infection and subsequent establishment.

The best approach to ensuring that an incursion of *Salmonella* Enteritidis in Australian layers is controllable and, ideally, eradicable, is by establishing monitoring programs that ensure early detection of infection and implementation of effective control strategies. Consistent and systematic monitoring of layer breeding flocks and product is essential.

The objectives of the project were to:

- Review the international situation with respect to *Salmonella* Enteritidis infestation, elimination and control.
- Raise awareness of the potential threat that *Salmonella* Enteritidis poses to Australian poultry production through organisations such as the Australian Veterinary Poultry Association.
- Recommend monitoring systems to keep Australian flocks *Salmonella* Enteritidis free and maintain Australia's current commercial and trade advantages.
- Develop eradication and control strategies for Australia in the event of a *Salmonella* Enteritidis outbreak.

Each of these objectives was successfully completed.

As a consequence of this project SE awareness was raised and monitoring and control strategies developed. The study also resulted in recognition of the need to develop rapid detection tests for virulent and non-virulent salmonella strains.

CIF-1A: Rapid detection of virulent Salmonella in egg and poultry products

Salmonella Enteritidis is the most significant cause of human illness from eggs internationally, yet it is not present in Australian commercial layer flocks. Therefore continuous surveillance of Australian layer flocks for this *Salmonella* serovar is vitally important for maintaining the high degree of public acceptance in eggs as a safe and healthy food product in Australia.

The most common *Salmonella* serovar isolated from Australian chickens is *Salmonella* subsp. II Sofia (approximately 50% of isolation). As this serovar is considered to be essentially avirulent, a rapid test that would allow differentiation of *Salmonella* subsp. II Sofia from other more virulent *Salmonella* serovars would be of value to the industry.

Molecular methods have allowed for the rapid and specific identification of organisms based on the differences in genetic sequence of the organisms and these techniques were applied to the research.

The research objective was to develop rapid and specific molecular detection methods for the differentiation of *Salmonella* Enteritidis and *Salmonella* subsp. II Sofia from other *Salmonella* serovars in egg and poultry products.

More specifically the projects objectives were:

- To develop a system based on gene sequences for the rapid characterisation and differentiation of *Salmonella* spp. of economic and public health significance in egg and poultry products and in environmental samples.
- To develop simple sample preparation techniques for the isolation and concentration of *Salmonella* spp. from egg products for use in combination with identification systems.

- To apply the developed detection and identification systems for differentiation of non-pathogenic *S. sofia* and pathogenic non-*S. sofia* isolates and *S. Enteritidis* (SE) PT4 (a major poultry pathogen in Europe and USA) and other *Salmonella* spp. of industry importance.
- To develop user-friendly systems such as 'BioChips' (DNA micro-array systems) and colorimetric detection systems for the identification of multiple products.

The research outcome was a series of rapid tests that allow for the specific detection of *Salmonella* Enteritidis and *Salmonella* subsp. II Sofia in egg products. In addition, the approaches developed in this project can be used for specific detection of other major egg and poultry serovars of *Salmonella*. Once validated, the diagnostic tools developed will be available for use in conjunction with salmonella food risk assessment.

SAR-42A: A Salmonella quantitative risk assessment model for the egg industry

Egg products contaminated with *Salmonella* are a recognised cause of food borne illness. The Australian egg industry is untroubled by strains of *Salmonella* Enteritidis that have caused human illness abroad, however unwanted introduction of specific *Salmonella* into populations of humans and poultry has significant implications for public health and national and international trade through introduction of technical barriers in the international trade of egg products.

The projects objectives were:

- To develop a Quantitative Risk Assessment (QRA) model for *Salmonella* in eggs that will allow assessment of the impact of industry practices on the occurrence of Salmonellosis in humans.
- To evaluate the food safety risk of alternative control measures and production systems.

A comprehensive review of Australian egg related food-borne outbreaks was completed as part of the project. Data collected from the FAO Risk Assessment of *Salmonella* in eggs and broilers was re-evaluated and used to develop a dose response model. Modular exposure assessment models for shell eggs that describe production from point of lay to the end of retail storage were developed using data from surveys of Australian egg production and processing practices. The impact of production, processing, wholesale and retail practices on potential for growth of *Salmonella* in retail eggs has also been evaluated. Risks to consumers were estimated for different food types containing eggs contaminated with *Salmonella*. The exposure assessment and inactivation kinetics of *Salmonella* were also used for analysis of risk associated with current practices used for processing of liquid egg products and review of current Australian standards.

As a result of this research project a quantitative methodology is now available for the Australian egg industry that allows assessment of the *Salmonella* risk to consumers from various industry practices.

SAR-47: National food safety risk profile of eggs and egg products

Risk profiling is now recognised as an important first step that is essential for effective food safety risk management. It has recently been defined as "a description of a food safety problem and its context developed for the purpose of identifying those elements of a hazard or risk that are relevant to risk management decisions" (Codex Alimentarius Commission). This project aimed to conduct a through chain food safety risk profile for the Australian egg industry.

Specifically the projects objectives were to:

- Identify public health hazards that enter any point of the food chain for eggs and egg products produced in Australia and rank them in terms of health risk to the consumer.
- Identify hazards of potentially high risk where too little information exists for a confident ranking of risk and provide 'what if' scenarios raised by risk managers during expert consultations.
- Identify potential management strategies for the identified hazards.
- Identify product/pathogen combinations in which, further risk analysis might be required by risk managers.

Expert consultations between risk managers and assessors were held to thoroughly assess the feasibility of risk profile work, ensure risk management questions were clearly articulated, provide ongoing review of technical outputs for relevance against these objectives and modify/expand expected outputs in terms of opportunities created by early findings. Risks associated with existing and potential biological, chemical and physical hazards were examined. Risk ranking of hazard/product combinations was achieved using both an established semi-quantitative and a qualitative methodology, that embodied established principles of food safety risk assessment from farm-to-fork. Scenarios of egg-use and consumption pathways were modelled to establish risk rankings of hazard/egg and egg product combinations.

Non-SE Salmonella was identified as the principal egg-associated hazard. Highest risk arises from foods prepared using non-commercial cracked eggs or un-pasteurised egg pulp in uncooked or lightly cooked meals. The relative risk of eggs from non-cage systems for *Salmonella* is unknown and warrants further consideration. Other contributory factors to risk for which data is lacking include efficacy of egg washing conditions and time/temperature of egg handling storage between egg grading floors and retail in Australia.

The report provides a technical resource for industry and regulatory agencies to address food safety issues associated with eggs and egg products. The project provided a through chain food safety risk profile for the Australian egg industry.

Research results from this project were incorporated into Food Standards Australia New Zealand (FSANZ) food safety requirements and the report has been downloaded more than 2,000 times since posting on the AECL website.

The *Salmonella* research cluster has clearly met an Australian public health need.

Funding for the Project Cluster

Egg producer levy funding for the cluster contributed through RIRDC and AECL managed research portfolios along with research organisation and other contributions are shown in the table.

Table 3.2 Project Cluster Funding by Year and Source (\$)

	AECL/RIRDC	Research Organisation	Other	Total
UQ-19E				
1993-94	28,541	0	0	28,541
1995-96	28,541	0	0	28,541
DAV-146A				
1998-99	20,000	25,569	0	45,569
1999-00	20,000	25,569	0	45,569
CIF-1A				
2000-01	62,250	46,079	18,750	127,079
2001-02	62,250	46,079	18,750	127,079
2002-03	62,250	46,079	18,750	127,079
2003-04	62,250	46,079	18,750	127,079
SAR-42A				
2002-03	11,310	0	0	11,310
2003-04	11,310	0	0	11,310
SAR-47				
2003-04	38,000	0	0	38,000
2004-05	38,000	0	0	38,000

Source: AECL Project Database

The grand total of direct project costs was \$755,156

In addition to the direct project costs associated with this *Salmonella* public health cluster, costs were incurred to realise human health and other cluster related benefits in the Australian community. These costs included:

The development and implementation of FSANZ food guidelines to realise the public health benefits identified in the RIRDC/AECL research; and

Costs to egg producers and the food chain from adoption of resultant FSANZ food safety programs and other measures (eg NSW Food Act Egg Food Safety Scheme, The Egg Industry Act (Tas), Food Safety Scheme for Eggs and Egg Products (Qld), etc).

These costs are more fully developed in the cluster evaluation and are included in the cost benefit analysis.

Project Outcomes and Research Benefits

Outcomes from the five projects that make up the *Salmonella* public health cluster are shown in the table.

Table 3.3

Outcomes from Salmonella Public Health Cluster

UQ-19E 'The significance of salmonella, particularly <i>S. Infantis</i> , to the Aust egg industry'.	DAV-146A 'International review of <i>Salmonella Enteritidis</i> (SE) epidemiology and control policies'.	CIF-1A 'Rapid detection of virulent <i>Salmonella</i> in egg and poultry products'.	SAR-42A 'A <i>Salmonella</i> quantitative risk assessment model for the egg industry'.	SAR-47 'National food safety risk profile of eggs and egg products'.
Outputs				
Baseline survey of salmonella prevalence in Aust layer flocks.	An international review of virulent <i>Salmonella Enteritidis</i> and its control.	Development of tests to separate virulent and non-virulent salmonella strains in poultry.	A 'dose response' model for assessing the impact of food industry practices on occurrence of salmonella.	An audit of the human health risk from salmonella in Australian eggs.
Outcomes				
Limited <i>Salmonella. Enteritidis</i> in Aust (a virulent and human life threatening form).	Awareness raising with Aust poultry vets – economic importance of ongoing freedom from SE.	Tests developed with commercial application.	A review of salmonella outbreaks in Australia and overseas.	Identification of public health hazards.
However <i>Salmonella Infantis</i> is a significant public health issue and is present in Aust layer flocks.	Monitoring systems developed for early detection of SE and to keep Australian flocks <i>Salmonella Enteritidis</i> free.	Capacity to diagnose salmonella strain and respond quickly to strains with human health implications.	Ability to test alternative egg production, food preparation and disease control measures.	Management strategies for the risks identified.
<i>S Infantis</i> is able to penetrate the eggshell if in contact with infected faecal matter.	Control and eradication strategies put in place for the Aust situation.	Diagnostic tools available for use in conjunction with salmonella food risk assessment.	Ability to measure salmonella risk from 'point of lay' to alternative retail practices and food types.	Non SE salmonella identified as the principal egg-associated human health hazard.
Recommendations on faecal material on eggshells subsequently incorporated into Egg Corp Assured.	Recognition of the need to develop rapid detection tests for virulent and non-virulent salmonella strains.		Tools for the completion of a national salmonella food risk assessment.	Study recommendations immediately incorporated into new Aust NZ Food Standards Code.
Recognition of the need for additional knowledge on risk pathways for salmonella infection between bird and egg for human consumption.				

Source: AgEconPlus analysis

AECL's investment of grower levies in the salmonella public health cluster has resulted in:
Knowledge from a baseline survey of the prevalence of salmonella in Australian layer flocks and the infection pathways between bird and egg;

Assurance that the virulent salmonella form, *S. Enteriditis*, which is highly problematic in Europe and the USA, has limited prevalence in Australia;

Improved awareness, monitoring and control strategies for *S. Enteriditis*;

A new diagnostic test that is able to distinguish non-virulent from virulent salmonella strains;

A dose response model that is able to assess the impact of food industry practices on the occurrence of salmonella in eggs and egg products; and

A national risk assessment for eggs and egg products the recommendations from which have been incorporated into new National Food Standards, subsequent state legislation and egg industry food safety programs.

In short, all these outcomes have contributed to a reduction in food borne illness due to egg consumption.

How these project outcomes translate into economic benefits for the Australian community and levy paying egg producers is developed in the section below.

Identification of Research Benefits

A schematic of benefit flow resulting from levy payer funded research is shown in Figure 1 over page.

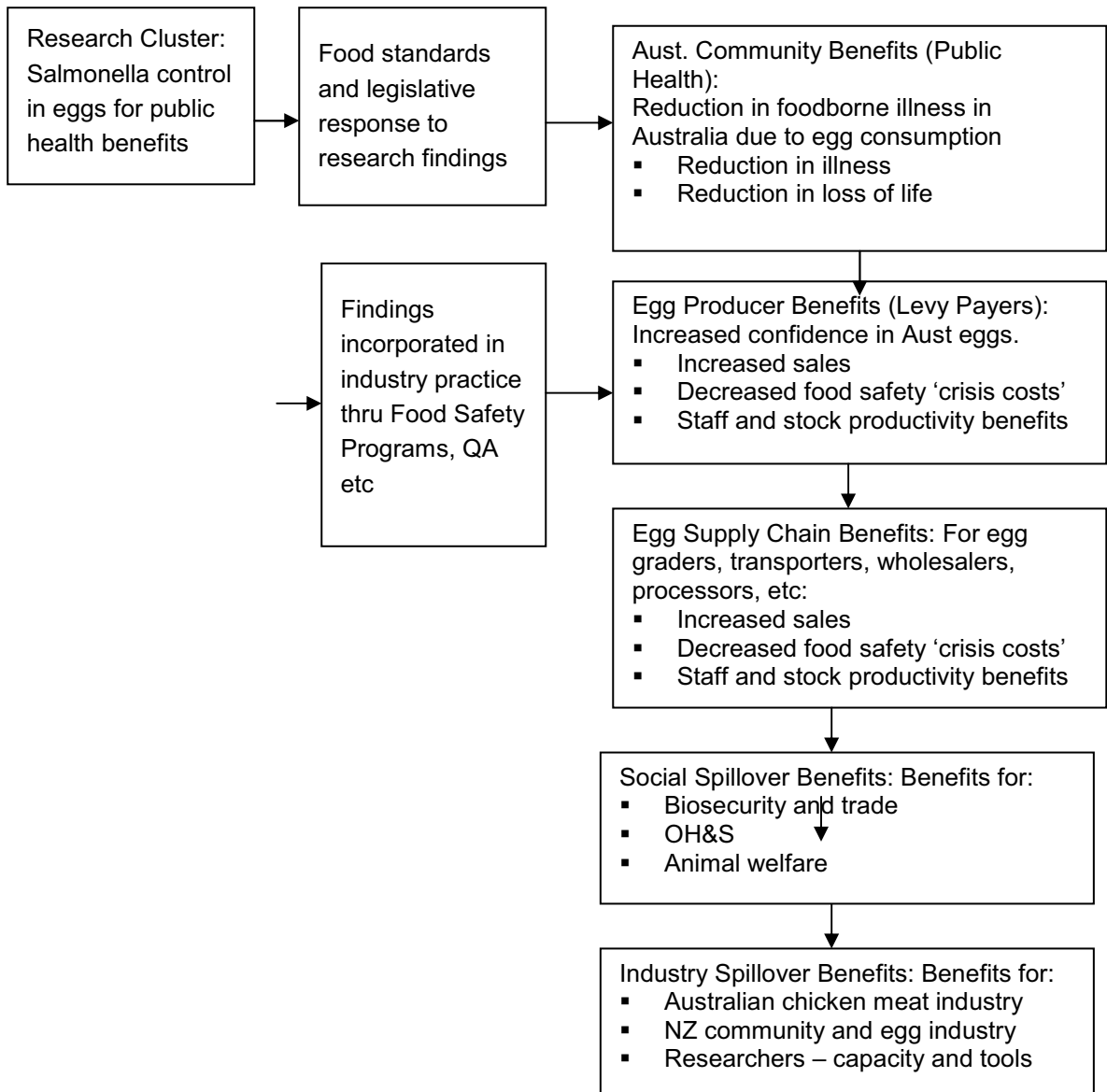
Australian Community Benefits (Public Health)

Outcomes from this cluster of levy payer research have been taken up by FSANZ and incorporated into Australia New Zealand Food Standard 2.2.2 and are likely to shape the National Food Safety Standard for Eggs and Egg Products due for completion in 2008. Subsequently state based food authorities have implemented Australia New Zealand Food Standard 2.2.2 through state based legislative responses and overseen the implementation of food safety programs in egg businesses and the supply chain where this has been warranted (for example Food Safety Scheme for Eggs and Egg Products in Qld and the Egg Food Safety Scheme under development in NSW).

Research implementation will result in a reduction in foodborne illness in Australia due to egg consumption.

The cost benefit analysis places most emphasis on the evaluation of this benefit (and its associated costs) given its primacy to the objectives of the research cluster.

Figure 3.1: Potential Benefits to the Aust Community and Levy Paying Egg Producers



Egg Producer Benefits (Levy Payers)

Implementation of findings from the research cluster will result in safer food and increased confidence in Australian eggs. The NSW Food Authority (2005) identified the benefits to egg producers of implementing Food Standard 2.2.2 through a food safety program as being:

- Decreased risk of damage to the egg industry from salmonella outbreaks.
- Better satisfaction of customers and insurance companies.
- Increased understanding and commitment to food safety.
- Management improvement through clear delineation of staff responsibilities (a requirement of an effective, audited food safety program).
- Better stock management leading to less wastage (spoilage).

In short research implementation will translate into additional sales and fewer food safety 'crisis' costs for egg producers. Crisis costs might include temporary closure of the industry through a salmonella outbreak and resultant reestablishment costs.

Egg Supply Chain Benefits

In addition to egg producer benefits, those in the egg supply chain (egg graders, processors, transporters, wholesalers, storage operators, retailers, etc) will benefit from a safer product through additional sales and fewer 'crisis' costs for the supply chain.

Industry Spillover Benefits

Spillover benefits will be generated through the application of research findings to the chicken meat industry in Australia where salmonella is also a problem of economic significance.

