

Schedule 1 ACTIVITIES OF THE CRC  
[Clauses 1.1, 4, 5, 6, 9, 10.5, 10.6, 14, 15.1]

**1.1 Outcomes**

The research and development programs of the CRC for an Internationally Competitive Pork Industry (Pork CRC) will result in the following outcomes:

1. Reduced production costs for high-quality pork through more reliable and consistent protein and energy supplies via innovative grain production, co-product utilisation and quality assessment.
2. Reduced production costs for high quality pork through improved herd feed conversion efficiency.
3. Increased demand for high-quality, niche Australian pork products as a result of enhanced capacity to deliver nutrients that promote the health and well-being of consumers via consumption of pork and pork products.

These research outcomes will contribute to Australia's industrial, commercial and economic growth through:

- Stabilised and sustained domestic and export pork market.
- Improved confidence in the pork industry leading to increased investment and industry growth.

**The scale of the outcome from the Pork CRC**

Outcomes of the Pork CRC will be realised economically through:

1. A reduction in the on-farm cost of production from \$2.0/kg to \$1.50/kg carcass weight (based on 2004 currency values); and
2. Development of value-added pork products that capture new niche markets by 2012.

The gross value of these outcomes totals \$203.9 million/per annum at the farmgate with an additional return exceeding \$31.5 million/annum for the farmgate sector.

In particular, the annual gross benefits from reduced cost of production, improved market outcomes and retailer returns will be gained from factors outlined in Table 1.

**Table 1. Factors contributing to annual gross benefits**

<b>Subprogram</b>	<b>Goals</b>	<b>Annual Benefit (m)</b>
<b>Farmgate benefit 1 – reduced production costs</b>		
1a) More consistent and stable protein and energy supplies 1b) Innovative pulse and grain production and quality assessments tailored to pork production	10% reduction in the average cost of pig diets	33.7
1a c) Innovative pulse and grain production 1b) Closer matching of dietary specifications to pig requirements	An increase in the average energy yield from feed grain of 1 MJ digestible energy per kg feed, which will increase FCE by about 7%.	16.8
2a b) Strategies for the manipulation of feed conversion efficiency (FCE) 2c) Enhanced metabolic efficiency and improved animal health.	An improvement in FCE from 4.3 kg to 3.6 kg of feed per kg of lean meat produced.	56.1
2c) Improved efficiency on nutritional and prophylactic disease treatments 2d) Improved reproduction efficiency and reduced sow turnover volumes.	Secondary benefits from a better absorption of overhead costs from increased throughput efficiencies. Secondary benefits from reduced use of medications.	10.6
<b>Farmgate benefit 2 – improved market outcomes</b>		
3a b) Increased innovation and range of viable fresh pork products. 3a b) Improved eating qualities aligned to production enhancements. 3a b) Increased product application opportunities for processed pork and better demonstrated benefits for the consumer	A 10% increase in domestic sales volumes	63.4
3a b) Increased range of viable fresh pork products for export markets. 3a b) Demonstrated benefits for the export consumer from work in Australian markets.	A 10% increase in export sales volumes	12.8
All) Increased range of viable fresh pork products. All) Improved eating qualities aligned to production enhancements.	A \$1/kg increase in returns from both markets for 10% of the product sold into higher value markets.	10.5
<b>TOTAL FARMGATE</b>		<b>203.9</b>
<b>Post-farmgate benefit 1 – retailer returns</b>		
All) Increased range of viable fresh pork products. All) Improved eating qualities aligned to production enhancements.	75% capture of \$1/kg increase in returns from both markets	31.5
<b>TOTAL POST-FARMGATE</b>		<b>31.5</b>
<b>TOTAL</b>		<b>235.4</b>

**Assumptions**

Reduced production costs, improved market outcomes and retailer returns have been assessed assuming:

1. A baseline cost of production of \$1.90/kg of live weight for a pig production enterprise;
2. Slaughter volumes of 5.0 million/year, which are 5% lower than current levels due to the expected production/supply response to the industry conditions that have prevailed throughout 2003-04;
3. Current industry average feed conversion achievements;
4. A high adoption rate (70%) of CRC outcomes through the commitment to the CRC of commercial pork production and processing participants, peak industry bodies and major feed grain suppliers;
5. The market and product mix of the Australian pork industry in 2004;
6. Farmgate values at an average of \$2/kg in 2004 dollars (May 2004 average industry prices have been reported by Australian Pork Limited for 60-75kg animals of \$2.00 to \$2.07);
7. Consumers pay an additional \$1/kg cwe for premium, nutritionally fortified pork and producers capture 25c/kg of this premium.

## **National Research Priorities**

### **An Environmentally Sustainable Australia – Transforming existing industry goals.**

The Pork CRC will transform the Australian pork industry while maintaining environmentally sustainable agricultural practice allowing the efficient production of innovative pork products from grain resources with improved conversion efficiency.

*Research Program 1 – Securing more reliable and consistent supplies of protein and energy for pig diets.* Development of dedicated cereal grains and pulses for use by the pig industry will help ensure a closer match of diet specifications to pig requirements resulting in reduced outflows of excess nutrients in effluent. In addition, cereal and pulse varieties with a higher yield per hectare in growing regions close to pig producing regions reduce the agronomic and freight inputs required to deliver nutrients to the pig. Production of non-traditional cereal and pulse crops in rotation with traditional crops is viewed as a means of not only improving the supply of protein and energy to the pig industry, but of increasing the production efficiency of existing cropping areas. This contributes to an environmentally sustainable Australia through a reduction in agronomic inputs as a result of improved crop rotations. A significant proportion of this research program is also directed at making better use of traditional co-products in pig feeds (that often represent waste streams). The research will explore ways for the pork industry to make use of these potential protein and energy sources through a program of ingredient characterisation and the development of alternative feeding strategies. Again, this will reduce the pressure on traditional protein and energy resources, and reduce the potential environmental impact of waste streams from other industries.

*Research Program 2 – Improving herd feed conversion efficiency.* Improving herd feed conversion efficiency is the single most efficient way of increasing profitability from pig production. In addition, efficient production of high value protein such as pork represents one of the most important facets of provision of sustainable food resources for the human population. As a key performance indicator, outputs from the Pork CRC will continue to a reduction in herd feed conversion from the current level of 4.2 kilograms of feed for every kilogram of pork produced to 3.5:1. Based on the current annual production of pork, this equates to an annual reduction in total feed use of approximately 247,000 tones. This will significantly contribute to an 'environmentally sustainable Australia' through reduced pressure of protein and energy inputs and increased metabolic efficiency of the pig resulting in reduced gaseous and effluent outputs.

### **Frontier Technologies for Building and Transforming Australian Industries – Breakthrough science**

Through research programs 1 and 2, the Pork CRC will provide significant breakthroughs in pig and plant biology to advance knowledge and facilitate the development of technological innovations for the pork industry,

*Research Program 1: Securing more reliable and consistent supplies of protein and energy for pig diets.* Breakthrough science in this research program will increase the understanding of the chemical and physical characteristics of cereal grain cell walls and protein matrix so that feeding, processing and intervention strategies and products can be developed to make better use of starch. Breakthrough science on the relationship between pig biology and starch characteristics of sorghum could yield an extra 2 MJ of digestible energy per kilogram of sorghum used. Based on an annual sorghum consumption by the pig industry of 180,000 tones and a value of \$30/tonne for 2 MJ of digestible energy, this is worth \$5.4 million to the pig production sector alone and has potential to simultaneously increase the value of sorghum to grain growers relative to other grains.

*Research Program 2: Improving herd feed conversion efficiency.* Breakthrough science in this project would lead to technological innovations that could revolutionise livestock and human nutrition.

Potentially one of the most significant outcomes from this proposed research program is the capacity to measure feed intake of an individual animal within a group using either a metabolic or digestive marker. The primary driver of all livestock nutrition and diet formulation is feed intake and yet it is one of the most difficult parameters to accurately measure in individual animals of any livestock species on a routine basis under commercial production conditions.

Productivity from sows is superior to gilts (ie. first litter sows) in pig production systems. Facilitating a better understanding of 'sow factors' that contribute to improved productivity will allow technological innovations that improve the productivity of gilts and other breeding females. The development of 'placental efficiency markers' will also allow intervention assessment of embryo survival in breeding females.

### ***Frontier Technologies for Building and Transforming Australian Industries – Frontier Technologies***

Research programs 1 and 2 will also use and develop capacity in biotechnology, genomics and phenomics to power the pork industry of the future. Through program 1, existing biotechnology, genomic and phenomic tools employed by Australia's world-class plant breeding facilities will be harnessed by the Pork CRC for the rapid development of new cereal and pulse varieties that have extended growing regions, and more suited to pig producing regions, and have specific characteristics that ensure efficient nutrient use by the pig.

Key research outputs from program 2 will enhance leading edge capacity in biotechnology, genomics and phenomics. In particular, quantitative trait loci (QTL), genetic markers and genetic receptors will be identified to enhance feed intake, feed conversion efficiency and disease resistance. Further to this, identification of novel molecules from colostrum and plasma and the identification of cytokines that can act as natural immunotherapeutics represents biotechnological interventions that will potentially stimulate feed intake, promote gastrointestinal health and reduce use of some antibiotics.

While consideration needs to be given to market perception of some technologies, this research program will focus on the commercial application of cloning and stem cell technology, capacity for slow-release or oral delivery of porcine somatotropin, and manipulation of the natural release of endogenous pig growth hormone. Advances in this field will contribute significantly to this national research priority and will benefit many other sectors beyond the pork industry.

### ***Promoting and Maintaining Good Health – Preventative healthcare***

Through research program 3 (*Enhancing capacity to deliver nutrients that promote health and well-being through pork*), the Pork CRC will establish cost-effective ways of incorporating key functional nutrients into pork during the production phase, and most importantly, quantifying the human health attributes for consumers through the new and established nutritional models. Key targets include:

*Selenium (Se):* Due to the relatively low level of selenium in Australian and New Zealand soils many primary products from these countries have lower Se levels than products from higher Se regions. While it is generally accepted that Se intakes of Australian and New Zealand consumers are sufficient to ensure that there are no overt signs of deficiency, there is evidence that low intakes may contribute to an increased risk for some cancers (eg bowel). Protein-bound Se is more bioactive and less toxic than inorganic forms of Se and there is benefit in delivering Se in organic forms in food. It needs to be determined if selenium in enriched pork is more bioactive than other forms of selenium, and the health benefits for consumers quantified.

*Omega-3 fatty acids ( $\omega$ 3):* The primary benefit of  $\omega$ 3 are for heart health and the prevention or alleviation of inflammatory conditions, such as arthritis, asthma and bowel disease. There is also evidence for a wider range of other metabolic and behavioural benefits. Manipulation of the  $\omega$ 3 content of interstitial membranes in pork will provide an efficient way of delivering this nutrient to consumers in an easily absorbed, bioactive form. Pork CRC research will develop cost-effective mechanisms for the incorporation of this fatty acid into pork.

*Other compounds:* In addition to manipulation of the fatty acid content, excellent opportunities exist to manipulate the intramuscular fat component of pork with respect to fat-soluble bioactive and flavour compounds. For example, it is possible to decrease the cholesterol component of pork by dietary lecithin supplementation, which is likely to have the added benefit of improving tenderness. Other compounds that can be manipulated include the fat-soluble vitamins (A, D, E) and fat-soluble antioxidants and other organics (eg carotenoids, lutein, lycopene).

## **1.2 Governance and Management**

### **1.2.1 Governance, Management and Collaboration**

The Pork CRC will be constituted as a company limited by guarantee ('Pork CRC Ltd'). All core participants will not be required to become members of Pork CRC Ltd ('Members') although Pork CRC Ltd will encourage all core participants to do so. Regardless of whether a core participant is a Member, all core participants are parties to the Participants Agreement and entitled to the same flow of information about the activities of Pork CRC Ltd. Membership will not be transferable (so that on retirement a Member would relinquish membership rather than transfer it) and will not confer any rights to assets of Pork CRC Ltd.

To ensure optimum flow of relevant information, Pork CRC will establish subcommittees to address and report to the CRC Board. In the first instance, the following subcommittees will be established:

- Research and Development Committee

This subcommittee will comprise a minimum of two Board members, the CEO and independent advisors as deemed appropriate. The primary functions of the Subcommittee will be to make recommendations to the Board in relation to a) relevant research priorities for each year of the CRC, b) short-listed research projects and their respective budgets relevant to the nominated research priorities in each year of the CRC, c) ensure no overlaps between research programs, d) ensure adequate levels of interaction between private and public participants in the CRC, e) monitor the research activity of participants relative to their nominated in-kind contributions and f) the relevance of and the technical risks associated with the research programme.

- Commercialisation Committee

The Pork CRC Ltd does not plan to establish a separate commercialisation company at the outset, but will pursue commercialisation of outcomes via participants in the CRC or appropriate licensing arrangements with external partners. In the event an existing commercialisation pathway does not exist, the Pork CRC Ltd will look to establishing a commercialisation entity in its own right. When appropriate, the Board will utilise a Commercialisation Subcommittee comprising at least two Board members, the CEO and independent advisors as required to make recommendations to the Board on the most appropriate pathways to commercialise outcomes. This Subcommittee will also make recommendations to the Board in relation to protection of intellectual property.

- Education Committee

The Education Subcommittee will comprise at least two Board members, the CEO and the Leader of Programme 4 who will make recommendations to the Board on a) priority post-graduate training areas relative to industry wide capacity, b) recruitment and selection of suitable post-graduate students, c) and adequacy of the training and education subprogram over the life of the CRC.

- Audit Committee

The Audit Committee will comprise not less than three Board members and one independent who will also fulfil the role of chairperson of the Committee. This Committee will actively engage an independent auditor to review the annual activities of the CRC.

### *Pork CRC Ltd Board*

- Pork CRC Ltd will have a 9 person board ('Board'), including the Chairperson. Each core participant will be entitled to nominate a person to stand for election as a director and the core participants between them vote to elect up to 6 directors of the Board. The CEO will not be a director. The remaining 2 directors will be independent of the core participants and will be appointed following a) an internal review of the expertise existing on the Board after appointment of core participant-elected directors and identification of key expertise requirements, b) a formal selection process for specialist directors, and c) ratification by the Board.
- A majority of the directors will be appointed from end-user enterprises.
- A proportion of directors will be required to resign every three years (except for the first three years when a pro-rata proportion will be required to retire earlier). Resigning members may renominate and there will be no constraints on re-election. A director that has been nominated by a core participant must resign if that core participant resigns from Pork CRC Ltd.
- The Board will (among other things) be responsible for decisions relating to the spending of Pork CRC Ltd funds, the research program, protection and commercialisation of IP, and appointment and remuneration of a CEO.
- The Chair will have the casting vote at Board meetings in the event that there is an equality of votes.
- Written resolutions will be possible between Board meetings but will require a unanimous response, otherwise a teleconference or face-to-face meeting will need to be organized.
- A quorum of 6 will be required at Board meetings consisting of at least one research provider, one end user and one independent.
- A simple model for voting at Board meetings will be presented initially and Board members will then have the option to raise decisions that need a different majority.
- Proxies will not be accepted at Board meetings.