Benefits will also be realised in the New Zealand community and New Zealand egg industry when FSANZ food standards, which cover Australasia and include AECL research outcomes, are implemented in that country.

Furthermore research community knowledge and tools were produced as a result of investment in this research cluster. This intellectual capital has potential for further application to the egg and other Australian industries. Detection test products from research project CIF-1A, for example, are currently embargoed while the intellectual property owners explore additional commercialisation opportunities. Revenue streams from salmonella detection test commercialisation opportunities have not been quantified in the cost benefit analysis.

Social Spillover Benefits

Animal welfare gains through healthier flocks with less salmonella and OH&S gains for those working on egg farms are also possible from the completion of this research. Healthier flocks and improved working conditions result from salmonella management through food safety programs informed by this research cluster.

A social spillover benefit of more significance resulting from this research is the capacity of the Australian egg industry to both detect the presence of the deadly SE salmonella serovar in Australia and prevent its establishment. This capacity also enhances Australia's ability to negotiate trade access for Australian egg and egg products on the basis of the ability to prove ongoing SE freedom.

Environmental Spillover Benefits

Spillover benefits into wild bird populations/environmental health associated with a reduction in salmonella in human population may be possible. This benefit is relatively minor but given the

capacity of diseases such as Avian Influenza to move between wild bird populations and humans should not be underestimated.

These benefit items are considered in the cluster evaluation.

Approach to the Cluster Evaluation

The Economic Base Case

Salmonella is the principle cause of egg related food poisoning events in Australia (Daughtry *et al* 2002 and NSW Food Authority 2005).

Illness Caused by Egg Consumption

In Australia an estimated 5.4 million people experience foodborne illness each year. This rate of infection (one out of approximately every four persons) is similar to that found in other developed countries (Commonwealth Department of Health and Aging (DOHA) OzFood Net Working Group 2005). Surveillance and monitoring also indicates that incidences of foodborne illness are increasing.

DoHA's OzFoodNet foodborne illness database recorded 375 reported outbreaks of foodborne or suspected foodborne disease over 42 months between January 2001 and June 2004 - pre incorporation of AECL's salmonella public health research into FSANZ Food Standard 2.2.2. i.e. they occurred under the base case.

Of these outbreaks, 31 or 8.3% (31/375) were potentially associated with egg consumption. Eggs or food which contains eggs as a key ingredient were closely associated with 19 (59%) of these outbreaks and food made with raw eggs was involved in 15 outbreaks. These 31 outbreaks affected 733 people, with 125 people hospitalised and 3 people not surviving (NSW Food Authority 2005).

Investigators reported that five (16%) outbreaks were due to mixed meals, of which one component was an egg dish. In eight outbreaks (25%) a food vehicle was unable to be implicated as the cause of illness. However, eggs had been eaten in some of the cases and in five of the eight outbreaks food made with raw eggs had been consumed (NSW Food Authority 2005).

In a 1996 outbreak of Salmonella, egg product in a dessert sauce supplied to an Australian airline was implicated in 488 reported cases of gastro-associated illnesses among airline passengers, 56 of which required hospital treatment (NSW Food Authority 2005).

OzFoodNet data also showed that of the agents responsible for the 23,250 cases of foodborne diseases notified in Australia in 2003, 31% were due to salmonella (NSW Food Authority 2005).

It is important to note that the OzFoodNet data represents only those cases that are the most clearly attributable to eggs. The data is only a small proportion of the actual cases of foodborne illness associated with eggs, given that most illnesses go unreported (NSW Food Authority 2005).

Queensland for the past eight years recorded at least twelve outbreaks of egg related foodborne illness, resulting in 796 cases of illness, 81 hospitalisations and 2 deaths. Poor food safety and quality control at the primary end of the food chain was found to be a contributing factor in a high profile egg related foodborne illness incident in 2003 at an aged care facility in Queensland, which resulted in 47 cases of illness and 2 deaths.

Less than 5% of foodborne illness cases are actually reported in formal notifications because the overwhelming proportion of outbreaks goes unrecognised. It is often very difficult to identify a key ingredient or critical factor contributing to the occurrence of the illness.

Loss of Life Caused by Foodborne Illness Due to Eggs

DoHA generally does not identify the outbreaks where death due to illness associated with the consumption of eggs has occurred because they can be subject to coronial findings.

DoHA estimates that the multiplier for Salmonella infections in eggs and egg products is approximately 1 notified infection to every 15 infections occurring in the community, with a credible interval of 5 to 25.

In 2003 the following deaths involving eggs or egg products were recorded:

- Two deaths in a Queensland outbreak of salmonella in a nursing home where raw egg drinks (suspected cause) were given to residents.
- One death in a Victorian outbreak of salmonella associated with Vietnamese pork rolls.

Base Case Economic Implications

Illness and loss of life caused by eggs under the base case will be averted following implementation of AECL funded public health cluster findings. Base case illness/loss of life rates due to egg consumption are summarised in the table below. Base case illness rates/loss of life rates and their economic consequences were sourced from a NSW Food Authority Regulatory Impact Statement (NSW Food Authority 2005), which was prepared to support implementation of the AECL research through FSANZ national food standards. Base case data used by the NSW Food Authority included:

Illness caused by egg consumption:

- Australia wide there are an average of 8.8 cases pa of salmonella linked foodborne illness associated with egg consumption.
- For each case reported there are 15 cases that go unreported i.e. 132 cases per annum.
- Each case results in the hospitalisation of 6 people i.e. 792 are made sick to the point of requiring hospitalisation with salmonella from consuming eggs each year.
- The cost per illness reflected in lost wages, carer costs and medical expenses is \$2,470 per person. Hospitalisation and other costs sourced from Food Science Australia and Minter Ellison Consulting (2002).

Loss of life caused by foodborne illness due to egg consumption:

Australia wide there is one death per annum attributable to salmonella linked foodborne illness associated with egg consumption.

Human life has equal value regardless of age, sex, race, job, vocation or education and a value per human life of \$5 million is ascribed. Human life value was sourced from Food Science Australia and Minter Ellison Consulting (2002).

Table 3.4 Base Case Foodborne Illness Rates, Loss of Life and Economic Cost Due to Salmonellosis Resulting from Egg Consumption (cost per annum)

	Number of Cases (i.e. people impacted under the base case)	Cost Per Person (\$/person)	Annual Cost (\$)
Illness Caused by Egg Consumption	792	\$2,470	\$1,956,240
Loss of Life Caused by Foodborne Illness Due to Egg Consumption	1	\$5,000,000	\$5,000,000

Source: AgEconPlus analysis of NSW Food Authority data

The economic cost to the Australian community of illness/loss of life associated with egg consumption and salmonella under the base case is almost \$7 million per annum.

Estimation of Cluster Benefits

Australian Community Benefits (Public Health)

As a consequence of the implementation of the findings of this research cluster through FSANZ and the state food safety agencies there will be a reduction in base case foodborne illness rates and loss of human life. This public health benefit was quantified by the NSW Food Authority in their Regulatory Impact Statement using the following data:

Public health benefits from improved salmonella risk management in eggs and egg products will be realised through the implementation and auditing of Food Safety Programs consistent with FSANZ Food Standard 2.2.2.

Food safety program implementation on-farm and through the egg supply chain will not be 100% effective in eliminating salmonella from shell eggs and egg based products.

Best available evidence is that Food Safety Schemes reduce the risk of foodborne illness by 70% over base case levels (Food Science Australia and Minter Ellison Consulting (2002).

On this basis implementation of research cluster findings through FSANZ and state based food safety programs will result in 554 fewer illnesses caused by egg consumption (792 illnesses by a 70% annual reduction) and 0.7 of a life saved (1 life lost under the base case by a 70% annual reduction).

It is noted that there are 67.543 million dozen shell eggs sold at retail each year (AC Nielsen research).

The economic implications of these data are shown in the table below.

Table 3.5 Public Health Benefits from Salmonella Research Cluster Implementation

	Number of Cases Avoided (i.e. people no longer impacted)	Cost Avoided Per Person (\$/person)	Annual Benefit (\$)
Reduction in Illness Caused by Egg Consumption	554	\$2,470	\$1,368,380
Reduction in Loss of Life Caused by Foodborne Illness Due to Egg Consumption	0.7	\$5,000,000	\$3,500,000

Source: AgEconPlus analysis of NSW Food Authority data

The annual public health benefit from salmonella research cluster implementation is almost \$5 million. This benefit is realised through the imposition of industry and other costs. These costs are estimated in the valuation of cluster costs section below.

Spillover Benefits – Egg Producers, Supply Chain, Social and Environmental

The NSW Food Authority was able to quantify a series of spillover benefits for egg producers and the supply chain from research implementation through a food safety program. The NSW Food Authority drew on the following data:

Nationally there are 775 businesses in the egg production and supply chain including 423 egg producers.

Quantifiable benefits are realised for each of these businesses as a result of decreased risk of damage to the reputation of the egg industry, better satisfaction of customers and insurance companies, better management practices and record keeping, increased staff understanding of and commitment to food safety, management improvement through clear delineation of staff responsibilities and better stock management leading to less wastage (spoilage).

In aggregate the value of these benefits to egg producers and the supply chain was estimated at \$5,500 per business per annum.

A research cluster spillover benefit of \$4,262,500 per annum was realised (\$5,500 per business by 775 egg businesses).

Additional social and environmental benefits are flagged but not quantified in this analysis.

Estimating Cluster Costs

Research Costs

Research costs total \$755,156 (see Table 2) and were incurred by levy payers, research organisations and others between 1993 and 2005. All research costs are included in the cost benefit analysis.

Implementation and Other Costs

Implementation of research findings through FSANZ Food Standards, state based food agency regulations and industry food safety programs will result in industry and agency costs. The NSW Food Authority quantified these costs for the NSW situation on the following basis and the same logic is applied to this cost benefit analysis for the national situation:

Costs will be incurred by egg producers and other egg businesses for egg food safety program implementation. The NSW Food Authority, working with industry, established that costs will be incurred for licensing, food safety program establishment and management, auditing, food sampling and any one off capital improvements.

Annualised these egg producer and egg supply chain business costs are estimated at \$4,400 per egg business.

Research implementation costs, borne by the egg industry are estimated at \$3,410,000 per annum (\$4,400 per business by 775 egg businesses).

There are no Australian community, researcher, environmental or social costs associated with this research or its implementation. The additional cost to the egg industry of food safety programs will be borne by egg producers and the supply chain. Market forces are such that consumers will resist opportunities to pass on costs in the form of higher prices.

Testing the Cluster Counterfactual

Testing the counterfactual is the process used to determine the additional value created by AECL from investment in the research cluster. The counterfactual analyses the benefits (public and private) that would have been produced if the investment had not been made (CRRDCC 2007).

The counterfactual is addressed by posing a series of questions directed at what would have occurred in the absence of AECL investment (CRRDCC 2007).

Would the research have occurred without AECL investment (i.e. does the research address a market failure)?

The research would not have occurred without AECL investment. The benefits delivered by this research are for the Australian community. They are additional public health benefits. Spillover or incidental benefits i.e. increased confidence in Australian eggs are captured as an aside by Australian egg producers.

Were the benefits simply brought forward as a result of AECL investment?

No there is insufficient incentive for the research to be completed outside the current funding model.

Has an efficient use of funds occurred because of the funding model/public private partnership?

Yes an efficient use of funds has occurred. The presence of funding from the Australian government to match producer levy contributions has allowed investment in a public good outcome that would not have occurred if only private levy payer funds were available.

Is AECL an efficient model for research delivery?

AECL is an efficient model for research delivery. The RDC is able to pool levy payers' funds, leverage them through matching Australian Government payments and channel them into public benefit research projects that are beyond the scope of individual egg producers. Individual egg producers do not have the capacity to address projects with public health benefits even if spillovers from this research increase confidence in Australian eggs. Other more immediate research priorities with greater emphasis on the producer 'bottom line' would capture egg producer funds.

Does the Presence of AECL increase the resultant adoption rate?

Yes the presence of AECL increases resultant food safety program adoption rates. Recommendations are incorporated in tools such as the egg industry's quality assurance program Egg Corp Assured and through AECL endorsement of statutory food safety programs.

Would the research have been completed overseas and been available to Australia anyway?

No in fact there is a risk that overseas salmonella research incorporating findings from countries with more virulent salmonella strains largely absent from Australia (eg *Salmonella Enteritidis*) would have driven regulatory food safety programs here in Australia. In this situation the Australian industry may have found itself with a more punitive food safety program with consequential losses in efficiency for both egg producers and the Australian community. For example SE control overseas has resulted in a regulatory requirement for the whole supply chain to be refrigerated. Food Science Australia estimate that this would add \$180 million in egg industry costs.

Would substitute technologies have been developed?

CIF-1A produced diagnostic technologies. The remaining projects in the cluster were concerned with the generation of knowledge of a disease in the food chain in the Australian situation. Substitute technologies for this knowledge are not available.

Are there sufficient incentives for voluntary groups to get together and complete the research?

No research outcomes are public benefit in nature and are therefore realised by the whole community rather than individuals for private gain. Groups of producers or more likely substantial egg producing individuals might put individual food safety programs in place uninformed by their own research but they would still be subject to the negative outcomes for their businesses associated with disease outbreak caused by other individual producers or links in the food chain.

Additionality

Refers to the amount of spillovers that are conditional on public support for AECL (CRRDCC 2007). In this instance all project benefits are reliant on public support for the salmonella research cluster.

Capacity/Incentive to Invest in Absence of Levy and Public Contribution

This research cluster would not be funded in the absence of public funding under the RDC model for AECL. In the absence of a compulsory levy there is insufficient capacity and incentive for the egg industry to complete this research cluster.

Informed by the counterfactual, additionality and the need for a public contribution to fund this research cluster the evaluation was completed.

Results and Sensitivity Testing

Project cost benefit analysis was completed using the Guidelines for Evaluation (May 2007) prepared by the CRRDCC. Data driving the analysis is summarised in Table 3.6 and results are presented in Table 3.7.

Table 3.6 Key Parameters Underlying the Analysis

<p>The discount rate for future costs and benefits and the compound rate for historical research costs is 5% real.</p> <p>Nationally there are 775 businesses in egg production. Implementation of research findings through food safety programs will cost each egg business \$4,400 pa.</p> <p>National implementation of egg food safety programs occurs in 2008. The research has a useful economic life of 15 years before the industry situation in relation to salmonella changes and the FSANZ food standards are re-written. The Australian Community Benefits (public health) are available from 2008 Egg producer benefits, egg supply chain benefits, industry spillover benefits, social spillover benefits and environmental spillover benefits have not been quantified.</p>

Table 3.7 Cost Benefit Analysis, Salmonella Control in Eggs for Public Health Benefits

Key Parameter	Net Present Value (5% discount rate)	Benefit Cost Ratio	Internal Rate of Return
Food Safety Program 'life' of 5 years	\$6 million	1.37	154%
Food Safety Program 'life' of 15 years	\$15 million	1.43	156%
Food Safety Program 'life' of 20 years	\$18 million	1.43	156%

Source: AgEconPlus analysis

The project returns a strong result for the Australian community, which realises significant human health benefits funded by Australian egg producers. The Net Present Value (NPV) of the project cluster is \$15 million using the 'core' data set and a real discount rate of 5%.

The sensitivity of this result to changes in the 'life' of the current generation of national and state food safety programs that build on this research cluster is also shown in Table 7. Reducing the 'life' of food safety programs that incorporate research cluster results from 15 to 5 years still delivers a positive outcome for the Australian community – a NPV of \$6 million.

Conclusion

Cluster 1 Salmonella control in eggs for public health benefits is an R&D 'hero' project that delivers substantial benefits for the Australian community and in so doing protects the integrity of the Australian egg industry.

Cluster 2: Cannibalism Control in Layers – Diet, Microbes and Fibre

Cluster Identification

This cluster analysis addresses a single egg producer levy funded project – UNE-72A which commenced 1 July 1999 and was completed 1 November 2002.

Table 4.1 R&D Projects included in the Cannibalism Control Cluster

ID	Project Title	Project Period
UNE-72A	Effect of diet composition, gut microbial status and fibre forms on cannibalism in layers.	1999-2002

Source: AECL Project Database

Cluster Description and the Problem Being Addressed

Cannibalism, the behaviour where birds start pecking or eating flesh of other birds, was a major problem for the Australian layer industry. Prior to the commencement of this study in 1999 mortality from cannibalism in some strains ranged from 10% to 20%, depending on the production system and management strategies employed (Cumming *et al.*, 1998).

Cannibalism appeared to be highest in imported bird strains. The Australian egg industry had a flock size of approximately 10 million layers in 1999 and a 10% across the industry mortality during lay meant a potential loss to the industry of \$10 million per annum.

The objectives of this project were to:

- Examine the interaction between diet composition and the incidence of cannibalism.
- Investigate the effect of gut microbial status on cannibalism in layers.
- Develop dietary strategies to minimise cannibalism in laying hens.

Dietary strategies that reduce cannibalism in layers reduce flock morbidity and mortality and enhance the economic position of egg farmers.

Funding for the Project Cluster

Egg producer levy funding for the cluster contributed through RIRDC and AECL managed research portfolios along with research organisation and other contributions are shown in the table.

Table 4.2 Project Cluster Funding by Year and Source (\$)

	AECL/RIRDC	Research Organisation	Other	Total
UNE-72A				
1999-00	56,316	14,173	0	70,489
2000-01	56,316	14,173	0	70,489
2001-02	56,316	14,173	0	70,489
2002-03	56,316	14,173	0	70,489

Source: AECL Project Database

The grand total of direct project costs was \$282,000.

Project Outcomes and Research Benefits

Project Outcomes

Outputs from the project include four publications in the Australian Poultry Science Symposium and one publication in the Journal of Applied Poultry Research.

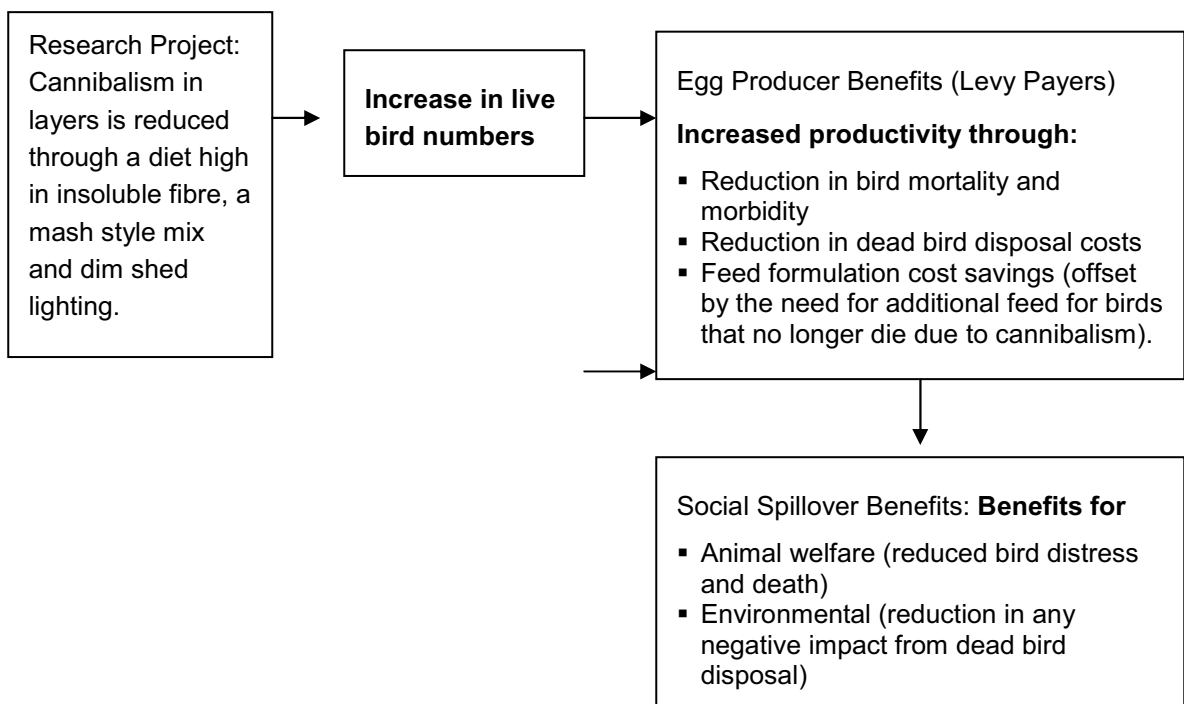
The research has shown that layers reared under dim light and supplied with a diet containing high-insoluble dietary fibre, such as low cost rice hulls, decreased the incidence of cannibalism mortality, whereas brightly lit sheds and a diet containing high soluble dietary fibre increased the incidence of pecking leading to cannibalism. Increased digesta passage rate seems to result in birds feeling hungry quicker and as a consequence birds spend more time feeding and less time pecking. A mash diet form was more effective in reducing cannibalism than the pelleted form.

The project has shown that a high-insoluble fibre diet, a mash style mix and dim shed lighting reduces cannibalism in layers.

Identification of Research Benefits

A schematic of benefit flow resulting from levy payer funded research is shown in Figure 4.1 below.

Figure 4.1: Potential Benefits to the Aust Community and Levy Paying Egg Producers



Egg Producer Benefits

Egg producer implementation of findings from the cannibalism control in layers project resulted in a reduction in lost production from dead and injured birds, cost savings in dead bird disposal and a reduction in feed cost associated with a change to a lower cost, high fibre feed.

The principal egg producer benefit from this research will be a reduction in lost production from dead and injured birds caused by cannibalism. Dead bird disposal cost will be a minor positive benefit for egg producers and feed cost savings from a low cost high fibre diet together with cost savings from converting to a mash style mix (where a mash style mix isn't already standard farm practice) will be offset by the additional cost of feed for birds that no longer die due to cannibalism.

Social Spillover Benefits

Implementation of findings from the cannibalism control in layers project will improve the welfare of layers. There will be less pecking in layer flocks leading to less death and injury requiring subsequent euthanasia. Cannibalism affects hens in cage, barn and free-range production systems but is more prevalent in barn and free-range systems. As a result of implementing findings from this project, birds will lead longer, less stressful and more productive lives.

In addition research implementation will result in environmental benefits from not having to dispose of as many dead or dying birds in a premature and high cost way. Birds who are the victim of cannibalism can be disposed to farm pits or at rendering plants but most are disposed to local council owned landfill. Costs are incurred for freezing dead birds before collection, transportation and the cost of landfill. In contrast birds that are disposed of at the end of their productive lives either earn a small positive return for farmers or are removed at no cost.

Approach to the Cluster Evaluation

The Economic Base Case

In the absence of research outputs from this project there would still have been positive reductions in layer mortality rates during the current century. This is because reductions in layer mortality since the early 2000s have been due to a combination of factors including:

- Genetic improvement in day old chicks supplied to egg producers. Chicks are now more robust with lower 'background' level mortality rates than they were in 1999.
- Vaccination for disease control such as Marek's disease, which previously had a significant impact on layer mortality. Individual shed mortality rates of 20% were not uncommon prior to the widespread adoption of Rispen's vaccine.
- Adoption of effective animal husbandry techniques including the newly developed laser beak trimming of day old chicks. Beak trimming has reduced the incidence of pecking in Australian flocks.
- Movement to controlled environment sheds with control of light below 5 lux. Previously layer sheds were constructed to make use of natural light and ventilation. Reliance on natural light and ventilation resulted in uneven temperatures with less productivity from the birds.
- Uniform artificial lighting achieved through the use of improved controlled environment shedding. Recommendations on lighting were made as a result of investment in this and other Australian and international egg industry research projects.
- General advances in layer nutrition and feed formulation. Again improvements in feed formulation are linked to this project as well as other research outcomes.

This project is part of a research continuum stretching back to the 1970s showing that dietary fibre reduces cannibalism in poultry. Certainly in the period since the release of this report (2003) high fibre diets have become increasingly popular for cost, nutrition and cannibalism prevention reasons. Pre 2000 Australian industry nutritionists were recommending a maximum of 5% dietary fibre in layer diets. In 2007 they are recommending diets with 6% fibre. Furthermore, and drought permitting, fibre (eg lucerne meal, rice hulls, etc) is a relatively low cost feed and a plentiful feed source.

Consequently this project is only able to claim a proportion of the improvement in mortality rates experienced in Australian layer sheds since 1999.

Mortality rates in the Australian egg industry vary between sheds, farm production system and the strain of bird used. Popular layer strains such as ISA, Hyline and Inghams Hisex all have different 'background' mortality rates. Furthermore mortality information tends to be confidential to individual farm operations and is not collated across the industry.

Best estimate mortality rates pre project implementation, post project implementation and what is attributable to this project (i.e. reduction in cannibalism rates due to UNE-72A) are shown in Table 4.3. These 'best estimates' are reviewed in the cost benefit analysis using sensitivity testing.

Table 4.3 Across the Board Industry Mortality Rates for Hens in Lay

Production System	Industry Mortality Rate (Flock %)		
	Pre-Project Implementation (2000 to 2003)	Post Project Implementation (2004 to 2024)	Attributable to this Project
Cage Laid	10	7	1.5
Barn Laid	12	8	2
Free Range	16	10	3

Source: AgEconPlus consultation with industry consultants and nutritionists

Estimation of Cluster Benefits

Reduction in lost production as a result of cannibalism control is the principal benefit originating from this project. This benefit is quantified using the following data:

The Australian layer flock is currently 13.175 million hens (ABS Catalogue No 7121 reported in AECL Annual Report 2006). The flock is stable at this level over the 30-year life of the cost benefit analysis.

Cage eggs account for 75% of Australian production by volume, barn laid 5% and free range 20% (ACNielsen reported in AECL Annual Report 2006).

The reduction in mortality attributable to this project is 1.5% for cage laid, 2% for barn laid and 3% for free-range (estimates shown in Table 3).

The benefit of the research is death avoided in these birds between 16 and 35 weeks i.e. through the peak of their productive lives (AgEconPlus assumption).

Lost production is 160 eggs per bird at an average farm gate value for eggs of \$1.62 dozen (ABS Catalogue No 7503 reported in AECL Annual Report 2006 with no allowance for variation in price for production system or the current drought).

The additional production from hens no longer lost to cannibalism as a result of this research project has no impact on the price of eggs received by egg producers.

By 2007, five years after the research reports release 80% of Australian layer flocks have adopted low cost high fibre diets. This adoption rate remains constant throughout the analysis period. This data is tested using sensitivity analysis.

The value of the reduction in lost production is shown in Table 4.4.

Table 4.4 Egg Producer Benefits, Additional Production Due to Cannibalism Control

Production System	Industry Mortality Rate (Flock %)		Annual Producer Benefit (\$ farm)
	Hens Protected from Cannibalism	Eggs from Protected Hens	

	(No.)	(Dozen)	gate)
Cage Laid	118,000	1,600,000	\$2.6 million
Barn Laid	10,000	133,000	\$215,000
Free Range	63,000	840,000	\$1.4 million

Source: AgEconPlus analysis

NB: There were 13.175 million hens in the Australian industry at 30 June 2005.

The annual producer benefit from cannibalism control as a result of this research project is \$4.2 million.

Estimating Cluster Costs

Research Costs

Research costs total \$282,000 (see Table 2) and were incurred by levy payers and research organisations between 1999 and 2003. All research costs are included in the cost benefit analysis.

Implementation Costs

Implementation of the findings from this project results in no additional cost to egg producers. Fibre is added to layer feed rations reducing the calorie level and the need for other higher cost ingredients. The cost of feeding additional birds that no longer die resulting in improved production, as a result of reduced cannibalism, together with the savings in costs of converting to a mash based feed mix, offsets increased feed consumption as a result of a slight increase in feed consumption due to feeding a lower density feed.

There are no costs to other parts of the supply chain or the Australian community from implementing the cannibalism research findings.

Testing the Cluster Counterfactual

The counterfactual, the benefit that would have been produced if investment in the project had not been made, is tested through the following questions.

Would the research have occurred without AECL investment (i.e. does the research address a market failure)?

The research is of direct benefit to Australian egg producers who were having difficulty with overseas-developed layer lines under Australian production conditions. The research benefits Australian egg producers and spillover animal welfare and environmental benefits are incidental.

Given that the research addressed a significant industry problem, it is possible that one of the larger industry producers may have undertaken this research for themselves. However, under these conditions resulting outcomes would have been 'commercial-in-confidence' and would not have been available to all producers in the industry. Completing the research through the AECL structure has resulted in a superior outcome for industry with spillover benefits (animal welfare and environmental) for the Australian community.

Were the benefits simply brought forward as a result of AECL investment?

No there is insufficient incentive for the research to be completed, and available for the whole industry, outside the current funding model.

Has an efficient use of funds occurred because of the funding model/public private partnership?

An efficient use of funds has occurred because of the public private partnership funding model. The presence of matching public monies has provided incentive for an industry levy and investment in projects of this nature. In the absence of the current model, it is likely that the research findings would only be available to the industry's larger players.

Is AECL an efficient model for research delivery?

AECL is an efficient model for research delivery. In this instance AECL was able to work with the researcher to scope an appropriate project that delivered outcomes of benefit to industry. Research cost was a relatively modest \$282,000.

Does the presence of AECL increase the resultant adoption rate?

Yes the presence of AECL increases resultant adoption rates. Research outcomes are communicated through AECL channels that include newsletters and bulletins, research update reports, industry extension officers and on farm demonstrations of research outcomes. The fact that it is an AECL research outcome also assures egg producers that the research is not promoting a vested interest eg a feed supply company marketing high fibre additives.

Would the research have been completed overseas and been available to Australia anyway?

The project addressed an 'Australia specific' research issue i.e. the performance of overseas developed layer lines under Australian conditions. It could not have been completed overseas.

Would substitute technologies have been developed?

Possibly substitute technologies would have been developed in this instance eg proprietary feed additives to mitigate cannibalism. However, it is unlikely that an 'elegant' solution such as substituting a high cost ingredient for a lower cost fibre would have been produced.

Are there sufficient incentives for voluntary groups to get together and complete the research?

While it is possible that voluntary groups may have got together and completed the research it is more likely that smaller producers would have missed out on research findings and larger producers would have completed the investigation and kept 'commercial-in-confidence' resultant research implications.

Additionality

Additionality refers to the spillovers that are conditional on public support for AECL. In this instance it is unlikely that the spillover benefits realised would be available in the absence of a levy, smaller producers would simply have 'missed out' and resultant animal welfare and environmental gains would not have been realised. However, a levy without matching government funds may still have been sufficient to ensure the project was completed.

Capacity/Incentive to Invest in Absence of Levy and Public Contribution

Given the commercial nature of outcomes from this research, i.e. additional production at a lower cost, this research might well have been completed in the absence of a public contribution.

Results and Sensitivity Testing

Project cost benefit analysis was completed using the Guidelines for Evaluation (May 2007) prepared by the CRRDCC. Results are summarised in Table 4.5.

Table 4.5 Cost Benefit Analysis, Cannibalism Control in Layers

Key Parameter	Net Present Value (5% discount rate)	Benefit Cost Ratio	Internal Rate of Return
Low lift in mortality rate of 0.5%, 60% research adoption	\$8 million	24	220%
Mean lift in mortality rate of 1.5%, 80% research adoption	\$43 million	117	1083%
High lift in mortality rate of 2.0%, 100% research adoption	\$58 million	159	1468%

Source: AgEconPlus analysis

The project yields a very strong result for industry. A Net Present Value (NPV) for industry of \$43 million is realised using the 'core' data set and a real discount rate of 5%.

The sensitivity of this result to changes in 'core' data is also shown in Table 5. A halving of the improvement in mortality rates attributable to this project (i.e. improvement in cage layer mortality of 0.5% rather than the core analysis value of 1.5%) together with a 20% reduction in the uptake of research results (i.e. 60% of the industry adopt rather than the 80% assumed) still delivers a very healthy outcome for industry – a NPV of \$8 million.

Conclusion

UNE-72A research on the effect of diet composition, gut microbial status and fibre forms on cannibalism in layers is an R&D 'hero' project with returns for industry of present value \$43 million for a present value outlay of \$370,000.

Cluster 3: Project Egg - Consumer Sensory Research

Cluster Identification

This cluster analysis addresses a single egg producer levy funded project delivered by Colmar Brunton, David McKinna *et al* and the University of Sydney between February and October 2006 – Project Egg: Consumer Sensory Research. The project was to identify the sensory parameters of egg quality as determined by consumers.

Table 5.1 R&D Projects included in the Sensory Research Cluster

ID	Project Title	Project Period
1ECSR	Project Egg: Consumer Sensory Research.	2006

Source: AECL Project Database

Cluster Description and the Problem Being Addressed

The project's aim was to improve consumer perceived egg quality and consistency as a means of increasing consumer satisfaction and thus provide a framework for differentiating eggs, attracting a price premium for superior eggs and in so doing enable the facilitation of the growth and development of the Australian egg industry.

The objectives of this project were to:

- Identify the key drivers that determine consumers' perception of egg quality.
- Quantify the relative importance of each driver.
- Determine for each attribute the threshold at which consumer perception moves from unacceptable to acceptable to superior.
- Examine the importance of branding, packaging and endorsements in the overall egg offering.
- Quantify the impact of egg quality on the price consumers are willing to pay for eggs.
- Assess the correlation between consumer visual rating of broken eggs in situ versus a digital image.

Funding for the Project Cluster

Egg producer levy funding for the cluster contributed through the AECL managed research portfolio, along with research organisation and other contributions are shown in the table.

Table 5.2 Project Cluster Funding by Year and Source (\$)

	AECL	Research Organisation	Other	Total
1ECSR				
2006-07	\$286,310	0	0	\$286,310

Source: AECL Project Database

The grand total of direct project costs was \$286,310.

Project Outcomes and Research Benefits

Project Outcomes

Outputs were delivered for all six project objectives. The key drivers that determine consumers' perception of egg quality, and their relative importance, were found to be as per Table 5.3.

Table 5.3 Consumer Perception of Egg Quality

Variable	Importance (%)
Yolk colour	47
Albumen quality (measured in Haugh units)	17
Blood/meat spots	15
Shell colour	14
Weight	7

Source: Colmar Brunton 2006

Yolk colour is the most important driver, followed by albumen quality, blood/meat spots, shell colour and total egg weight. The study reports the threshold at which consumer perception of each of these drivers moves from unacceptable to acceptable to superior. Consumer requirements for yolk colour are easily met through the addition of a low cost natural colouring to layer feed.

Branding, packaging and endorsements in the overall egg offering are also reported. The study found that the most compelling components of packaging appeared to be:

Production system used – free-range, organic, barn laid.

Endorsements – RSPCA, Heart Foundation tick.