### *Pork CRC Ltd Member Meetings*

- Meetings will be conducted in accordance with the Pork CRC Ltd Constitution.
- Members meetings will appoint directors and determine remuneration of the Chairperson and Board.
- Each member will have a vote, with a value equal to that member's proportionate contribution to Pork CRC Ltd.
- The value of votes of a member of the Pork CRC Ltd will be calculated annually on the basis of their cash contributions and the value of their respective in-kind contributions which has been deemed equivalent in value to cash contributions.
- Most decisions of members will be determined on the basis of a simple majority at correctly advertised meetings (unless required otherwise by the Participant Agreement or the Corporation Act).
- Quorum will be majority of members providing they also represent the majority of votes.
- The Chair will not have a vote at a members meeting.

### **Chief executive officer (CEO)**

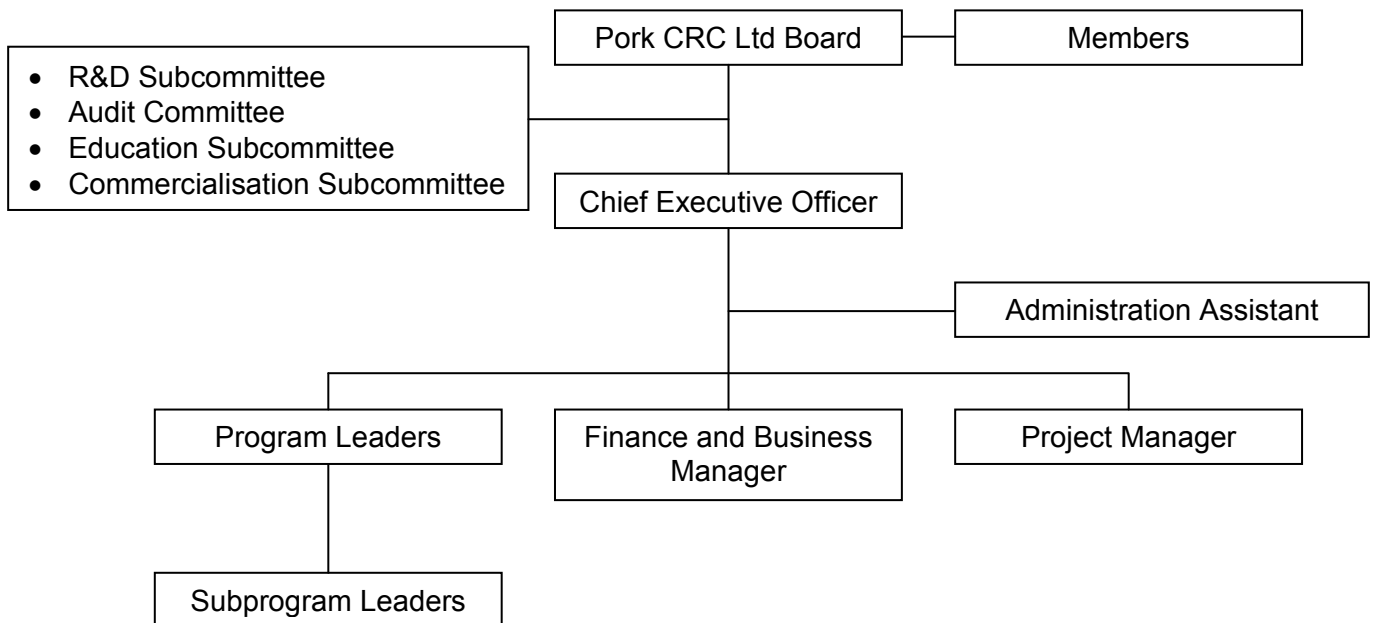
The CEO will be accountable for planning, directing and controlling the activities of the Pork CRC. In particular, the CEO will:

- Administer and manage the Pork CRC Ltd according to the policy established by the Board and in response to statutory obligations under relevant federal and state/territory legislation;
- Establish the overall research, capacity building, technology adoption and commercialisation programs, including the appointment of program leaders and subprogram leaders;
- Review, direct and recommend research, capacity building, technology adoption and commercialisation programs in a timely manner;
- Ensure the Pork CRC Ltd is properly staffed at all times to meet the objectives of the CRC;
- Create and maintain an environment conducive to optimum achievement of results from the respective programs within the Pork CRC;
- Ensure the outcomes from the Pork CRC are appropriately promoted to end-users and that any intellectual property is managed in accordance with the Pork CRC articles of incorporation;
- Maintain effective relationships between all Pork CRC participants, and commercial and other research groups not directly involved in the Pork CRC;
- Ensure sound financial control of the Centre's activities by establishment of and adherence to annual budgets;
- Promote the growth and development of the Pork CRC through the preparation of a business plan; and
- Represent the Pork CRC, in conjunction with the Board, in industry, government and public arenas.

Dr Roger Campbell has been appointed as the first CEO of the Pork CRC Ltd.

## Organisation chart

The following initial structure of the Pork CRC Ltd organisation is proposed:



## Risk Management

Financial and technical risks will be identified by using the highest standards of corporate governance, which are consistent with the principles of the Australian Institute of Company Directors. The board will use the audit sub committee to manage financial risks, which will meet at least twice per year and report to the Board. Technical risks will be managed by stringent assessment of projects, including assessment of risk by management and Board panels. Reports of these assessments will be provided to management and the Board. Risks associated with potential conflicts between participants will be managed by effective consultation, communication strategy, regular reporting as per participant's agreement and monitoring of potential risks by the Board.

## Effective collaboration

The governance and management structure will ensure effective collaboration between the participants through:

- A high level of involvement of commercial participants on the Board, the various subcommittees and in specific research and development projects;
- A relatively flat management structure with a high level of involvement from Program and Subprogram Leaders;
- A world-renowned pig research scientist (Dr Roger Campbell) has been appointed as the CEO. Dr Campbell is familiar with many of the research organisations, researchers and industry participants in the Pork CRC and is well placed to ensure the strategic objectives of the CRC are met through effective collaboration.
- Many of the participants in the Pork CRC are also end-users of the technology that will be developed ensuring rapid uptake, and collaborative working relationships to ensure the outputs remain commercially focussed.

### 1.2.2 Specified Personnel – Chairperson and Chief Executive Officer

Chairman of the Board	Dr John Keniry
Chief Executive Officer	Dr Roger Campbell

## 1.3 Commercialisation and Utilisation Plan

### 1.3.1 Target Market(s)

#### Rationale

Globalisation, food safety requirements, technology developments and trade reforms have forced profound structural changes in the Australian pork industry over the past 5 years. In 1998, the industry was focused on the domestic market and international competitiveness was not critical to its profitability. Since that time, added competition from imports, together with opportunities in Asian markets have prompted industry restructure (with assistance from the Australian Government).

Over this time, pork exports have increased in value from \$40 million in 1998 to \$250 million in 2003 (largely related to increasing market share in Singapore and Japan), and there has been a 40% increase in gross value of pork production to \$969 million. This has been accompanied by a reduction (20%) in the number of pig farms, and expansion in the slaughter capacity of specialist, export-oriented pig abattoirs and a 12% increase in the number of pigs produced per sow per year (to 5.7 million pigs produced per year from 340,000 sows).

Despite these advances, the Australian pork industry finds it increasingly difficult to achieve sustainable returns. The cost of production, and thus profitability of the industry, is determined by feed prices and the efficiency of conversion to pork product. Over the last three years feed prices have been high and variable and feed conversion efficiencies into lean meat are suboptimal. These barriers to profitability are further compounded by unfavourable exchange rates which have stalled export growth, and increasing domestic and export market competition, particularly from countries with lower costs of production or subsidised production. In the last 4 years pork imports into Australia, principally from Canada and Denmark, have risen by 64%.

Whilst Australia has the potential to substantially increase production to meet some of the growing demand for pork products in Asia, we must compete against much larger exporters (some with subsidised production) on either price, quality and/or service in what are largely commodity, price-driven markets. To remain viable in global markets as a niche producer and exporter, attract further investment and build on past success, the industry must reduce the cost

of production and add value to, or differentiate its product range. In addition, although Australia is a low-cost producer by world standards in times of grain surplus, high and unpredictable grain prices remain a crippling burden in times of drought, particularly as grain cannot be readily imported.

## Target markets

The Pork CRC research program will generate the following marketable outputs with associated target markets including:

1. New information to improve on-farm management decisions, and new processes, or enhancements to existing practices (eg. crop agronomy, feed formulation strategies, sow management techniques) will be directly targeted towards piggery owners and managers, and service providers (eg. nutritionists, consultants, veterinarians) with transfer via established and novel pathways.
2. New prototype products to improve on-farm efficiency) eg. grain varieties, equipment, feed additives, metabolic modifiers and gene markers) will directly targeted towards pork producers, stockfeed manufacturers and service providers.
3. New pork products will be targeted towards highly integrated pork producers, food processing companies and retailers with transfer via intellectual property commercialisation licences.
4. A new generation of well-trained specialists with pork industry expertise which will be targeted towards research and teaching institutions, highly integrated pork producers and service industries.

The high level of involvement of the target markets in the Pork CRC research programs and company management (ie at Board level and research administration level) will ensure the markets are continually monitored and their needs are conveyed to the Pork CRC on an ongoing basis.

### 1.3.2 Strategy

Some of the strategies for utilisation and commercialisation are based on mechanisms that are well recognised by the majority of industry participants (ie. low risk). Significant involvement by Australian Pork Ltd will ensure ongoing R&D investment outside the scope of the Pork CRC is complementary and that integration occurs where appropriate (especially during the technology transfer phase). In addition, existing pork industry infrastructure will facilitate monitoring of Pork CRC outcomes so that a net benefit from commercialisation and utilisation can be quantified.

Adoption and utilisation of Pork CRC outputs will be assured by the balance of end-user participants and the established technology transfer mechanisms in the pork industry. The outputs will include:

1. *New information* to improve on-farm management decisions, and *new processes*, or enhancements to existing practices (eg. crop agronomy, feed formulation strategies, sow management techniques);
2. *New prototype products* to improve on-farm efficiency) eg. grain varieties, equipment, feed additives, metabolic modifiers and gene markers);
3. *New pork products*; and
4. *A new generation of well-trained specialists* with pork industry expertise.

Each of these outputs requires a different strategy for commercialisation and utilisation by end-users with achievement of this via several pathways.

**New information and new processes** will be directly used by piggery owners and managers, and service providers (eg. nutritionists, consultants, veterinarians) with transfer via established and novel pathways.

Over years of investment in research and development (R&D) through levy contributions, the pig production sector has developed successful channels for communicating new information to producers and encouraging the adoption of innovations. The Pork CRC will use these channels, supported by the in-kind investment of Australian Pork Ltd, to ensure that new information and technologies are effectively integrated with existing knowledge. The Pork CRC core commercial participants are highly integrated companies, incorporating grain production, feed formulation, commercial facilities and staff for applied R&D, pig production, processing and, to varying degrees, further processing and marketing to domestic and export markets. These companies have a combined production capacity representing 30% of the industry and their in-kind investment will allow large-scale evaluation of promising new technologies within fully commercial environments before promotion to the wider industry. Through close cooperation with these 'lead-user' companies under the co-investment structure of the CRC, beneficial innovations will be rapidly adopted by a significant part of the industry before final development is completed and documented.

Examples of existing pork industry information dissemination mechanisms that will be utilised by the Pork CRC include:

- **Uptake Technology Forum** to showcase new technologies – biennial Australian Pork Ltd meeting attended by end-users representing 80% of Australian pork production (plus opportunities for video conferencing to remote locations);
- Australian Pork Ltd **Group Demonstration funding** to encourage groups of producers to trial new technologies arising from Pork CRC research;
- **Pan Pacific Pork Expo** – biennial conference and tradeshow for producers;
- **Australian Pig Science Association (APSA)** – internationally-recognised biennial technical conference for scientists, technical service providers, extension officers and leading producers. APSA is a supporting participant of the Pork CRC, and by combining a Pork CRC annual conference with the APSA conference every two years, the Pork CRC is assured of a wide national and international audience for some of its outcomes.
- **Pork Trends** – monthly news-sheet to Australian Pork Ltd members.
- **InnovatE** electronic newsletter from Australian Pork Ltd – reports local and overseas research findings;
- **Commercial industry press** (Australian Pork Newspapers, The Pork Producer, Pork Journal).
- State Department **industry-specific communications** (SA – Pig Industry News; WA – Pig Tales).

Other technology transfer pathways and strategies that will be utilised by the Pork CRC include:

*Targeted information packages and expert working groups.*

The Pig Research and Development Corporation examined “pathways for nutritional information” (Project DV 1638, 2001) and identified that five nutritionists or providers of feed formulation advice serviced almost 68% of Australian pork production with the next five providers servicing an additional 19% of pork production. Since that review was undertaken, it is likely that only eight nutrition providers service more than 90% of the commercial pork production sector. Similar ratios exist for the provision of specialist veterinary services and other service providers to the pork industry. This unique industry structure means that establishment of expert working groups comprising these key individuals servicing the pork industry is an efficient way to disseminate information to industry and ensure wide adoption. The Pork CRC will convene these groups and will facilitate targeted delivery of information generated by Pork CRC research programs.

*Utilisation of existing grains industry information dissemination mechanisms.*

The opportunity exists to utilise GRDC's extensive communication network to disseminate information, promote new initiatives and enhance the link between grain growers and pork

producers. The GRDC communication mechanisms that could be utilised by the Pork CRC include:

- **Ground Cover** – newspaper updating farmers on the latest in research;
- **Growers Group** – news and information from groups of growers active in grains research. Includes Local Farmer Group Network, Partners in Grain, Grower Group Alliance and TOPCROP;
- **Advice sheets** – research information and advice for farmers and agronomists.

#### *Grains/Pork Industry Liaison Officer*

Adoption of some outputs from the Pork CRC will require changes in traditional grain and pulse production practices, not only in the crops and varieties planted, but the agronomic practices required to optimise yield. The supply of high yielding feed grains with specific nutritional attributes for pigs will also necessitate an increased level of interaction between pork producers and grain growers. To bridge this divide, the Pork CRC will examine opportunities for the use of a Grains/Pork Industry Liaison Officer and/or novel agronomic adoption packages to facilitate the development of these relationships and to promote confidence in the capacity to farm grains on behalf of the pork industry.

#### *Specialist skill-development workshops and training kits.*

The pork industry has a strong reputation in the development of training kits based on research outcomes and the use of these kits to facilitate specialist skill-development workshops for pig producers and their staff in regional locations. The Pork CRC will utilise this base to expand the scope of these workshops and training kits based on relevant research outcomes.

#### *Short knowledge-development courses.*

Delivery of Pork CRC research outputs via short courses will support life-long learning initiatives for pork producers and managers, and will be targeted so that formal qualifications are not required for participation.