Functional benefits/claims – Omega 3, antibiotic, hormone free.

Carton – strong, recyclable, clear, colourful, informative labels.

Egg size – extra large, large.

In 2006, the branding of eggs was largely seen as insignificant in the eyes of the Australian consumer. The pack size and configuration also appeared to be relatively unimportant.

Consumer willingness to pay for superior quality eggs was also tested and assuming the average retail price for a dozen eggs was \$3.00, the majority of consumers indicated that they would be willing to pay up to \$3.50 for eggs of their 'ideal' quality. This indicates that consumers, on the whole, would be willing to pay around 15% more for eggs that are of a superior quality to the eggs they currently buy.

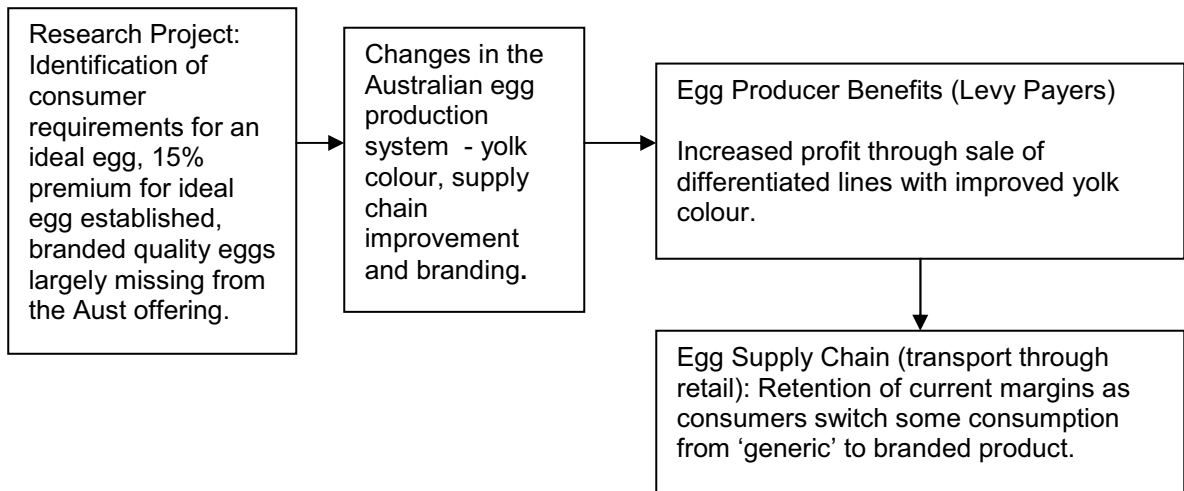
The implications of the research are that in order to produce superior eggs, egg producers should focus on producing large, pink brown shelled eggs with a strong yolk colour (most important) and no blood/meat spots. Egg distribution channels should enable eggs to arrive on the supermarket shelf with a firm albumen.

At the current time proprietary brand label eggs are losing market share to un-differentiated generic product (consumers perceive 'that an egg is an egg' in the Australian market place), consumers are not receiving the superior quality eggs that they require and producers are missing out on premium prices and subsequent profits.

Identification of Research Benefits

A schematic of potential future benefit flows resulting from implementation of this levy payer funded research is shown in Figure 5.1.

Figure 5.1: Potential Benefits to Levy Paying Egg Producers and the Aust Community



Egg Producer Benefits

Egg producer benefits are realised from the implementation of this research through the production and delivery of premium egg lines with a strong yolk colour (most important quality factor) on a consistent basis via a proprietary owned brand. Consistent egg colour is achieved through addition of a low cost natural colouring to layer feed.

Egg Supply Chain Benefits

The egg supply chain will be unconcerned about a shift to superior egg quality delivered via a proprietary owned brand. Margins are consistent between generic and proprietary owned branded product.

Australian Consumer Benefits

Implementation of this research will deliver Australian consumers eggs that consistently meet their quality requirements. This research project shows that consumers are willing to pay for this improvement.

These benefits are considered in the cluster evaluation.

Approach to the Cluster Evaluation

The Economic Base Case

At the current time Australian consumers see no meaningful difference between eggs and are generally shopping on price. Brand loyalty is weak with only 4% of the market recognising and remaining loyal to any one proprietary brand (Blue Moon Research and Planning 2007 in AECL 2007).

Given this market situation, owners of generic egg labels (also known as private-label or store branded eggs) have realised a market opportunity: most consumers think that an egg is an egg – no matter what the brand. Since 2000 these brand owners and egg buyers have launched new brands, set purchasing terms to egg producers, discovered that the egg industry is willing to sell eggs at lower price points and as a result, have offered cheaper, generic-label eggs to their shoppers. The market share of generic-label eggs has increased from 19% in 2000 to 62% in 2007 (AC Nielsen 2007 in AECL 2007).

Over this same period the average retail price of generic-label eggs has increased from \$2.58 per dozen in 2000 to \$2.90 per dozen in 2007, representing an increase of 12%. If pricing was to maintain parity with CPI, average prices would need to have increased from \$2.58 to \$3.31 per dozen. If egg producers supplying generic labels had 'passed on' the additional cost of feed price increases caused by an extended drought, prices would need to have been considerably higher. Egg producers supplying generic labels have failed to maintain their pricing position (data sourced from AC Nielsen 2007 and reported in AECL 2007).

Over the period 2000 to 2007, egg producers marketing branded eggs have seen their average price increase from \$2.75 per dozen in 2000 to \$4.16 per dozen in 2007 an increase in average price of 51% (AC Nielsen 2007 in AECL 2007). This price increase has been at the expense of market share – see Table 5.4 below.

Table 5.4 Base Case Retail Price and Market Share, Generic and Branded Eggs

Label	Price 2000 (\$' dozen)	Price 2007 (\$' dozen)	Market Share 2000 (%)	Market Share 2007 (%)
Generic-brand	2.58	2.90	19	62
Proprietary-brand	2.75	4.16	81	38

Source: AC Nielsen 2007 in AECL 2007

The period 2000 to 2007 has seen the growth in generic labels and the expense of proprietary brands with the result that the Australian egg category has become a commodity business. There is no meaningful brand presence, no product differentiation and the lowest price has become the market for all eggs. In other words, generic label brands have cannibalised proprietary egg sales – resulting in a decline in category revenue. The supply chain is immune to this change, maintaining its margins regardless of the brand sold, producers have 'worn the cost' of egg market commoditisation. Table 5.5 shows the value lost in the category.

Table 5.5 Loss in Value resulting from Egg Category becoming a Commodity Business (\$ million per annum)

	Current Value Based on 2000 Market Shares	Current Value Based on 2007 Market Shares
Value of generic-brand sales	37.2	121.4
Value of proprietary -brand sales	227.6	106.8
Total Value	264.8	228.2

Source: AC Nielsen 2007 in AECL 2007

NB: Assumes consistent retail sales volume of 67.5 million dozen (AC Nielsen 2005/06)

Some \$36.6 million per annum in value (\$264.8 million less \$228.2 million) has been stripped from the Australian egg category between 2000 and 2007.

Implementation of research findings i.e. strong yolk colour and brand development, will recover some of this loss in value for egg producers who develop proprietary brand sales.

Estimation of Cluster Benefits

Capture of the 15% premium for supply of the ideal egg is the principal benefit originating from this project. This benefit is quantified using the following data:

Not all producers in the industry will develop proprietary lines to complement generic sales nor will it be possible to shift all production into the premium category.

Industry consultation reveals that ‘early movers’ are already taking up research findings and best estimates are that 30% of industry retail sales will move to branded production incorporating research findings.

Uptake will be quite rapid and will be complete by 2009.

Adopters will shift the retail price for their premium lines from the current generic price of \$2.90 dozen (\$1.62 dozen farm gate) to \$3.34 dozen (\$1.86 dozen farm gate).

The value of proprietary label product incorporating research findings and marketed to retail is shown in Table 5.6.

Table 5.6 Benefit Estimate – Sale of Branded Product Incorporating Research Findings (\$’million per annum)

	Quantum
Retail sales volume (million dozen)	67.5
Sales of branded product incorporating research findings (%)	30
Premium for branded product with research findings (\$/dozen)	0.24
Gross Benefit 2009 (\$ million per annum)	4.9

Source: AC Nielsen 2007 in AECL 2007

The annual total benefit is \$4.9 million in 2009.

Estimating Cluster Costs

Research Costs

Research costs total \$286,310 (see Table 2) and were incurred by levy payers in 2006/07. All research costs are included in the cost benefit analysis.

Implementation Costs

Implementation of the findings of this project results in only modest additional costs for producers. Operational costs are incurred for adopting producers to alter the amount of natural colouring agent added to generic and premium lines, redesign operational systems to grade out strong yolk colour lines and marketing effort to reposition some of their current brand offering as premium, proprietary branded product. Most of this cost will be production manager time and an allowance of \$2,000 pa per adopting producer is made. The 30% of industry retail sales that constitute proprietary branded product will be supplied by the 10% of the industry’s producers (72 egg farmers) who recently attended AECL ‘how to’ marketing workshops aimed in part at uptake of project research findings.

An industry wide implementation cost of \$144,000 (72 farms at a cost of \$2,00 per farm) is incurred.

Testing the Cluster Counterfactual

The counterfactual, the benefit that would have been produced if investment in the project had not been made, is tested through the following questions.

Would the research have occurred without AECL investment (i.e. does the research address a market failure)?

The research would not have occurred without AECL investment. There was no incentive for the links in the supply chain (grading, transport, distribution centre and store) to research and address consumer sensory requirements. Commodity sales are just as valuable to the supply chain as branded product sales. Only consumers and producers lose utility from the commoditisation of the egg market. Furthermore, it is unlikely that the cost of consumer

sensory research could have been funded by an individual or group of producers. Basic research of this nature could not be funded in this industry outside of AECL.

Were the benefits simply brought forward as a result of AECL investment?

No there is insufficient incentive for the research to be completed, and available for the whole industry, outside the current funding model.

Has an efficient use of funds occurred because of the funding model/public private partnership?

An efficient use of funds has occurred because of the public private partnership funding model. The presence of matching public monies has provided incentive for an industry levy and investment in projects of this nature. In the absence of the current model, it is likely that this type of 'basic' research on the egg category would not have occurred. Producers would have been more interested in short term and 'quick fix' promotion.

Is AECL an efficient model for research delivery?

AECL is an efficient model for research delivery. In this instance AECL was able to work with the researcher to scope an appropriate project that delivered outcomes of benefit to producers and consumers.

Does the presence of AECL increase the resultant adoption rate?

Yes the presence of AECL increases resultant adoption rates. Research outcomes are developed and communicated through various AECL channels including a series of national training workshops targeting egg marketing.

Would the research have been completed overseas and been available to Australia anyway?

Possibly, however its believability and therefore adoption level is increased if it is completed in Australia and the findings are published on Australian consumer requirements.

Would substitute technologies have been developed?

Substitute technologies are not relevant in this instance.

Are there sufficient incentives for voluntary groups to get together and complete the research?

Voluntary groups are unlikely to fund this style of 'basic' consumer research preferring instead 'quick fix' investments in promotion.

Additionality

Additionality refers to the spillovers that are conditional on public support for AECL. In this instance the spillover benefits are relatively modest and are limited to the additional consumer satisfaction achieved through the availability of eggs that meet sensory requirements. There are no environmental or health spillover benefits or costs associated with this project.

Capacity/Incentive to Invest in Absence of Levy and Public Contribution

Given the 'basic' or fundamental nature of this research and the likely requirement for promotion funding it is unlikely that the project would have been commissioned in the absence of the levy and a public contribution.

Results and Sensitivity Testing

Project cost benefit analysis was completed using the Guidelines for Evaluation (May 2007) prepared by the CRRDCC. Results are summarised in Table 5.7.

Table 5.7 Cost Benefit Analysis, Consumer Sensory Research Findings

	Net Present Value (5% real discount rate)	Benefit Cost Ratio (1:x)	Internal Rate of Return (%)	Cost (present value of all funds invested)
Low sales branded product (10% production, 36 producers)	\$12.7 million	13.64	153%	\$1 million
Mean sales branded product (30% production 72 producers)	\$41.8 million	23.60	266%	\$1.8 million
High sales branded product (40% production 100 producers)	\$55.7 million	23.70	291%	\$2.5 million

Source: AgEconPlus analysis

The project yields a very strong result for industry. A Net Present Value (NPV) for industry of \$42 million is realised using the 'core' data set and a real discount rate of 5%.

The sensitivity of this result to changes in 'core' data is also shown in Table 7. A reduction in the take up rate of this research by half the number of producers accounting for only 10% of total production still delivers a very healthy outcome for industry – a NPV of \$12.7 million.

Conclusion

1ECSR consumer sensory research and implementation through branded product is an R&D hero project with returns for industry of present value \$42 million for a present value outlay of \$2.5 million.

Cluster 4: Ullage Audit, Solutions Development and Implementation

Cluster Identification

This cluster analysis addresses AECL's investment in understanding the causes of ullage in the supermarket supply chain and the formulation and implementation of solutions.

Ullage is defined as the lack; deficiency; amount by which a quantity is short of a full measure. Ullaged, an adjective, means not the full measure (Hutchinson Encyclopaedia, 2007). In the Australian retail industry ullage has come to mean the loss of salable product through the supply chain from production to handover to the end consumer at retail point of sale. Ullage is concerned with breakage of eggs and damage to their packaging from the grading floor, through transportation, to the distribution centre, to back of store and in retail display.

The cost of ullage right through the supply chain, including retail point of sale is borne by egg producers. Supermarkets and other supply chain participants make claims on egg producers for the number of eggs that have been ullaged.

AECL has invested in three linked projects to address ullage in the egg supply chain, they are:

- Audit of ullage in NSW Coles/BiLo stores;
- Audit of grading floors; and
- Audit of distribution centres.
- Cluster Description and the Problem Being Addressed

These three linked projects were undertaken in late 2004 in NSW and Victoria over a two-week period. Audits were completed in twenty-eight regional and metropolitan Coles and BiLo stores. The supply chain was divided into four areas: grading floor; transport to distribution centre; transport from distribution centre to store; and in-store. Comprehensive audits were completed in all four parts of the supply chain.

Eight main causes of ullage were identified, they were:

- Condensation weakening outer cartons;
- Upsizing eggs without upsizing cartons;
- Back of store storage from incorrect store ordering;
- Pallets stacked too high;
- Egg boxes not handled as fragile;
- Different shaped outer boxes making pallets difficult to stack;
- Already damaged egg cartons used during the grading process; and
- Damaged product due to grading floor machine errors.

Action plans were subsequently put in place by AECL and the industry to reduce ullage in the egg supply chain.

Funding for the Project Cluster

Egg producer levy funding for the cluster contributed through AECL managed research along with research organisation and other contributions are shown in the table.

Table 6.1 Project Cluster Funding by Year and Source (\$)

	AECL	Research Organisation	Other	Total
Audit – Coles/BiLo				
2004-05	\$106,260	0	0	\$106,260
Audit – Grading Floor				
2004-05	\$35,379	0	0	\$35,379
Audit – Distribution Centre				
2004-05	\$54,500	0	0	\$54,500

Source: AECL Project Database

The grand total of direct project costs was \$196,079.

Project Outcomes and Research Benefits

Project Outcomes

AECL and industry have formulated and implemented an action plan to address each of the eight major causes of ullage in the egg supermarket supply chain. The action plan addresses each of the eight major causes:

- Condensation weakening outer cartons
- Solution: pallets bound with materials that don't capture moisture. Two proprietary materials have been tested, approved and adopted by the majority of the industry.
- Upsizing eggs without upsizing cartons
- Solution: upsize egg cartons when using upsided eggs. The majority of the industry has increased the carton sell size for 70g+ eggs (which account for 1% of the market).
- Back of store storage from incorrect store ordering
- Solution: the Retail Category Management (RMC) project was developed by AECL to redress correct ordering, storage, handling, stock rotation and hygiene of eggs at store level. The RMC project has taken place at Coles/BiLo in Victoria, NSW and Queensland.
- Pallets stacked too high
- Solution: Outer cartons should not be stacked higher than 5 rows. Egg producers have adopted this rule and are delivering product into distribution centres stacked 5 rows high.
- Egg boxes not handled as fragile

Solution: the production of an egg handling procedures information resource. As part of this solution new artwork for outer packaging has been developed, as well as an interim stocker for pallets. The artwork has been approved and adopted by the majority of the industry. It labels eggs as fragile and stipulates that outers should not be stacked higher than 5 rows.

Different shaped outer boxes making pallets difficult to stack

Solution: industry standards for both outer and inner packaging. Industry working towards equal pallet configurations between producers.

Already damaged egg cartons used during the grading process

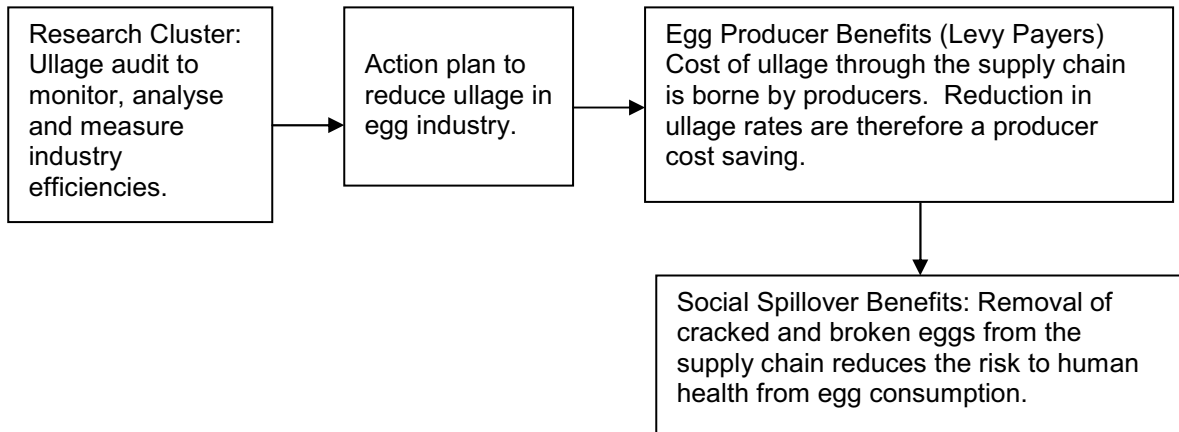
Solution: issue at one grading floor detected. This is covered by Egg Corp Assured and has since been resolved. Damaged product due to grading floor machine errors.

Solution: grading floor quality control. Egg Corp Assured covers this.

Identification of Research Benefits

A schematic of benefit flow resulting from levy payer funded research is shown in Figure 1 below.

Figure 6.1: Potential Benefits to Levy Paying Egg Producers and the Aust Community



Egg Producer Benefits

The cost of ullage though the supply chain is borne by egg producers. Retailers monitor ullage through the supply chain and deduct payments to producers for shortfalls in eggs sold at retail. A reduction in ullage rates is therefore a producer cost saving.

Social Spillover Benefits

Removal of cracked and broken eggs from the supply chain reduces the opportunity for bacteria to contaminate retail packages. Bacteria with the potential to cause human sickness include, but are not limited to *Salmonella spp*, *Bacillus cereus*, *Listeria monocytogenes* and *Staphylococcus aureus*.

Approach to the Cluster Evaluation

The Economic Base Case

The ullage audit revealed the source and percentage of total egg breakages through the grocery/retail supply chain, Table 6.2.

Table 6.2: Source of Total Egg Breakages Across the Supermarket Egg Supply Chain

Grading Floor	Transportation	Distribution Centre	In-Store
At grading floor before distribution	From grading floor to back door of the DC	From the DC to the back door of store	Within the store to customer
20.16%	4.54%	21.12%	54.18%

Source: AECL Ullage Audit Update (2007)

Industry data indicates that the average ullage rate across the grocery/retail supply chain is 3%. In 2005/06 grocery/retail sales volume was 67.5 million dozen eggs. Egg producers, the ultimate bearers of ullage costs, therefore did not receive payment for a total of 2 million dozen eggs. These eggs have a farm gate value of \$1.62 per dozen. The total cost of ullage to Australian egg producers supplying the grocery/retail sector is \$3.28 million pa.

A percentage of these base case costs have been saved through implementation of ullage audit research findings.

Estimation of Cluster Benefits

Eventually ullage audits and action plans will cover all industry supply chains. AECL research is planned through to 2008. In 2007 outcomes have been implemented across one of the large supermarket chains which accounts for sales of approximately 15 million dozen eggs per annum. From 2009 these benefits will be available to the other large supermarket chain, which accounts for estimated sales of 20 million eggs per annum. By 2011 the balance of the supply chain (sales of 32.5 million dozen pa) will have adopted research outcomes.

Industry advice is that implementation of ullage research outcomes has resulted in a decrease in average ullage rates of 0.5%. The benefit includes allowances for both high ullage and low ullage Australian states (longer and shorter supply chains) and parts of this supply chain where only some of the research results are applicable. For example interstate egg transport has always been on pallets stacked to a maximum of 5 cartons high and one supermarket chain has always used 5 carton stacking as a specification for all its transportation. The benefit of implementing ullage research is quantified using the following data:

The research is implemented by a single grocery/retail supply chain with sales of approximately 15 million dozen eggs pa in 2007 (stage one implementation), the second grocery/retail supply chain supplying 20 million dozen eggs adopts research findings in 2009 (stage two implementation) and the rest of the sector adopts in 2011 (stage three implementation).

Reduction in ullage rate of 0.5% i.e. average ullage rate decreases from 3% to 2.5%.

The farm gate value of eggs no longer cracked or broken through the supply chain is \$1.62 dozen.

The annual producer benefit from implementing ullage research findings is \$121,500 pa in 2007, an additional \$162,000 pa in 2009 and a further \$263,250 pa in 2011.

Estimating Cluster Costs

Research Costs

Research costs total \$196,079 (see Table 1) and were incurred by levy payers in 2004/05.

Implementation Costs

Costs associated with implementing ullage audit outcomes including extension of finds to stages two and three include:

Establishment and ongoing operation of AECL's Supply Chain Enhancement Industry Consultative Committee (ICC). The ICC ensures research recommendations are relevant to industry and advises on their implementation.

Annual costs for ICC operation are \$7,500. The ICC will operate for the period through to at least 2011.

Pallet wrapping with a tested and approved proprietary film to prevent cartons absorbing moisture.

Purchase of an appropriate wrapping machine in year one of implementation of each stage (2007, 2009 and 2011) at \$50,000 per unit. Operating costs for film for the new machines are less than current carton wrapping costs. No ongoing additional operating cost is incurred.

Stage one implementation requires 3 machines, stage two requires 4 machines and stage three, for smaller individual supply chains, uses hand application of the new approved proprietary film and no machines are purchased.

Upsizing egg cartons for jumbo (>70g) eggs.

Large eggs which account for 1% of production are simply packed in existing 'ten packs' rather than the traditional dozen pack. No additional cost is incurred.

Egg boxes not handled as fragile.

Artwork on boxes modified at a very minor cost to better emphasis the fragile nature of the product.

Pallet stacking to a maximum of 5 rows.

Pallet stacking to a maximum of 5 rows reduces transport pallet averages from 48 to 40 and adds 0.6 cents per dozen to the cost of transport in the supply chain.

Stage one implementation will result in an additional annual cost of \$90,000, stage two additional transport cost will be zero – this supply chain already employs 5 row stacking and stage three will be \$195,000.

Significant costs are incurred to implement the ullage research cluster.

Testing the Cluster Counterfactual

The counterfactual, the benefit that would have been produced if investment in the project had not been made, is tested through the following questions.

Would the research have occurred without AECL investment (i.e. does the research address a market failure)?

The research addresses a market failure. There was no incentive for the links in the supply chain (grading, transport, distribution centre and store) to research and address the causes of ullage on their own. Ullage costs were simply passed back to producers who accepted reduced payments as part of the cost of doing business. It is possible that some of the larger producers in the industry may have undertaken ullage reduction work on their own. However, research outcomes would not be available to the whole industry and producers, acting on their own, would have been less likely to secure the through chain cooperation secured by AECL and its Supply Chain Enhancement Industry Consultative Committee.

Were the benefits simply brought forward as a result of AECL investment?

No there is insufficient incentive for the research to be completed, and available for the whole industry, outside the current funding model.

Has an efficient use of funds occurred because of the funding model/public private partnership?

An efficient use of funds has occurred because of the public private partnership funding model. The presence of matching public monies has provided incentive for an industry levy and investment in projects of this nature. In the absence of the current model, it is likely that the

research findings would only be available to the industry's larger players and the benefits generated would have been at a lower level.

Is AECL an efficient model for research delivery?

AECL is an efficient model for research delivery. In this instance AECL was able to work with the researcher to scope an appropriate project that delivered outcomes of benefit to industry. Research cost was a relatively modest \$196,000.

Does the presence of AECL increase the resultant adoption rate?

Yes the presence of AECL increases resultant adoption rates. Research outcomes are developed and communicated through AECL's Supply Chain Enhancement Industry Consultative Committee.

Would the research have been completed overseas and been available to Australia anyway?

The project addressed an 'Australia specific' supply chain issue. The causes of ullage, in this instance, were unique to Australian supply chain conditions.

Would substitute technologies have been developed?

The research was about auditing existing practices/technologies and applying 'off the shelf' solutions. Overseas substitute technologies would not have been possible in this instance. With this said, proprietary pallet wrap film, developed overseas, was applied as part of the ullage reduction solution.

Are there sufficient incentives for voluntary groups to get together and complete the research?

While it is possible that voluntary producer groups may have got together and completed the research it is less likely that research outcomes would have been available to other supply chains or that voluntary producers would have secured the same level of supply chain support. AECL was instrumental in securing participation throughout the various links of the supply chains researched.

Additionality

Additionality refers to the spillovers that are conditional on public support for AECL. In this instance it is unlikely that the spillover benefits realised would be available in the absence of a levy, smaller producers would simply have 'missed out' and resultant human health benefits, realised through removal of cracked and potentially contaminated eggs, would have been realised at a lower level. However, a levy without matching government funds may still have been sufficient to ensure the project was completed.

Capacity/Incentive to Invest in Absence of Levy and Public Contribution

Given the commercial nature of outcomes from this research, i.e. additional returns to producers who lower ullage rates, this research might well have been completed in the absence of a public contribution.

Results and Sensitivity Testing

Project cost benefit analysis was completed using the Guidelines for Evaluation (May 2007) prepared by the CRRDCC. Results are summarised in Table 6.3.

Table 6.3: Cost Benefit Analysis, Ullage Audit, Solutions Development, Implementation

Key Parameter	Net Present Value (5% real discount rate)	Benefit Cost Ratio (1:x)	Internal Rate of Return (%)	Cost (present value of all funds invested)
Low ullage rate reduction 0.25%	\$2.3 million	0.79	0%	\$3.0 million
Mean ullage rate reduction 0.5%	\$4.7 million	1.59	37%	\$3.0 million
High ullage rate reduction 1%	\$9.4 million	3.18	123%	\$3.0 million

Source: AgEconPlus analysis

The project yields a favourable result for industry. A Net Present Value (NPV) for industry of \$4.7 million is realised using the 'core' data set and a real discount rate of 5%. Ullage savings made by producers are greater than the costs incurred for research and the costs incurred by the supply chain, which will be passed back to producers, for implementation.

The sensitivity of this result to changes in 'core' data is also shown in Table 3. A halving of the improvement in ullage reduction attributable to this project (i.e. a reduction in ullage rates from 3% to only 2.75%) results in a negative outcome for industry – costs exceed benefits. For the project to break even a minimum ullage reduction rate of 3% is required.

Conclusion

Ullage auditing, solutions development and implementation generates a positive return for Australian egg producers.

Appendix 3: Optimal Egg Marking Under Changing Market Structures

Extract from Freebairn, Goddard, Griffith and Shank (2004) Optimal Egg Marketing Under Changing Market Structures: A report for the Australian Egg Corporation Limited

Objective

The aim of this project has been to evaluate the returns to egg farmers of a generic advertising program funded by a levy per unit of production. Being competitive price takers, farmers will gain from the program only if the net price they receive increases.

Necessary Conditions

If the generic advertising program is to increase the net return to farmers, several pre-conditions, or necessary conditions, must be met. These include: the advertising program succeeds in increasing the quantity of eggs sold at retail; that these extra sales are reflected in higher farm prices; and that farmers can supply the extra sales only by production with a higher marginal cost. These prior conditions for success of the program can be answered only after an initial assessment of the industry.

Processed Egg Products

Advertising of processed egg products is unlikely to alter the farm price received for eggs used for these products. The Australian market for processed eggs is closely linked with the world market, with both exports and imports. Since Australia is a small player in the world market for processed egg products, the Australian price is set by the world price, adjusted for the exchange rate. Successful advertising of processed egg products in Australia will have no effect on price, and therefore cannot benefit farmers.

Shell Eggs

By contrast, the shell egg market is largely insulated from international trade because of quarantine restrictions on imports. In this context, a generic advertising program that increased sales of domestic shell eggs could flow into higher farm prices if the other necessary conditions hold.

The structure of the shell egg market has undergone enormous change over the last decade and it is still evolving. There are several important characteristics of the post-farm shell egg industry which need to be recognised in evaluating the effects of advertising on farmer returns. First, shell eggs are not a homogeneous product, but many differentiated products. At one level we can distinguish niche products, including barn-laid eggs and special farmer-retailer relationships, and commodity eggs. Within the category of commodity eggs, there are different processor brands, and increasingly important are “store” or “private label” brands, as well as farmer brand eggs. These different brands retail at different prices and the price pattern varies over time. Also, different marketing strategies, including advertising, are associated with the different brands. Second, while there are many farmers, there are a small number of processors, and the retail sector is dominated by two national supermarket chains. It is important to recognise the potential market power of the retailers, and to a lesser extent the processors, in evaluating the flow-through effect of increased retail sales from advertising, to higher farm prices.

Farm Supply

Advertising will increase the farm price of eggs, and potentially benefit farmers, only if the extra production to meet the extra sales created by advertising involves higher marginal costs than current production. At least in the short and medium term, industry representatives argue that the farm marginal cost or supply curve is upward sloping. Reasons for the rising per unit cost for extra eggs include investor demands for a premium to increase the share of their investment portfolio in eggs, environmental regulations and costs, and limited managerial expertise.

Necessary Conditions Met for Shell Eggs

We conclude that for shell eggs a successful generic advertising program could increase farm prices and egg farmer returns. The next question is whether the increase in farm price due to advertising is greater than the portion of the funding levy which ultimately is paid by farmers.

Models

A generic advertising program funded by a levy on per unit farm production has two sets of effects on farm returns. First, the advertising-induced increase in market sales pushes outwards the demand for eggs at the retail and the farm levels. Second, the funding levy adds to production costs and shifts upwards the farm level egg supply curve. The demand and supply curve shifts lead to changes in market prices and quantities which affect the net return received by farmers. An extensive literature of models to evaluate the effects on prices and quantities of advertising and levies was reviewed.

Basic Competitive Model

A number of formulae are available for estimating the required increase in extra sales from the generic advertising program, funded by a producer levy, which increases the net farm return per dozen eggs, and thereby yields a net return to egg producers. The base formula is derived from a simple model which assumes competitive behaviour in the post-farm processing and retailing sectors of the industry. This formula is of the form

$$(dQ / dA) / Q > E (L / P)$$

where Q is egg sales, A is advertising, E is the absolute value of the elasticity of demand, L is the levy per dozen eggs, P is the retail price of a dozen eggs, and d is the symbol for derivative or small change. The left hand term $(dQ / dA) / Q$ is the minimum required increase in egg sales due to advertising. It is the increase in sales, the term dQ / dA , as a proportion of current sales, Q. The right hand term $E (L / P)$ is the elasticity of retail demand for eggs (the percentage change in eggs sold divided by the percentage change in the retail price), the term E, times the levy as a proportion of the retail price, the term L / P . The more elastic is retail demand and the lower is the price of eggs, the greater has to be the effect of advertising to increase sales if farmers are to gain.

Model Extensions

Given the high level of concentration of firms in the retailing and processing of eggs in Australia, we considered the effect of the potential use of market power by the post-farm sectors on returns to farmers from advertising. Taking the extreme forms of market power, namely monopoly and monopsony, the above formula for a competitive model continues to provide a good approximation. Essentially, the effects of market power on the returns to farmers from the advertising-induced outwards shift of the demand curve are offset by the effects of market power on the final incidence of the levy on farmers.

Another model extension looks at the effects of potential reactions by processors and retailers in the levels of advertising of processor and retailer brands of eggs, to a generic advertising program. These reactions can include a reduction of current brand advertising, which then requires even greater effectiveness of the generic advertising if egg farmers are to gain; or, the generic advertising program could encourage higher levels of brand advertising. There is no particular logic or available data to judge which reaction, if any, is most likely. It is an empirical matter, determined in individual market settings.

Econometric Study

To try and gain some of this necessary information on the demand for brands of shell eggs in supermarkets and on the behaviour of the post-farm processors and retailers of eggs, an econometric study was undertaken. Quarterly data from A C Neilson for the period 1998(2) to 2002(4) on retail prices, quantities and advertising for Sunny Queen, Pace Farms, Farm Pride, private (or store) label and generic (including all other) brands were used, together with AECL data on annual farm prices.

Some of the key results from the estimated demand equations include the following:

- The different egg brands are regarded by consumers as differentiated products and as imperfect substitutes.
- The aggregate price elasticity of demand is around -0.6, which is above previous estimates for Australia, but comparable with many overseas country estimates.
- There is little statistical evidence that brand advertising over the sample period affected either aggregate egg sales or the mix of brands sold.
- Changes in retail store marketing, together with a large relative price reduction, explains a marked increase in the sales of private label eggs, primarily at the expense of generic and Sunny Queen eggs.
- Estimates of the use of market power and of behaviour in the post-farm sector of the egg industry favour a price leader model.
- Pace Farms emerges as the price leader over the 1998 to 2002 sample period.

Break-even Assessment

Because we do not have consistent and believable estimates from past studies of the magnitudes by which advertising increases egg demand, and our estimates of brand advertising, we have chosen to report estimates of the minimum increase in sales which the generic advertising would need to generate that would be required to at least cover the cost borne by farmers of the levy. The levy is currently just under one cent a dozen eggs sold as shell eggs. These estimates are prepared by using the formula noted above. If the industry believes that a generic advertising program will achieve at least these minimum sales increases, farmer returns will increase. Sensitivity numbers are also reported.

For the current levy rate, and our preferred price elasticity of demand of -0.6, a generic advertising program would need to increase shell egg sales by 0.26 per cent, or by more than half a million dozen eggs a year, if farmers are to gain.