#### *Development of the Pork CRC brand.*

From the initial stages of bid development, the Pork CRC core participants have attempted to establish, and view as important, an identity enhanced through a logo and coordinated strategies. The Pork CRC will further develop this identity or brand so that sources of information and products can be easily recognised, and so that end-users associate these outputs with a credible, industry-driven, collaborative research and development effort increasing their willingness to utilise the information or adopt the output.



#### *Participant communication Network.*

A participants' communication network utilising the internet, newsletters and annual conferences will be established by the Pork CRC to build a strong culture of collaboration between all participants, to earn public support for the pork industry and the associated research and development conducted within the CRC, and to ensure that all participants understand the principal needs of stakeholders and report promptly their progress and outcomes.

#### *Website.*

A website will be established to communicate the objectives of the Pork CRC ([www.porkcrc.com.au](http://www.porkcrc.com.au)) details of the relevant research programs and participants, and research progress. The website will also provide a base for promotion of commercial products arising from the research program as well as relevant publications and links.

#### *Adoption of novel models that promote uptake and innovation.*

Private and public sector organisations, including existing CRC's, have invested heavily over recent years in the development of enhanced techniques that assist in increasing the adoption of research outputs. If a suitable model can be identified, the Pork CRC will examine opportunities to adopt the technique for the delivery and communication of its outputs.

**New pork products** will be adopted directly by highly integrated pork producers, food processing companies and retailers with transfer via intellectual property commercialisation licence.

The Pork CRC will develop cost-effective technologies to produce fresh and possibly processed pork cuts that are enhanced with a range of nutrients that are known to be beneficial to human health, and will determine the extent to which health claims can be made in the promotion of these products. It is envisaged that these technologies will be offered under non-exclusive licences to companies that have the capability to produce, distribute and promote brands based on the substantiated health benefits for local and export markets, to maximise market penetration. These three core participating commercial producer groups are all currently involved in supply alliances that produce either wholesale (QAF Meat Industries Pty Ltd – Baxters; Australian Pork Farms Group – Auspork and Daylesford Country Pork), export (The CHM Alliance-Sunpork) or local retail brands (The CHM Alliance – Hans Fresh) and are well placed to lead the development of new nutritionally-fortified brands into all major markets for Australian Pork.

**Trained specialists** will be engaged by the pork industry to redress the current lack of qualified personnel.

The critical research momentum generated by the Pork CRC and the influence the outputs will have on confidence and investment in the pig production will help stem the loss of existing technical expertise, and will increase the retention of newly trained specialists by the industry. This will provide a significant boost to the transfer of technology arising from the Pork CRC and will promote widespread adoption.

#### **Contribution of the main end-user participants in the Pork CRC**

1. Integrated pork producers and processors (Australian Pork Farmers Group, QAF Meat Industries Pty Ltd, The CHM Alliance).
2. Feed ingredient and therapeutic manufacturers and suppliers (Alltech Biotechnology Pty Ltd, Bartlett Grains Pty Ltd, Elanco Animal Health Pty Ltd, Feedworks Pty Ltd, Kemin Industries (Asia) Pte Ltd).
3. Stockfeed manufacturers and ingredient processors (Betterblend Stockfeeds Pty Ltd, Ridley Agriproducts Pty Ltd).
4. Agronomists and new cultivar suppliers (Grainsearch Pty Ltd).

#### *Integrated pork producers and processors.*

Core industry participants (farming 100,000 of the total 340,000 sows in the Australian pig herd) have already collaborated to generate the substantial seed funding (despite all experiencing losses in current markets) necessary to secure the involvement of essential university, government and other private sector participants. Combined with the support of Australian Pork Limited and the Western Australian Agriculture Produce Commission Pork Producer's

Committee, the Pork CRC involves 100% of the commercial pig sector in Australia through either direct cash investment, representation by the peak body and/or the provision of research capacity and demonstration sites. Through the proposed program, core industry participants will contribute to the basic research program in conjunction with traditional research providers, which will greatly enhance the rate of adoption. The Pork CRC will have the balance of participants necessary to ensure an integrated approach, both to research and to adoption of research outputs. It will also allow fragmented research groups to establish the critical mass needed to make significant advances towards the defined goals and to compete for limited resources.

Two core pork industry participants (The CHM Alliance and QAF Meat Industries Pty Ltd) have established science and technology programs, research expertise and training programs, and plan to contribute a proportion of these in-house resources to the Pork CRC. All core pork industry participants have made resources available for the demonstration of technologies and commercialisation of outcomes. Being integrated pork producers, this means they can directly demonstrate technologies relating to grain production, feed manufacture, ingredient processing, pig production, and fresh and processed pork products. Using industry facilities for research, training and demonstration/adoption activities, in collaboration with public sector research providers, will increase the relevance of the program, making the path to commercial adoption clearer and ensuring the success of the CRC.

*Feed ingredient and therapeutic manufacturers and suppliers.*

In addition to cash and in-kind investment, these end-users will contribute existing technologies to the Pork CRC research program including:

- Proprietary enzyme preparations and enzyme technology;
- Stable sources of omega-3 fatty acids (PorcOmega, SALmate);
- Metabolic modifiers (eg. Ractopamine);
- Proprietary acidifiers and related technologies;
- Sources of organic materials and supplements suitable for enhancing the nutritional attributes of pork.

*Stockfeed manufacturers and ingredient processors.*

Ridley Agriproducts Pty Ltd is Australia's largest stockfeed manufacturer and Betterblend Stockfeeds is a well-established grain trading, processing and stockfeed manufacturing business based in Oakey, Queensland. Both organisations will contribute to specific research programs and will provide expertise and infrastructure for the processing (eg. expanding, pelleting) of ingredients and complete pig feeds.

*Agronomists.*

The members of Grainsearch Pty Ltd were all original members in establishing the very successful Southern Farming Systems. This is a farmer driven non-profit organisation undertaking research and extension programs in the 'high rainfall and cool climate' region of Southern Australian with over 1000 members. Grainsearch Pty Ltd will provide the Pork CRC with access in the first instance to long season feed cereal varieties from the United Kingdom and France via licensing arrangements between Grainsearch Pty Ltd and Wrightson Seeds. The program will be amongst the first to utilise new technology for feed grain quality measurement to ensure that at all trial sites, characteristics for yield and disease resistances are matched with those nutritional features (digestible energy, voluntary feed intake and processing attributes) that are important to the pig production. As further encouragement for grain growers into a "new generation" feed grain industry, Grainsearch Pty Ltd will bring price risk management tools developed for feed grain supply chains.

## **Measuring National Benefit**

A number of mechanisms exist to measure the national benefit arising from adoption of Pork CRC outcomes. These include:

1. Australian Pig Check – This is a benchmarking program coordinated by Australian Pork Ltd that monitors both key production indices (such as average daily gain, feed conversion ratio, pigs born alive etc) and financial indices for a broad cross section of the pork industry. All commercial participants in the Pork CRC contribute to this database, and hence improvements in their business operations will be reflected in this benchmarking program and can then be used to estimate national benefit.
2. AUSPIG – AUSPIG is a simulation model developed by the Australian pork industry. The model is effective in simulating benefits arising from the implementation of changes in key production parameters. It will be used to quantify the benefit arising from implementation of many Pork CRC outcomes.
3. Commercial validation – Pork CRC outcomes will be validated in the commercial facilities of industry participants. These validations will be communicated to the wider industry and will allow a quantification of national benefit arising from the Pork CRC outcomes.