Bottom Line

Available estimates of the increases in sales of eggs due to advertising are too diverse, and too unreliable, to enable us to say whether the minimum threshold is likely to be met. The reported break-even assessment provides a benchmark for evaluating proposed programs, and for monitoring existing programs.

4.2 Model Development

Previous research regarding competitive interaction in oligopoly markets studies has taken three unique empirical forms. These are the menu approach or nonnested model comparison, conjectural variation (CV) models, and time series causality or Granger causality models (Putsis and Dhar, 1998; Kadiyali, Vilcassim and Chintagunta, 1996).

Menu or nonnested menu approaches for estimating competitive interaction require specification of the various forms of competitive interaction to be considered (e.g., Nash-Cournot, Nash-Bertrand, Stackelberg). Which model fits the data best is then ascertained by significance tests, the lowest sum of squared errors (if using 3SLS), the lowest log-likelihood ratio (if FIML is used) or by non-nested tests similar to the type introduced by Vuong (1989). The menu approach is so named because researchers infer firm behavior based upon which model interacts with the data best. Previous research using this approach includes Gasmi and Vuong (1991), Gasmi, Laffont and Vuong (1992), Raju, Sethuraman and Dhar (1990), and Kadiyali, Vilcassim and Chintagunta (1996). Raju, Sethuraman and Dhar (1990) present an analytical framework to investigate what makes a product category more conducive for store brand introduction. In this framework they use simple two-tailed significance tests to compare contrasting models investigating two general hypotheses; (1) other things being equal, private label brands are more likely to be introduced in categories with smaller cross-price sensitivity among national brands and a larger number of national brands, and (2) other things being equal, the market share of private label brands will be higher in product categories with smaller cross-price sensitivity among national brands and a smaller number of national brands. Significance tests performed on models with varying price sensitivities, number of national brands and number of store brands, suggest that store brand introduction is likely to increase retailer profit if cross-price sensitivity among national brands is low and cross-price sensitivity between the national brand and the store brand is high.

In contrast, Kadiyali, Vilcassim and Chintagunta (1996) use the menu approach to investigate market conduct. Bertrand-Nash pricing is compared against Stackelberg pricing rules. Interest in this approach recognizes that with the use of market-level data, not individual consumer-level data, price and sales data cannot be treated as exogenous variables. Price determination is not only a function of demand but also the pricing rules or conduct of producers, manufacturers and retailers. Using 3SLS and the lowest sum of squared errors as the decision criteria, they reject Bertrand-Nash pricing in favour of Stackelberg pricing. Since the elasticities generated in either model are significantly different, the authors suggest that market own- and cross-price elasticities are dependent upon what is assumed for the underlying price-setting behaviour. Ultimately, the menu approach offers a procedure of ad hoc tests for fitting a particular model to observed data.

Conjectural variation (CV) models in comparison do not specify a particular conduct. Based on early work by Iwata (1974), Gallop and Roberts (1979), Spiller and Favaro (1984) and Gelfand and Spiller (1987), CV models estimate a conjectural variation or “conduct” parameter that may measure behavioural deviation from Cournot-Nash or Bertrand-Nash behavior (Liang, 1987; Putsis and Dhar, 1998; Cotterill, Putsis and Dhar, 2000). If both firms have a conduct parameter equal to zero, then Nash behaviour is assumed, and if one firm has a conduct parameter equal to one then a Stackleberg relationship is observed. Research utilizing CV models include Liang (1987), Conrad (1989), Gasmi, Laffont and Vuong (1992), Dhar, *et al.* (2002), Friedman and Mezzetti (2002) and Kinoshita, Suzuki and Kaiser (2002). To illustrate the CV approach, the model of Liang (1987) is used. While being one of the first substantial CV models, because it was an analysis of the data gathered during the US Federal Trade Commission antitrust case brought against Kellogg, General Mills, and General Foods in the 1970’s, the research utilizes one of the most complete data sets found in the literature. Not only are retail and producer prices and quantities available so also are manufacturer wholesale prices. While some other studies have assumed a fixed marginal cost at the manufacturer level (Kadiyali, Vilcassim and Chintagunta, 1996), the availability of actual wholesale prices allows successive estimation of price-cost markups throughout the marketing chain. As a result, vertical interaction between manufacturers and processors can be appropriately modelled and estimated. Liang uses a conduct parameter to estimate independent or collusive behaviour, where independent behaviour is assumed to be Bertrand-Nash conduct and collusive behaviour is assumed to be Stackelberg conduct. Liang models demand as a function of own-price elasticities, cross-price elasticities, and a conjectural response elasticity. The parameter on the conjectural response is constrained between zero and one and indicates increasing collusive behaviour as it approaches one. Liang finds that the amount of independent or collusive interaction is market dependent. The companies studied exhibit highly arranged or reactionary strategies in some markets, while in other markets their actions seem independent of each other. Liang’s use of the CV model in a fully structural system is seen as one of the first empirical studies to investigate both processor and retailer interaction. Undoubtedly others will follow.

Time series causality or Granger causality tests utilize time series data and causality tests to infer firm reactions toward each other (Putsis and Dhar, 1998). For example, if firm B chooses its optimal behaviour after observing firm A’s behaviour, and vice versa, these observed choices are related time series events. Systematic investigation over time may illustrate causality relationships. This approach is particularly useful to confirm leader-follower relationships as determined by menu approaches or CV models. This approach may be particularly useful in examining dynamic relationships where firms are assumed to compete repeatedly over time in mega-games instead of a single period game.

Investigation in this study uses a menu approach similar to that presented by Kadiyali, Vilcassim and Chintagunta (1996).

However, before beginning model development, an initial complication is recognized. While it is true that in a fully structural model wholesale prices are endogenously determined, the price information available for this study is at the retail level. Using the following reasoning, similar to that illustrated by Kadiyali, Vilcassim, and Chintagunta (1996) for product line pricing, we can abstract from the role of the retailer to develop an understanding of processor conduct.

Think of the following sequence of moves being repeatedly played in the market: processors price their product(s) to the retailers and advertise, taking into account rival pricing policies and advertising behaviour as well as retailer behaviour. While advertising by processors is usually assumed for branded products only, processors may engage in generic advertising if the

expected returns warrant the investment. Retailers then determine the retail price and private label advertising. When processors take these rules as given, the interaction between processors and retailers is assumed to be Nash: processors choose their wholesale prices and advertising investment as a response to retailer advertising. An important assumption is that retailers do not compete horizontally within a particular product category. This assumption, when considering producer-retailer Nash interaction, is similar to assuming a fixed markup pricing rule in setting retail prices. Should retailers strategically set retail prices and advertising, both retail and wholesale prices would be required for empirical estimation.

The Model

Let the demand facing each firm be linear in prices and represented as follows,

$$q_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \frac{P_j}{CPI} + X_i \quad 1$$

where $i=1 \dots n, j=1 \dots n$, n equals the number of processors being considered, q and p represent the quantities and prices, α_i , and γ_{ij} represent demand parameters to be estimated, and X_i represent other exogenous variables and parameters used for empirical estimation.

Using economic theory, non-sample information is used to impose homogeneity of degree zero in prices and price symmetry (i.e $\gamma_{ij} = \gamma_{ji}$). Homogeneity of degree zero is imposed by dividing each price by the consumer price index (CPI). The imposition of price symmetry is seen as a unique approach to this research. Previous research has not accounted for price symmetry in demand as can be derived from consumer preference theory.

Processor profit functions can be illustrated as

$$\pi_i = (p_i - mc)q_i \quad 2$$

where π_i and mc represent profit and marginal cost of production for processor i . Note that given the lack of production cost information, the producer/farm gate prices are used as an estimate of mc .

In the Bertrand-Nash game, each processor develops a marketing strategy by optimizing their own price with respect their own profit function. This type of competition models direct horizontal price competition between processors. The following first order condition (FOC) can be derived,

$$\frac{\partial \pi_i}{\partial p_i} = \alpha_i + \sum_{j=1}^n \gamma_{ij} \frac{p_j}{CPI} + \sum_{j=1}^n \frac{\lambda_{ij}}{adv_j} + X_i + \gamma_{ii} \frac{(p_i - mc_i)}{CPI} = 0 \quad 3$$

Solving the FOC for p_i , we derive a price reaction function for processor i as

$$p_i = -\frac{1}{2g_{ii}} \left(a_i CPI + \sum_{i \neq j} g_{ij} p_j + X_i CPI \right) + \frac{mc}{2} \quad 4$$

Combining demand equations and price reaction functions, the following system of equations exists for empirical estimation.

$$q_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \frac{p_j}{CPI} + X_i + \varepsilon_i \quad 5a$$

$$p_i = -\frac{1}{2g_{ii}} \left(a_i CPI + \sum_{i \neq j} g_{ij} p_j + X_i CPI \right) + \frac{mc}{2} + \varepsilon_{i+n} \quad 5b$$

The errors ($\varepsilon_1 \dots \varepsilon_{n+i}$) are econometric estimation errors that result when missing data or uncertainty is encountered. As will be illustrated, these errors warrant the use of seemingly unrelated regression (SUR) rather than individual estimation of the above equations.

In a price leadership or Stackelberg game, one processor (processor k , where $k=1 \dots n$, but $k \neq i$) is chosen as the leader and all other firms follow. The leader develops a marketing strategy accounting for the optimal marketing decision of the followers. The choice of an initial leader is not important as long as each of the other processors is given the opportunity to lead (estimation of various possibilities is important because it helps avoid researcher estimation bias (Kadiyali, Vilcassim and Chintagunta, 1996)). In this example, the followers' FOCs and simplified price reaction functions are

$$\frac{\partial \pi_i}{\partial p_i} = \alpha_i + \sum_{j=1}^n \gamma_{ij} \frac{p_j}{CPI} + \sum_{j=1}^n \frac{\lambda_{ij}}{adv_j} + X_i + \gamma_{ii} \frac{(p_i - mc_i)}{CPI} = 0 \quad 6a$$

$$p_i = -\frac{1}{2g_{ii}} \left(a_i CPI + \sum_{i \neq j} g_{ij} p_j + X_i CPI \right) + \frac{mc}{2} \quad 6b$$

where $k \neq i$.

In the following four steps the leader's price reaction function is developed by substituting the followers' reaction functions into the leader's maximisation function. First, the leader's profit function is defined as

$$\pi_k = (p_k - mc)q_k \quad 7$$

Second, the demand equation for the leader's product is substituted into the profit function.

$$\pi_k = (p_k - mc) \left(\alpha_{ki} + \sum_{i=1}^n \gamma_{ki} \frac{p_i}{CPI} + X_k \right) \quad 8$$

Third, the leader forms a conjecture about the followers' conduct, substituting the followers' price reaction functions from equations 6b into its own profit function, equation 8, to replace all p_i ($k \neq i$). Lastly, completing the leader's FOCs and solving with respect to p_k , the leader's price reaction function is defined.

$$p_k = -\frac{1}{2\gamma_{kk} - \sum_{j \neq k} \frac{\gamma_{kj}^2}{\gamma_{jj}}} \left(a_k CPI + \sum_{j \neq i} \gamma_{ki} p_i + X_k CPI - mc \left(\gamma_{kk} - \sum_{j \neq i} \frac{\gamma_{kj}^2}{\gamma_{jj}} \right) \right) \quad 9$$

Combining demand equations and price reaction functions the following system of demand equation exists for empirical estimation.

$$q_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \frac{p_j}{CPI} + X_i + \varepsilon_i \quad 10$$

$$p_k = -\frac{1}{2\gamma_{kk} - \sum_{j \neq k} \frac{\gamma_{kj}^2}{\gamma_{jj}}} \left(a_k CPI + \sum_{j \neq i} \gamma_{ki} p_i + X_k CPI - mc \left(\gamma_{kk} - \sum_{j \neq i} \frac{\gamma_{kj}^2}{\gamma_{jj}} \right) \right) + \varepsilon_{k+n} \quad 11$$

$$p_i = -\frac{1}{2g_{ii}} \left(a_i CPI + \sum_{i \neq j} g_{ij} p_j + X_i CPI \right) + \frac{mc}{2} + \varepsilon_{i+n} \text{ where } i=1 \dots n, \text{ excluding } i=k. \quad 12$$

Given the available data, the exogenous variables summarized in X_i and used for empirical estimation are illustrated as follows

$$X_i = \sum_{j \neq i}^n \frac{\lambda_{ij}}{\left(\frac{adv_j}{CPI} \right)} + \mu_{i1} Time + \mu_{i2} Exp + \mu_{i3} q_i(-1) \quad 13$$

where adv_i is advertising expenditure by firm i , $Time$ is a time trend index, Exp is expenditure, $q_i(-1)$ is a lagged dependent variable, and λ and μ are parameters to be estimated. Advertising has been divided by the CPI to yield real advertising expenditures. The incorporation of advertising as an inverse relationship imposes diminishing returns to advertising.

Appendix 4: AECL Strategic Planning Process and Financial Forecast

The following flow chart depicts the strategic planning process that has been adopted by AECL in developing the 2nd strategic plan for AECL and the Australian egg industry. In addition to this process, the contents, timing and distribution of the plan will also comply with the Statutory Funding Agreement (SFA) between the Australian Government and AECL.



It is envisaged that the AECL Strategic Plan will be reviewed once every 12 months by the AECL Board and management team with a major review being conducted in 2011 prior to the development of a new strategic planning 'footprint' for the Australian egg industry.

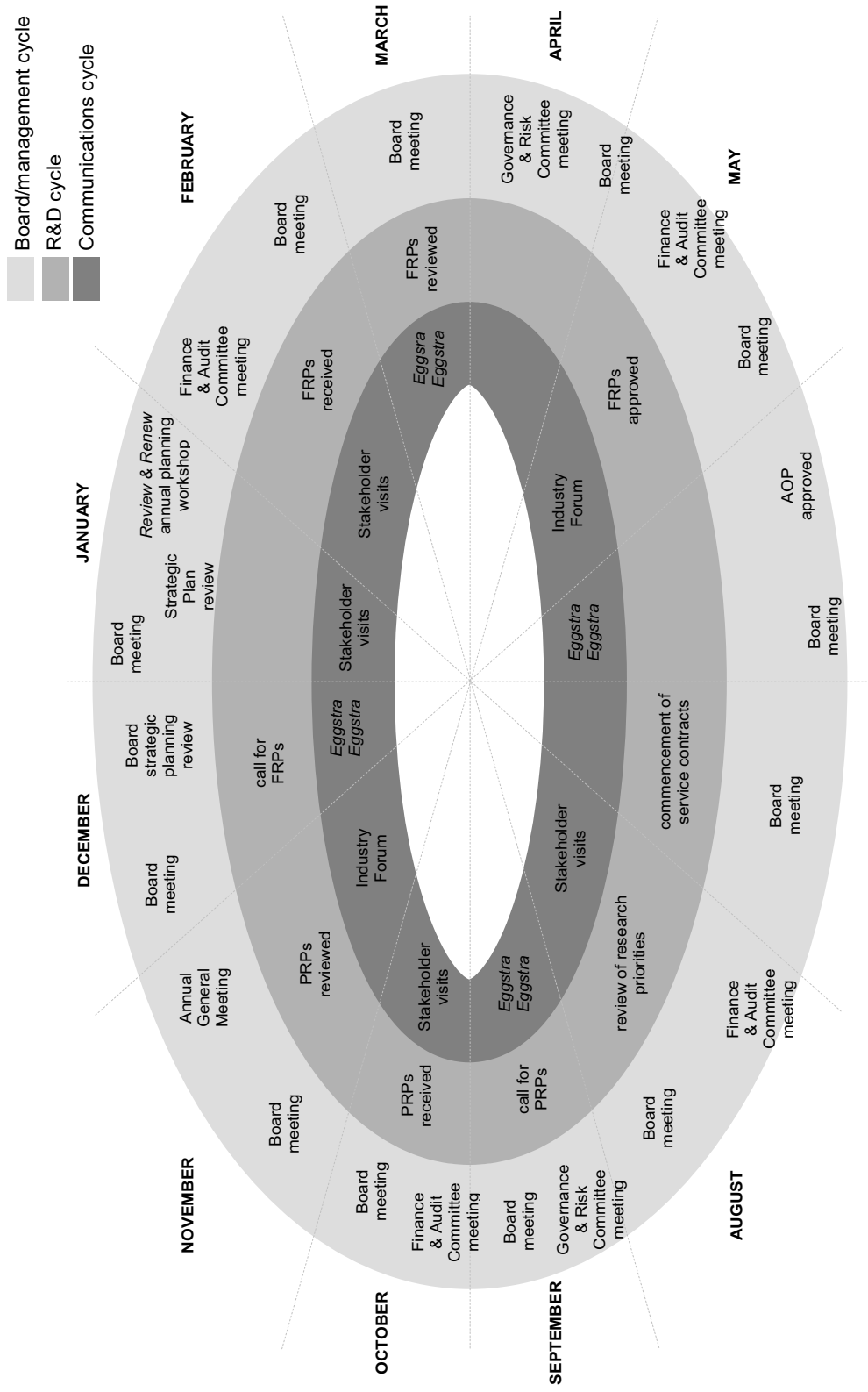
Financial forecast statement

The following budget forward estimate provides an overview of operating income and expenditure levels anticipated by AECL over the life of the strategic plan.

	<u>\$2,985,211</u>	<u>\$2,125,261</u>	<u>\$1,546,399</u>	<u>\$1,672,142</u>	<u>\$1,587,746</u>
	09/10 period	10/11 period	11/12 period	12/13 period	13/14 period
Opening Balance (1 July)					
Income					
Marketing Levy	\$3,737,500	\$3,793,563	\$3,850,466	\$3,908,223	\$3,966,846
R & D Levy	\$828,000	\$1,167,250	\$1,599,424	\$1,623,416	\$1,647,767
R & D Commonwealth Contributions	\$828,000	\$1,167,250	\$1,599,424	\$1,623,416	\$1,647,767
Associate Membership Subscriptions	\$10,000	\$18,000	\$18,000	\$18,000	\$18,000
Interest Income	\$45,000	\$30,000	\$30,000	\$30,000	\$30,000
Other Income	\$106,250	\$20,000	\$20,000	\$20,000	\$20,000
sub-total	\$5,554,750	\$6,196,063	\$7,117,315	\$7,223,054	\$7,330,380
less: Levy collection costs	-\$88,500	-\$92,925	-\$97,571	-\$102,450	-\$107,572
Total Income	\$5,466,250	\$6,103,138	\$7,019,743	\$7,120,604	\$7,222,808
Expenses					
Market Awareness	\$1,958,046	\$2,200,000	\$2,300,000	\$2,400,000	\$2,500,000
Market Education	\$970,723	\$1,000,000	\$1,100,000	\$1,200,000	\$1,300,000
Supply Chain Enhancement	\$330,785	\$300,000	\$300,000	\$300,000	\$300,000
Public Affairs & Stakeholder Relations	\$1,054,789	\$1,100,000	\$1,000,000	\$1,000,000	\$1,000,000
On-Farm Innovation & Efficiency	\$1,640,711	\$1,700,000	\$1,800,000	\$1,900,000	\$2,000,000
Corporate	\$371,146	\$382,000	\$394,000	\$405,000	\$417,000
Total Expenses	\$6,326,200	\$6,682,000	\$6,894,000	\$7,205,000	\$7,517,000
Net Surplus / (Deficit)	-\$859,950	-\$578,863	\$125,743	-\$84,396	-\$294,192
Closing Balance (30 June)	\$2,125,261	\$1,546,399	\$1,672,142	\$1,587,746	\$1,293,554

NB: Additional R&D Levy income and hence additional R&D Commonwealth Contributions is budgeted to increase from December 2009 and again from December 2010 due to increases in the Laying Chicken (R&D) levy amount from 7.2 cents to 10 cents from December 2009 and from 10 cents to 13.5 cents from December 2010 resulting in a matched increase in contributions from the Australian Government. Source: AECL Strategic Plan 2009-2013 (review & update)

Appendix 5: AECL Business / Planning Cycle



Appendix 6: Reductions in Public Funding for Rural RD&E

No budget joy – just a \$12m R and D cut

GABRIELLE JOHNSTON

10 Jun, 2010 04:00 AM, The Land

THE State Government has ignored calls for a bigger investment in agricultural research and development – and instead has slashed \$12 million from its current spending.

The State Budget, released on Tuesday, offers little joy for farmers outside some spending on roads and rural health.

Most markedly, it fails to deliver on calls for more dollars for research in the face of growing food security concerns worldwide.

The budget allocates \$443 million for the State's agriculture and fisheries sector in 2010-11 – up from \$427.2m – however, only about half this (\$227.2m) will go towards agriculture and biosecurity, slightly up on its share in 2009-10 (although this figure had increased with drought payments).

While Primary Industries Minister, Steve Whan, claimed the budget showed a continued commitment to agriculture expenditure and research, the NSW Farmers Association said it actually represented a 31 per cent cut in capital expenditure and 10pc cut in total expenditure on research, development and extension.

NSW Farmers president, Charles Armstrong, who rated the budget a lowly four out of 10, described cuts to R and D and extension as particularly "alarming".

He said last year \$150m was spent on research, development and extension services and this year this would drop to about \$138 million (excluding capital expenditure). "There's just no doubt at all that it (R and D spending) should have been significantly increased, or at least maintained, and preferably increased significantly," he said.

"To cut 10pc in total expenditure and about 31pc of the capital expenditure in the research and development and extension budget we find extraordinary."

Opposition spokesman for industry, Duncan Gay, was also concerned. "The effect is cumulative because this comes on top of the loss over the years of regional research stations and regional-employed researchers," Mr Gay said.

Mr Whan said the Government was streamlining R and D services by collaborating with other research facilities, including universities and the CSIRO, to avoid duplication of research and ensure taxpayers received "bang for buck".

"We've seen some savings in administration, so effectively our research effort is around about the same, but the overall budget in that part of the departments come down a bit because of the savings from our combining of backroom functions."

But Mr Armstrong said cutting the budget because savings had been made wasn't getting anywhere: "What we needed was for that saving to be reinvested." Discussing capital works, Mr Whan said new laboratory facilities would be provided at the Elizabeth Macarthur Agricultural Institute at a cost of \$29.9m.

"We've got \$4 million more going into the work at the Gosford Horticultural Institute, and we've also got a \$3.3 million investment in the biosecurity information system, which is important to our industries for our resistance to exotic diseases and pests."

Mr Whan said the budget also included a research program dealing with greenhouse gas emissions from agriculture. "We've got in NSW 700 scientists and technicians working on more than 900 projects in Industry and Investment," he said.

"By my understanding, we'd be the second biggest government research organisation in Australia, behind the CSIRO."

Meanwhile, about 103 offers of voluntary redundancy have been made to I and I workers in recent weeks as the Government says it looks for new "efficiencies" in the department.

It's believed the Government is aiming to cut 90 positions, which it describes as "back office" roles.

A number of I and I sources told The Land they did not know of any frontline workers who had been offered voluntary redundancies.

However, sources said they were worried about the potential impact if any reception/administration workers took up offers. "We made a commitment that no frontline positions would go, so we kept that commitment," Mr Whan said this week.

But there were certainly "a couple of cases" where voluntary redundancies had been offered because a line of research work had finished, he said. A circular sent to I and I staff in April said staff who accepted redundancy must finish work no later than June 24.

Source: The Land, Thursday 10 June 2010

VFF attacks research cut

2008/08/08 4:00:00 AM

The State Government's announcement that it will cut 70 regional research, extension and support staff positions will have five regional centres has been widely condemned as a cynical cut to farmer services.

Victorian Farmers Federation president Stuart Kaptey said farmers would find it difficult to understand how the reductions would deliver the planned increase in capacity for services provided by the Department of Primary Industries.

He also condemned the decision to close centres such as Walpeup where the loss would be keenly felt in the local community.

National Party deputy leader Peter Walsh and northern region member Damian Doum were also quick to condemn the moves but Mr Walsh said came on top of budget cuts for agriculture, forestry and fishing of 28pc in real terms since 1999.

Centres earmarked to close are the research centres at Kyaloram, Walpeup and Turlangi, along with service centres at Sorell, Sea Lake, Rainbow and Linton.

The surrounding land at the Rutherglen facility will be sold and research staff at the Snake Creek hatchery will be retained in Queensland.

This will involve the loss of 50 research and extension positions and a further 20 administrative and support staff.

Despite these changes, DPI secretary Richard Bullock said services to key farm sectors would increase.

Source: Stock & Land newspaper, 7 August, 2008

Cash-starved CSIRO cuts 50 jobs, shuts food plant

The CSIRO will shed up to 50 jobs in food science research and close its Sydney food processing test plant in a bid to save \$6 million over the next two years.

Australia's cash-strapped peak science organisation claims it must find annual savings of \$15 million over the next four years to absorb a \$63m cut to its budget by the Rudd Government.

The CSIRO recently announced plans to close Australia's biggest livestock research laboratory at Rockhampton, north Queensland, and its Merbein grape and citrus research laboratory at Mildura, northern Victoria.

Among the latest research casualties is cheese science an area in which Australia is a world leader, supporting a cheese export industry worth more than \$800m.

Other key food research areas to be cut by CSIRO include refrigerated transport, food microbiology, process engineering, meat industry services and food chemicals safety testing.

Staff at CSIRO's Food Science Australia were told of the cuts early this week by its chief executive, Anthos Yannakou.

The division's laboratories at North Ryde, Sydney, and Cannon Hill, Brisbane, will be hardest hit, with some researchers offered relocation to CSIRO laboratories in Victoria.

The division's \$20m refrigerated container system test facility in Sydney will be moth-balled, and possibly leased out for other research.

Scientists working on refrigerated transport systems had already been dispersed to other areas of CSIRO, Dr Yannakou said.

Other food research assets under review by CSIRO include the southern hemisphere's biggest high-pressure thermal sterilisation unit and several pilot-scale manufacturing systems to test new technologies in processing and packaging.

CSIRO Staff Association spokeswoman Pauline Gallagher said: "We will be doing everything possible to avoid jobs being lost, and will be asking CSIRO to pursue alternative forms of funding for research."

A CSIRO internal email obtained by The Canberra Times says roughly half of the Food Science Australia funding shortfall appears to have resulted from the Rudd Government's axing the Department of Agriculture, Fisheries and Forestry's \$54m Food Innovation grants program.

A spokeswoman for Federal Science Minister Kim Carr said it was inappropriate for him to comment on the CSIRO cuts to food research. "Staffing and budget issues are the responsibility of CSIRO management," she said.

Food Science Australia, which has an annual budget of \$33m, is Australia's biggest and most diverse food research group, contributing to a national food processing industry worth \$17 billion a year.

It receives about \$4m from the Victorian Government each year, but the Brumby Government recently cut \$1m in research funding to the division.

Dr Yannakou said the division would increase its research investment in nutrition, genomics, food materials science and "sensory science" or consumer preferences.

"We will also be looking to contribute to areas relating to climate and sustainability, like better use of water, where the research we do can make a critical difference."

The Canberra Times, 2 August 2008

Source: <http://www.canberratimes.com.au>

Ag cuts at all levels

CUTS to agricultural research and farm extension jobs are hitting at multiple levels this week as the Victorian Government and federally-funded CSIRO take the knife to their budgets to implement staff redundancies and cost savings.

The NSW Government is already on the back foot, defending what is seen as a deliberate dumbing down of its farm research and extension services, at a time when world food shortages and climatic challenges have farmers worried about how they will cope.

CSIRO is cutting back on its agricultural and food production research as it attempts to save \$63 million in the next four years.

On Tuesday Victoria's Department of Primary Industries announced it would restructure operations close five rural sites, including Kyabram Irrigated Research Institute, and cut 70 agriculture science extension and corporate services jobs.

Victorian Farmers Federation president Simon Ramsay said

By PHIL THOMSON

particularly concerning was the closure of research stations.

"Pressures facing Victorian farmers have never been greater," he said.

"Drought, climate change, distorted world markets and community pressure to reduce the environmental footprint of feeding Australia all demand significant research and extension efforts."

CSIRO Staff Association secretary Dr Pauline Gallagher said agriculture analysis at the nation's peak scientific organisation was being "slashed and burnt".

"Most cuts are falling within the food and livestock industries," she said.

Eight CSIRO jobs in wool and sheep meat research at Armadale are being made redundant while the organisation will cut up to 50 jobs at its Food Science Australia division.

It will also shut its Sydney food transport test plant

CSIRO also recently announced it was closing Australia's biggest livestock research laboratory at Rockhampton, Queensland, and its Merbein grape and citrus research laboratory at Mildura, northern Victoria.

In NSW, the Government is under attack for reducing "back office" and field staff supporting in its Department of Primary Industries (DPI) agronomists and leaving agronomy positions vacant for up to a year.

Primary Industries Minister Ian Macdonald, conceded some staff had voluntarily approached the department for redundancies but has hit back at Opposition claims DPI was making 200 positions redundant.

"Let's get one thing straight, there is no forced redundancy program," Mr Macdonald said.

"From the outset I ordered frontline services be streamlined from voluntary redundancies to ensure proper services to rural and regional NSW continue."

"It's clear NSW DPI's frontline services, including extension

continue to be the key to providing support to primary production in rural communities.

But farmers are anxious and Grain Growers Association chairman John Eastburn, Lynwood, Baradine, said rural research seemed to be moving backwards.

"It will leave us with a shortage of expertise and this, with all the talk of food security," he said.

Among those quitting the public sector is respected Tamworth wheat research agronomist Ray Hare, who said Federal Government reductions to funding research were one of his "bugbears".

"Diseases evolve, climate changes, forms of trade change, we've got to pre-empt those, otherwise some nasty surprises could come along," Dr Hare said.

A spokeswoman for Federal Science Minister Kim Carr, said the budget was "tough" on the CSIRO because of rising inflation.

"Labor's clean energy election commitments will deliver at least an additional \$25 million in funding for CSIRO's work on clean coal technologies," she said.

Rural facilities to close in major restructure

DPI to slash jobs

By LYNDAL READING

THE Department of Primary Industries will close bye-rural facilities and job 70 jobs under a major restructure across Victoria.

Sites at Moorang, Kyabram, Warragul, Sale and Rumbold will close next year and 50 agricultural, extension and extension (cell) and an estimated 70 administrative and corporate service staff will lose their jobs.

The DPI will also relocate staff from leased sites at Sea Lake and Charlton, while science activities at Snob Creek near Edlem will be progressively relocated to Queenscliff.

sympathetic to farmers, when he became Premier a year ago.

At the time, Mr Brumby said he had a clear commitment to improving services to farmers.

Mr Brumby said he would be continuing the wide-ranging network of DPI offices across the State and improving other initiatives.

Community and Public Services for their state secretary, Karen Batt, said the move would cut local government.

Staff are being let go in the process of closing 10 facilities, Ms Batt said.

DPI Secretary Richard Ball said the DPI needed to restructure as workers and facilities to meet reduced and restructured

funding from the farm sector and Commonwealth Government.

He said the DPI needs to do jobs in the while implementing new programs in the Victorian Government's \$2.5 billion Future Farming Strategy.

Mr Ball said the changes would not lead to any loss of services and makes farm services would increase.

Our dairy programs will expand under Future Farming and will be further strengthened by consolidating research at Ellahbank, Tatura and La Trobe University, Mr Ball said.

New funding was available for projects in high priority areas.

This means that there will be new jobs available, he said.

Mr Ball said since 1999 the number of DPI agriculture staff had grown by more than 30 per cent to 264 people.

He said staff numbers at sites including Tatura, Ellahbank, Ararat, Traralgon and Queenscliff would grow, and the DPI will continue to operate from about 70 sites throughout Victoria.

It is increasingly hard to provide an acceptable work environment and a critical mass of staff at our smaller facilities, Mr Ball said.

We struggle to attract leading scientists and young people to work at small sites, given that DPI competes in a national and global market for skilled staff.

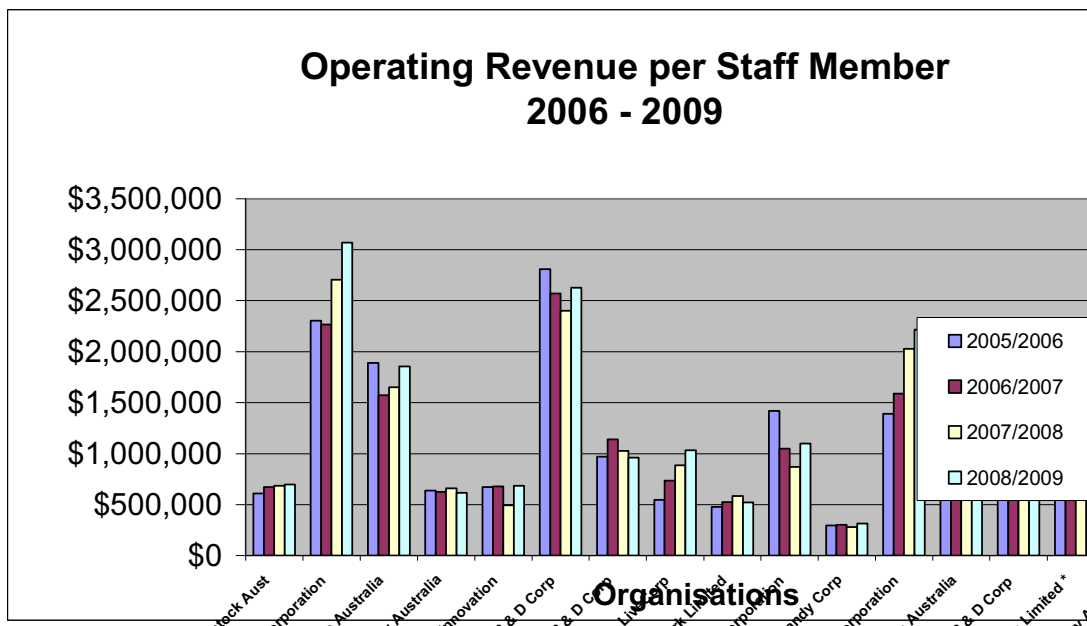
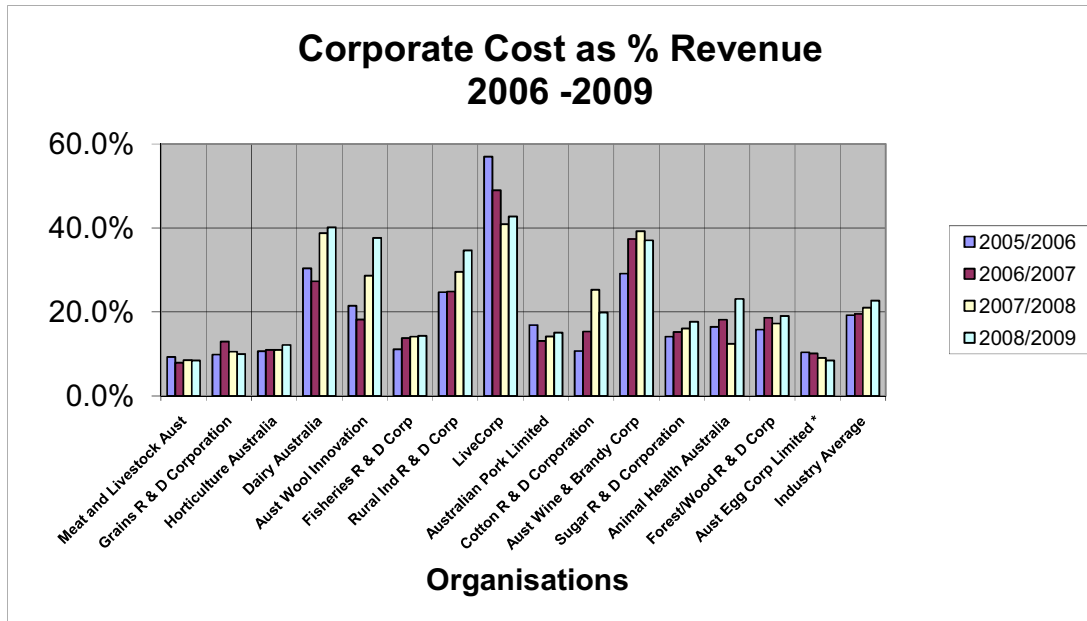