### **1.3.3 Governance and Operational Arrangements**

Governance and operational arrangements for commercialisation and utilisation of intellectual property arising from the Pork CRC will be consistent with the National Principles of Intellectual Property Management for Publicly Funded Research, including:

#### ***Pork CRC Ltd Policies***

The Pork CRC Ltd Board have established a model for the ownership, protection and exploitation of intellectual property arising from research activities conducted within the Pork CRC. In broad terms, the Board will decide whether any outcomes from the activities warrant pursuing intellectual property protection and may at all times commercialise the intellectual property in accordance with relevant sections of the Participant's Agreement, use the intellectual property for research, training and education purposes of the Centre; and licence any participant or any other person to use the intellectual property for the research, training and education purposes of the Centre.

To minimise time lag between the identification of a new product with commercial potential and its eventual application by the pork industry, the Pork CRC will develop commercialisation plans aimed at:

- Ensuring standard operating procedures are used in experimentation that will be compatible with registration and regulatory requirements.
- Ensuring that products and processes under development can feasibly be expanded to a commercial scale.
- Where appropriate, facilitating the efficient and timely testing of the efficacy and safety of products according to international regulatory standards.
- Developing a strong working relationship with statutory and government authorities involved in the registration of new products.

To maximise commercial involvement in the research program, it is proposed that licence agreements will be established with commercial entities as early as practicable in the life of the relevant projects. Licences will contain performance clauses designed to maximise market penetration and the commercial returns to the Pork CRC.

### ***Identification of IP***

The Pork CRC Ltd executive will establish an IP register and will work closely with program managers and researchers to make them aware of IP issues and ensure the requirements of the Commonwealth, the participants, research organizations and researchers are fully understood and covered in the program and project agreements. The IP register will be reviewed regularly by the R&D Subcommittee. Where necessary, IP issues within programs and projects will be reviewed by external referees and actions required reported back to the committee and the Board.

### ***Protection of IP***

The Pork CRC Ltd will maintain an IP register containing at least the date of entry on the register, a description of the IP, identity of the inventor and the party that developed the IP; and details of any agreements made by the Pork CRC Ltd with participants or with third parties in relation to disclosure or use of the IP. Project agreements will include provisions on Pork CRC Ltd requirements for the maintenance of laboratory records. Each Pork CRC Ltd Program Leader will be required to submit an annual communication plan for their subprogram and the Pork CRC Ltd will distribute disclosure guidelines for all publications and communications. The Board will consider training scientists working on Pork CRC Ltd projects in media communications.

### ***Ownership of IP***

The Pork CRC will adopt a Project IP model for the ownership of IP. Upon its creation, the legal interest in the Project IP will be owned by the Pork CRC Ltd and the beneficial interest in Project IP will be owned by the project participants and the Pork CRC Ltd as tenants in common in the project shares specified in the project details for the relevant project (or in equal shares for all project parties if shares are not specified in the project details). The Pork CRC Ltd will hold the interest of the project participants in the Project IP on trust.

Any student working on a Pork CRC Ltd project (funded in part or in full) or in receipt of a Pork CRC Ltd stipend will be required to assign any IP arising from their project to the Pork CRC Ltd with the responsibility for this assignment vesting with the institution through which they are enrolled.

### ***Assessment of existing IP***

The Pork CRC Ltd will utilise Program Leaders to assist with assessments of existing IP in relevant fields of research and to provide guidance to researchers on the use of this IP. In some cases, the Pork CRC Ltd will enlist external expert advice in these matters as part of the project assessment phase prior to commencement of the research.

### ***Management of IP***

Regular reviews of IP and associated commercial activities will be undertaken by the R&D Subcommittee with subsequent recommendations to the Board. This review process will also include recommendations on an appropriate path for commercialising IP arising from the research program.

### ***Sharing of benefits***

The Project IP model adopted by the Pork CRC Ltd allows the rights and needs of all participants in the project, members of the Pork CRC Ltd and the Australian pork industry to be considered and ensures that outcomes arising from the research are utilised in such a way that all stakeholders benefit.

## **Transparency and Reporting**

The Pork CRC Ltd will provide reports to stakeholders and the Commonwealth in accordance with the Commonwealth Agreement and the Participant's Agreement. Reports will detail how IP arising is being managed and commercialised.

### **Potential Conflict of Interest**

Conflicts of interest will largely be addressed by the Pork CRC having the exclusive right to commercialise the Centre IP at its discretion (including a right to sublicense), provided that it complies with all obligations under the Commonwealth Agreement regarding commercialisation, complies with all obligations under the Participant's Agreement and any applicable project details regarding commercialisation (including the applicable commercialisation plan and any additional obligations agreed specifically for that Project); and endeavours to achieve the Centre Objectives. As the Pork CRC Ltd has representative members on its Board, standard governance principles will be employed to ensure potential conflicts of interest are disclosed and managed appropriately.

#### 1.3.4 Commercialisation and Utilisation Programme

##### 1.3.4.1 Specified Programme Personnel and Private Sector Participants

<b>Commercialisation and Utilisation Programme</b>	
<b>Specified Personnel - Programme Leaders</b>	<b>Time Commitment (/annum)</b>
Mike Taverner	0.1
Frank Dunshea	0.1
David Henman	0.1
Ian Johnsson	0.1
<b>Private Sector Participants:</b>	
Alltech Biotechnology Inc.	
Australian Pork Farms Group	
Australian Pork Ltd	
Bartlett Grains Pty Ltd	
Betterblend Stockfeeds Pty Ltd	
Elanco Animal Health Pty Ltd	
Feedworks Pty Ltd	
Grainsearch Pty Ltd	
Kemin Industries (Asia) Pte Limited	
QAF Meat Industries Pty Ltd	
Ridley Agriproducts Pty Ltd	
The CHM Alliance	
WA Agricultural Produce Commission Pork Producers Committee	

##### 1.3.4.2 Outcomes, Outputs and Milestones

<b>CRC Outcome 1</b>	
<b>Reduced production cost for high quality pork through more reliable and consistent protein and energy supplies via innovative grain production, co-product utilisation and quality assessment.</b>	
<b>Output 1.1</b> New and adapted cereal varieties with outstanding yield, excellent disease resistance, wide adaptation and improved feed quality characteristics.	<i>Delivery date:</i> June, 2012
<i>Delivery targets</i> – 3-5 cereal cultivars with favourable yield, disease resistance, growing	

range and nutritional attributes for pigs available from 2008.	
<b>Milestone 1.1.1</b> Publication of practical guidelines for supply chain arrangements to deliver new and existing cereal cultivars to the pig industry.	<i>Achievement date:</i> December, 2006
<b>Milestone 1.1.2</b> At least one cereal cultivar available that has been selected for pig feed with associated recommendations for high yield, disease resistance, growing range and nutritional attributes.	<i>Achievement date:</i> June, 2008
<b>Milestone 1.1.3</b> At least two cereal cultivars available that have been selected for pig feed with associated recommendations for high yield, disease resistance, growing range and nutritional attributes.	<i>Achievement date:</i> June, 2010
<b>Milestone 1.1.4</b> At least three cereal cultivars available that have been selected for pig feed with associated recommendations for high yield, disease resistance, growing range and nutritional attributes.	<i>Achievement date:</i> June, 2012
<b>Output 1.2</b> Publication of practical guidelines for the production and supply chain arrangements for new and existing legume cultivars for the pig industry.  <i>Delivery targets:</i> Improved varieties of legume cultivars available. Agronomic practices suited to effecting yield and feed quality improvements.	<i>Delivery date:</i> June, 2012
<b>Milestone 1.2.1</b> Legume cultivars available that have been selected for pig feed and have associated recommendations for high yield.	<i>Achievement date:</i> December, 2007
<b>Milestone 1.2.2</b> Supply chains established for new and existing legume cultivars used for pig feed.	<i>Achievement date:</i> December, 2012
<b>Output 1.3</b> Enhanced and updated near infra-red spectroscopy (NIRS) calibrations for predicting the nutritional quality of feed ingredients for pigs.  <i>Delivery targets:</i> Initial NIRS calibrations for pig ileal digestible energy, faecal digestible energy, intake of available energy, chemical and physical characteristics of feed ingredients completed by June 2009 with annual updates including additional grains (particularly weather damaged) completed by June 2012.	<i>Delivery Date:</i> June, 2012
<b>Milestone 1.3.1</b> Commercial availability of NIRS calibrations for measuring the nutritional quality of cereal grains.	<i>Achievement date:</i> June, 2006
<b>Milestone 1.3.2</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2007
<b>Milestone 1.3.3</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2008
<b>Milestone 1.3.4</b> Updated NIRS calibrations for	<i>Achievement date:</i> January, 2009