Karen Batt

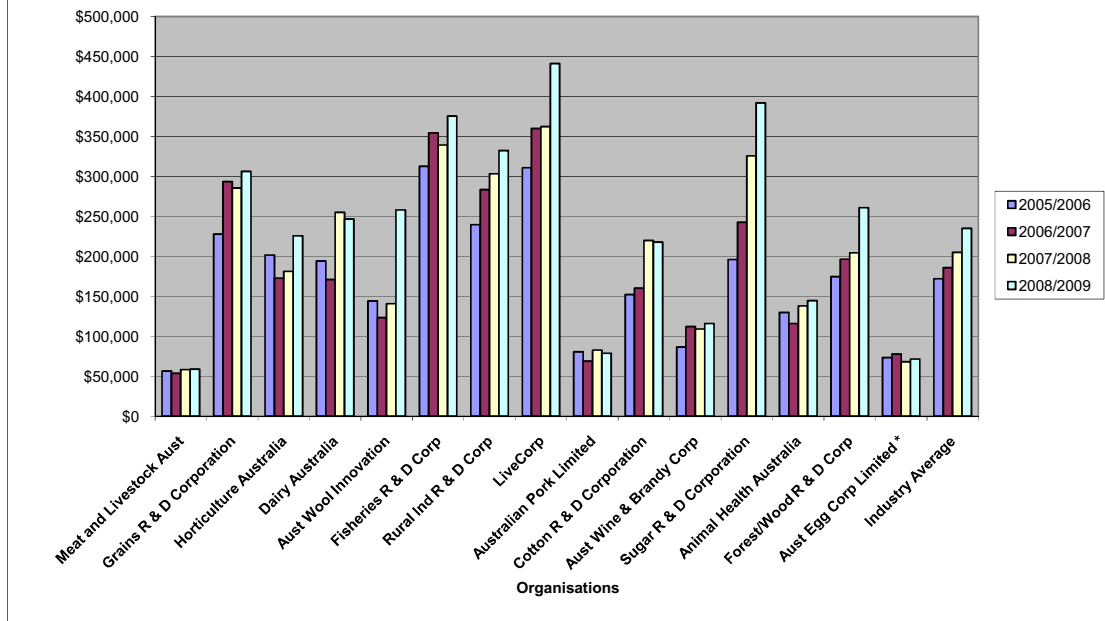
Farro land at Rutherford will also be sold off.

The restructure is in stark contrast to Premier John Brumby's comments to The Age in 2007 that he would be a

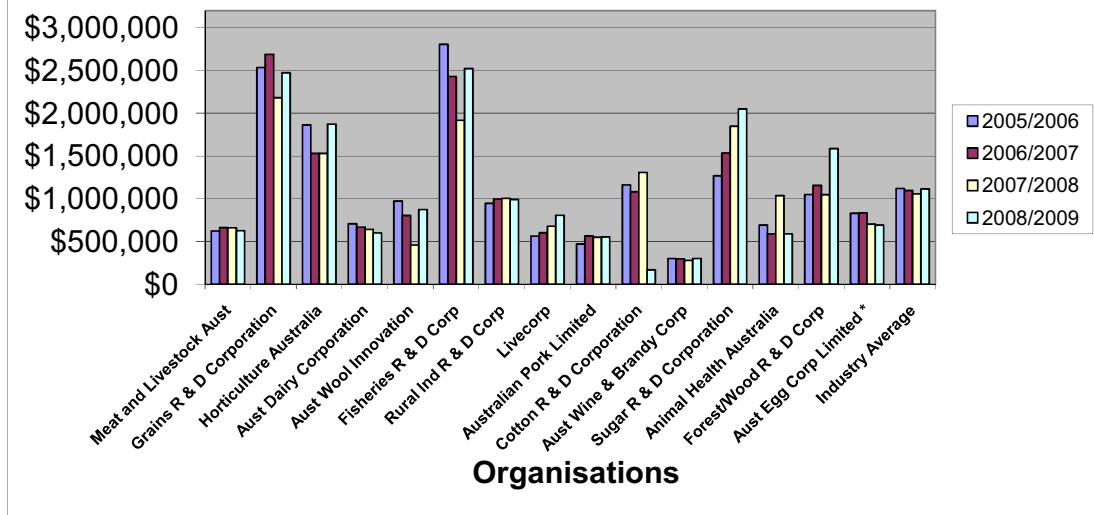
Appendix 7: Benchmarking of AECL Overheads

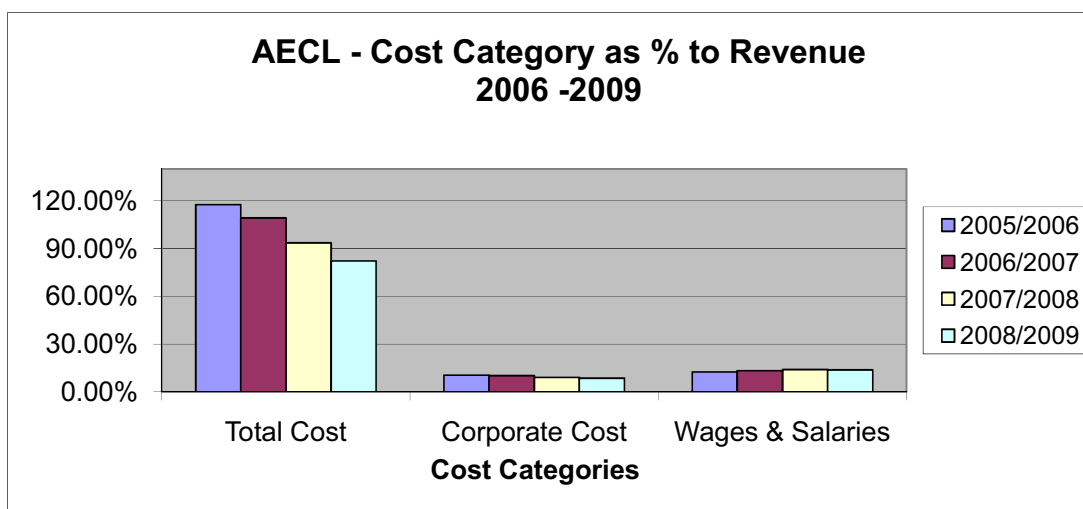
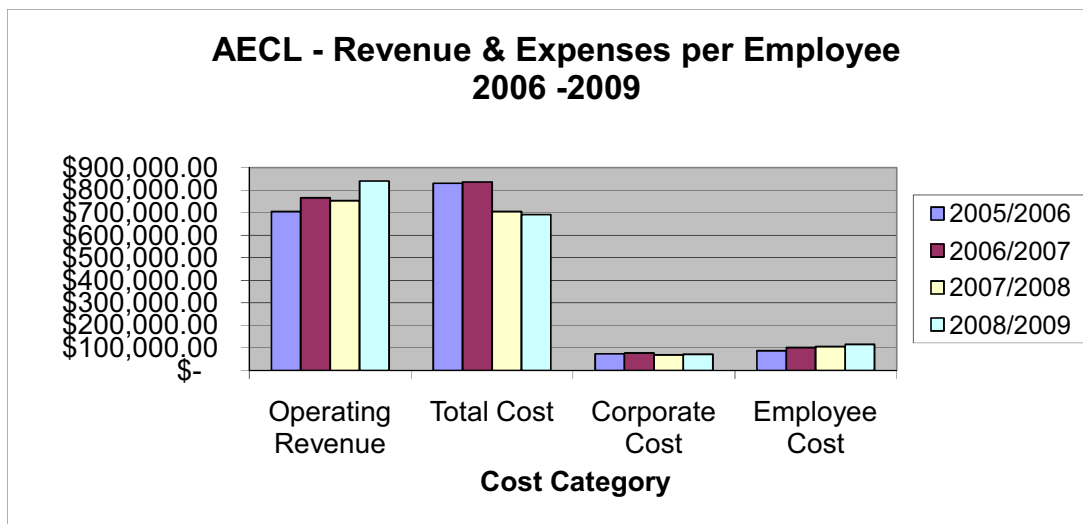
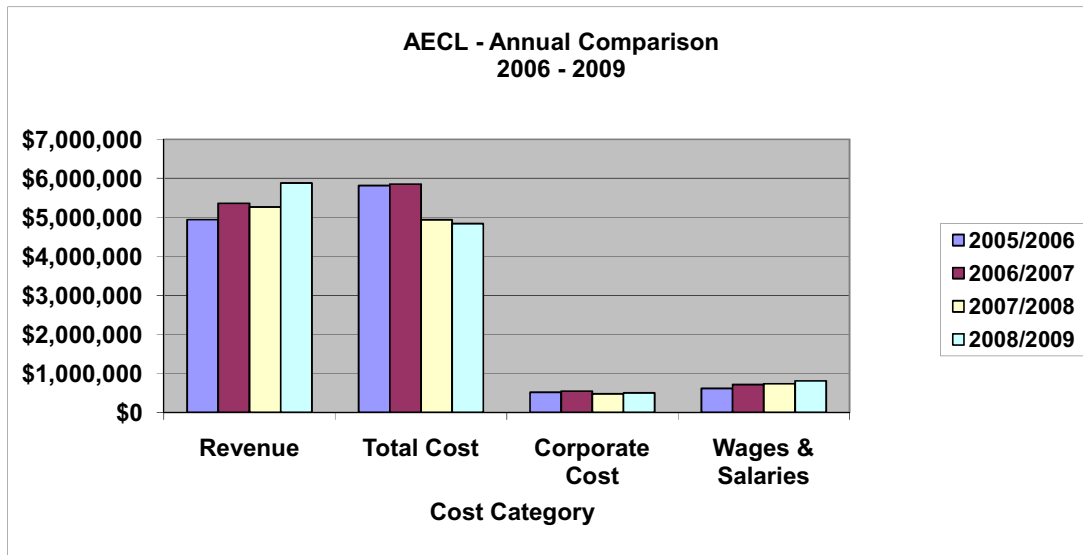


Corporate Costs per Staff Member 2006 - 2009



Total Cost per Staff Member 2006 - 2009





Appendix 8: AECL Collaboration with other RDCs

1.	Pre farm gate investment	:	\$1,455,980
	Post farm gate investment	:	\$ 638,338

COLLABORATIVE INVESTMENT

Table 1 – Collaborative investment by RDCs ~ 2009-2010

	Total RD&E spend	Total Collaborative spend (AECL + RDCs + Other)	AECL only Investment
Value/Percentage	\$2,094,318	55.77%	44.23%
No of Projects	41	19	22
Example		<p>'Poultry Co-Operative Research Centre'</p> <p>To maintain and enhance the egg industry's investment in R&D as it relates to hen nutrition, health, welfare and the environment for community benefit and food safety and quality.</p>	

Note:

It is difficult for AECL to provide a 'best' example as all projects are deemed critical.

Table 2 – Co-investment models

	Total Collaborative spend (AECL + RDCs + Other)	AECL + RDCs + Others	AECL + Others	AECL + RDCs only
Value/Percentage	\$1,167,999	30.99%	58.16%	10.85%
No of Projects	19	2	11	6
Example		<p>'Poultry Co-Operative Research Centre'</p> <p>To maintain and enhance the egg industry's investment in R&D as it relates to hen nutrition, health, welfare and the environment for community benefit and food safety and quality.</p>	<p>'How and when to introduce eggs to avoid egg allergies'</p> <p>Optimal timing information regarding introduction of egg into infant diets associated with egg allergy through evidence to allay fears of including eggs in infant diets. (See Note 2 below)</p>	<p>'Livestock feed grain user group and feed grain partnership'</p> <p>To progress towards the security and availability of feed grain at internationally competitive prices.</p>

Note 1:

It is difficult for AECL to provide a 'best' example as all projects are deemed critical.

Note 2:

This project was not included in Annexure 2/3 as projects in collaboration with other parties (non-RDC) were not previously included.

Annexure 1 - Profile of RDC

RDC	Date Formed	Size of program in 2010 Estimated ¹	FTE in R&D ²	Estimated 2010 Investment in Govt Rural R&D Priorities							
				Productivity	Supply Chain & Markets	Natural Resource Management	Climate Change	Bio-Security	Innovation Skills	Technology	Other
AECL	2003	\$ 2,084,312	1.6	\$ 148,468	\$ 873,141	\$ 6,000	\$ 100,100	\$ 303,863	\$ 542,277	\$ 110,378	\$ 12,000

Annexure 2 - All RDC's working together - Current R&D Projects¹

Current Projects Government Priority 1			Duration and \$value (AECL investment)
<p>Name and quick description of Joint Project *Test to differentiate Rispsens CVT988 vaccine from wild type MTV* Development of a diagnostic test differentiating between wild type and vaccine strains of MDV to improve the industry's ability to manage MDV</p>	<p>Participating RDC's AECL - 50% R/RDC - 50%</p>		<p>573,500 Duration: 2008/2009 to 2009/2010</p>
<p>*Livestock feed grain user group and feed grain partnership* To progress towards the security and availability of feed grain, at internationally competitive prices</p>	<p>AECL - 2% GRDC - 51% AFL - 7% MLA - 17% DA - 23%</p>		<p>53,500 Duration: 2009/2010</p>

Current Projects Government Priority 3			Duration and \$value (AECL investment)
<p>Name and quick description of Joint Project *Feedgrain partnership - Sorghum* Increase value and yield of sorghum as a feed ingredient via gene regulation to ensure the industry's access and security to cost efficient feed sources into the future.</p>	<p>Participating RDC's AECL - 2% GRDC - 51% AFL - 20% MLA - 17% DA - 10%</p>		<p>\$8,000 Duration: 2008/2009 to 2010/2011</p>

Current Projects Government Priority 4		
Name and quick description of Joint Project "Climate change research strategy (CCRSIP)" Cross sector research strategy to maximize ROI in relation to climate change information research and adaptation.	Participating RDC's All RDC's	Duration and \$value [AECL investment] \$32,000 Commenced : 2008/2009

Current Projects Government Priority 5		
Name and quick description of Joint Project "Improve control measures for infectious disease virus" To improve the industry's knowledge regarding gene mutations of IBDV to enable better management of the disease	Participating RDC's AECL - 25% RIRDC - 75%	Duration and \$value [AECL investment] \$9,096 Duration : 2006/2007 to 2008/2010

Current Projects Government Priority B	Participating RDC's	Duration and \$value [AECL Investment]
<p>Memorandum and quick description of Joint Project "Science and Innovation Awards for you-ix) people in agriculture" To develop and retain poultry science skills in the egg industry</p>	<p>AECL - 9% APL - 9% DA - 9% GRDC - 9% GWRDC - 0% FRDC - 9% AMIC - 9% HAL - 9% SRDC - 9% MLA - 9% RIRDC - 9%</p>	<p>Duration : Ongoing \$22,000</p>
<p>"Poultry Co-operative Research Centre" To maintain and enhance the egg industry's investment in R&D as it relates to hen nutrition, health, welfare and the environment for community benefit and food safety and quality</p>	<p>AECL - 20% RIRDC - 20% plus other non RDC participants</p>	<p>Duration : 2009/2010 for 7.5 years \$330,000</p>
<p>"Rural R&D Credits Committee (RRDC)" To maintain the egg industry's consultation and relationship with government on R&D matters to assist demonstrate community benefit as per the SFA and government priorities.</p>	<p>AECL - 0.42% plus all RDC's</p>	<p>\$2,500</p>
<p>"Investing in Youth Undergraduate Studentship Program" Scholarships and industry mentoring for undergraduate students studying primary industry</p>	<p>AECL - 10% RIRDC - 10% CRDC - 10% HAL - 10% GWRDC - 10% GRDC - 10% APL - 10%</p>	<p>Duration : 2009/2010 to 2012/2013 \$10,000</p>

Annexure 4 - Non R&D Projects

Section of Report	Brief description of activity/project/program	RDCs involved	Frequency of activity	Outcome / Benefit
	Food Policy Consultation Workshops	AECI, MLA, HAL and DA	Quarterly face to face meetings plus teleconferences and emails as required.	This group has been working with public health representatives to enhance communication and contribute to a national food policy.
	Stationery supply	AECI initiative - all RDCs have been invited to participate	When required.	Reduction in cost of stationery provision