reactive lysine.	
<b>Milestone 1.3.5</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2009
<b>Milestone 1.3.6</b> NIRS calibrations developed for measuring the quality of protein rich pig feed ingredients.	<i>Achievement date:</i> June, 2009
<b>Milestone 1.3.7</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2010
<b>Milestone 1.3.8</b> Updated NIRS calibrations including results from an additional 15-30 protein rich ingredients.	<i>Achievement date:</i> June, 2010
<b>Milestone 1.3.9</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2011
<b>Milestone 1.3.10</b> Updated NIRS calibrations including results from an additional 15-30 protein rich ingredients.	<i>Achievement date:</i> June, 2011
<b>Milestone 1.3.11</b> Updated NIRS calibrations including results from an additional 15-30 cereal grains.	<i>Achievement date:</i> June, 2012
<b>Milestone 1.3.12</b> Updated NIRS calibrations including results from an additional 15-30 protein rich ingredients.	<i>Achievement date:</i> June, 2012
<b>Output 1.4</b> Novel methods for improving the utilisation of feed ingredients by pigs.  <i>Delivery targets:</i> Novel or improved methods of processing feed Ingredients to increase economically their nutritional value for pigs from June 2008 to June 2012.	<i>Delivery date:</i> June, 2012
<b>Milestone 1.4.1</b> Novel or improved methods or intervention strategies for improving the utilisation of cereal grains by pigs.	<i>Achievement date:</i> June, 2008
<b>Milestone 1.4.2</b> Scale up of new processing technology by industry and delivery of cereal grains with increased nutritional quality.	<i>Achievement date:</i> June, 2012
<b>Milestone 1.4.3</b> Enhanced processing techniques for heat treated protein sources used in pig feeds.	<i>Achievement date:</i> June, 2012
<b>Output 1.5</b> Identification of novel feed ingredients.  <i>Delivery targets:</i> New range of feed ingredients for the pig industry by June 2010.	<i>Delivery date:</i> June, 2010
<b>Milestone 1.5.1</b> At least one novel feed ingredient identified for use in pig diets.	<i>Achievement date:</i> June, 2006
<b>Milestone 1.5.2</b> At least two novel feed ingredients identified for use in pig diets.	<i>Achievement date:</i> June, 2007
<b>Milestone 1.5.3</b> At least three novel feed ingredients identified for use in pig diets.	<i>Achievement date:</i> June, 2008
<b>Milestone 1.5.4</b> At least four novel feed ingredients identified for use in pig diets.	<i>Achievement date:</i> June, 2009
<b>Milestone 1.5.5</b> At least five novel feed ingredients identified for use in pig diets.	<i>Achievement date:</i> June, 2010

<b>CRC Outcome 2</b> <b>Reduced production costs for high quality pork, through improved herd feed conversion efficiency.</b>	
<b>Output 2.1</b> Method for the practical and continuous measurement of feed disappearance in groups (i.e. a pen of pigs at least daily).  <i>Delivery targets:</i> A demonstration model will be available by December 2007 and commercially available by June 2009.	<i>Delivery date:</i> January, 2009
<b>Milestone 2.1.1</b> Demonstration equipment available for measuring feed disappearance	<i>Achievement date:</i> December, 2007
<b>Milestone 2.1.2</b> Equipment for measuring feed disappearance commercially available	<i>Achievement date:</i> June, 2009
<b>Output 2.2</b> Method for the practical and continuous measurement of feed wastage in groups.  <i>Delivery targets:</i> Technology development completed by July 2007, with commercial package available to industry by the end of 2010.	<i>Delivery date:</i> December, 2010
<b>Milestone 2.2.1</b> Technology developed for the measurement of feed wastage	<i>Achievement date:</i> July, 2007
<b>Milestone 2.2.2</b> Techniques/technologies for measuring feed wastage available for commercial use.	<i>Achievement date:</i> December, 2010
<b>Output 2.3</b> Novel methods for the measurement of individual feed intake within a group.  <i>Delivery targets:</i> Systems will be available by December 2007, and the correlation with measurement of individual feed intake will be completed by December 2009.	<i>Delivery date:</i> December, 2009
<b>Milestone 2.3.1</b> Electronic identification and feeding systems suitable for use in the pig industry commercially available.	<i>Achievement date:</i> December, 2009
<b>Milestone 2.3.2</b> Alternate or new technologies for measurement of individual feed intake identified.	<i>Achievement date:</i> December, 2009
<b>Outputs 2.4</b> Prediction of animal performance through commercial application of "precision farming" techniques.  <i>Delivery targets:</i> Technology for integration of collected data available by December 2007, with established relationships between precision farming outputs and animal performance and appropriate monitoring software available by December 2010.	<i>Delivery date:</i> December, 2010
<b>Milestone 2.4.1</b> Technology capable of integrating collected environmental and animal data available for commercial use on farm.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.4.2</b> Established relationships between integrated collected data and animal status and performance (eg.health status,	<i>Achievement date:</i> July, 2008

growth rate) available for testing on a pilot scale.	
<b>Milestone 2.4.3</b> Commercial software package available for real-time monitoring of precision farming outputs and animal performance.	<i>Achievement date:</i> December, 2010
<b>Output 2.5</b> Strategies for achieving higher levels of feed intake in the post-weaning period.  <i>Delivery targets:</i> Demonstrate an increase in feed intake after weaning of 5-10% by 2011.	<i>Delivery date:</i> December, 2011
<b>Milestone 2.5.1</b> Dietary recommendations that allow for an increased feed intake after weaning.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.5.2</b> Recommendations and guidelines for liquid feeding of weaner pigs.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.5.3</b> Commercialisation of novel techniques and products to increase post weaning intake.	<i>Achievement date:</i> December, 2009
<b>Milestone 2.5.4</b> Commercialisation of alternatives to growth promotants.	<i>Achievement date:</i> December, 2012
<b>Output 2.6</b> Manipulation of grower pig intake.  <i>Delivery targets:</i> Demonstrate control of feed intake in the grower period of + or -, 5 to 10 percent.	<i>Delivery date:</i> December, 2010
<b>Milestone 2.6.1</b> Novel feed additives that elicit up to a 10 percent change in feed intake.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.6.2</b> Alternate dietary formulation strategies that elicit up to a 10 percent change in feed intake.	<i>Achievement date:</i> June, 2010
<b>Output 2.7 Control and</b> eradication strategies for production and welfare-limiting pig diseases.  <i>Delivery targets:</i> Development of effective control and/or eradication programs by year 2009.	<i>Delivery date:</i> December, 2009
<b>Milestone 2.7.1</b> Commercially effective control or eradication systems for Australian conditions.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.7.2</b> Publications on effective strategies.	<i>Achievement date:</i> June, 2011
<b>Output 2.8</b> Pigs selected for disease resistance.  <i>Delivery targets:</i> Commercial genotypes of pigs with selected disease resistance available to all Australian producers by 2012.	<i>Delivery date:</i> June, 2012
<b>Milestone 2.8.1</b> Novel quantitative traits and/or QTL's for immune competence.	<i>Achievement date:</i> June, 2011
<b>Output 2.9</b> Identified 'maternal factors' that improve growth and reduce mortality in gilt progeny.  <i>Delivery targets:</i> Identified traits of sows that can be applied to gilt management by 2010.	<i>Delivery date:</i> June, 2011
<b>Milestone 2.9.1</b> Dissemination of intervention studies to boost gilt progeny performance.	<i>Achievement date:</i> June, 2011

<p><b>Output 2.10</b> Control methods for respiratory and enteric disease.</p> <p><i>Delivery targets:</i> Alternative methods to control respiratory and enteric disease in pigs.</p>	<p><i>Delivery date:</i> June, 2012</p>
<p><b>Milestone 2.10.1</b> New methods for vaccine delivery.</p>	<p><i>Achievement date:</i> June, 2009</p>
<p><b>Milestone 2.10.2</b> Natural immunotherapeutics for control of disease in pigs.</p>	<p><i>Achievement date:</i> June, 2010</p>
<p><b>Milestone 2.10.3</b> License of potential immunotherapeutics.</p>	<p><i>Achievement date:</i> June, 2012</p>
<p><b>Output 2.11</b> Improved growth and feed efficiency through manipulation of hormonal pathways.</p> <p><i>Delivery targets:</i> A 15% Improvement in Food Conversion Ratio via manipulation of endogenous and exogenous hormones.</p>	<p><i>Delivery date:</i> December, 2011</p>
<p><b>Milestone 2.11.1</b> New delivery methods for exogenous growth hormones.</p>	<p><i>Achievement date:</i> June, 2011</p>
<p><b>Milestone 2.11.2</b> Novel nutritional techniques for the manipulation of the growth hormone axis.</p>	<p><i>Achievement date:</i> June, 2012</p>
<p><b>Output 2.12</b> Reproductive tools to commercially enhance production.</p> <p><i>Delivery targets:</i> New methods for the transfer of genetic material from 2009.</p>	<p><i>Delivery date:</i> June, 2012</p>
<p><b>Milestone 2.12.1</b> Refinement of embryo freezing techniques and available to the industry.</p>	<p><i>Achievement date:</i> June, 2009</p>
<p><b>Milestone 2.12.2</b> Commercial application of cloning techniques.</p>	<p><i>Achievement date:</i> June, 2012</p>
<p><b>Output 2.13</b> Strategies to maximise lifetime reproductive performance of the gilt and sow.</p> <p><i>Delivery targets:</i> Decrease in sow turnover rates from 2009 and increase sow productivity from 2011.</p>	<p><i>Delivery date:</i> June, 2011</p>
<p><b>Milestone 2.13.1</b> New industry reproduction manual to incorporate strategy for gilt breeding developed.</p>	<p><i>Achievement date:</i> June, 2009</p>
<p><b>Milestone 2.13.2</b> New industry reproduction manual to incorporate strategy for sow culling rate.</p>	<p><i>Achievement date:</i> June, 2011</p>
<p><b>Output 2.14</b> New genetic lines with superior reproductive performance.</p> <p><i>Delivery targets:</i> Superior maternal lines available to industry by June 2011.</p>	<p><i>Delivery date:</i> June, 2011</p>
<p><b>Milestone 2.14.1</b> Novel quantitative traits and/or QTL's for reproductive performance.</p>	<p><i>Achievement date:</i> June, 2010</p>
<p><b>Milestone 2.14.2</b> Commercialisation of novel quantitative traits and QTL's.</p>	<p><i>Achievement date:</i> June, 2011</p>
<p><b>Output 2.15</b> Identification of mechanisms involved with seasonal components of sow infertility.</p>	<p><i>Delivery date:</i> June, 2011</p>

<i>Delivery targets:</i> Reduced seasonal variation in reproductive performance by 2011.	
<b>Milestone 2.15.1</b> Commercialisation of novel products and strategies to overcome seasonal affects.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.15.2</b> New mating techniques to overcome sow infertility.	<i>Achievement date:</i> June, 2011

<b>CRC Outcome 3</b> <b>Increased demand for high quality, niche Australian pork products as a result of an enhanced capacity to deliver nutrients that promote the health and well-being of consumers via consumption of pork and pork products.</b>	
<b>Output 3.1</b> The “natural” human health advantages of pork will be established and verified, and the information used in the marketing of fresh pork.  <i>Delivery Targets</i> The natural health attributes of pork will become part of the marketing strategies for fresh pork and acceptance by consumers verified by consumer surveys and changes in the sale of fresh pork.	<i>Delivery date:</i> June, 2012
<b>Milestone 3.1.1.</b> The effects of pork on cardiometabolic health and weight loss introduced to the market place.	<i>Achievement date:</i> June, 2010
<b>Milestone 3.1.2</b> Establish and promote the advantages of pork in relation to its high thiamine level to human health with special emphasis on type 2 diabetics.	<i>Achievement date:</i> December, 2009
<b>Milestone 3.1.3</b> Establish and promote the effects of lean pork on satiety and weight control.	<i>Achievement date:</i> June, 2009
<b>Milestone 3.1.4</b> Establish and promote the role of pork in enhancing the iron status of humans with special emphasis on young women.	<i>Achievement date:</i> June 2009
<b>Output 3.2</b> Feed formulations and feeding protocols for cost-effective production of a range of consumer preferred trace mineral enriched fresh pork products.  <i>Delivery Targets:</i> Demonstration of bioavailability and bio-efficacy of trace mineral enriched pork products produced using cost effective trace mineral enrichment with organic dietary trace minerals by December 2010.	<i>Delivery date:</i> December, 2010
<b>Milestone 3.2.1</b> Delivery of selenium enriched fresh pork products	<i>Achievement date:</i> June, 2009
<b>Milestone 3.2.2</b> Demonstration of anticarcinogenic protective effects of pork bound selenium in a colon cancer model in the rat	<i>Achievement date:</i> December, 2009
<b>Milestone 3.2.3</b> Demonstration of	<i>Achievement date:</i> December, 2010

anticarcinogenic protective effects of pork bound selenium in humans	
<b>Milestone 3.2.4</b> Marketing of iron enriched pork as a source of iron in the human	<i>Achievement date:</i> December, 2010
<b>Milestone 3.2.5</b> Marketing of zinc enriched pork as a source of zinc in the human	<i>Achievement date:</i> December, 2010
<b>Output 3.3</b> Development and refinement of feed formulations and feeding protocols for cost-effective production of a range of consumer preferred fresh pork products containing fat soluble bioactives.  <i>Delivery Targets:</i> Demonstration of bioavailability and bioefficacy of a number of fat soluble bioactives in pork and pork offal and development of enriched pork products produced using cost-effective dietary enrichment by June 2012.	<i>Delivery date:</i> June, 2012
<b>Milestone 3.3.1</b> Demonstration of most cost-effective feeding regime to produce tender cholesterol modified pork	<i>Achievement date:</i> December, 2009
<b>Milestone 3.3.2</b> Define a cost-effective feeding regime to maximise health active components in intramuscular fat in pork.	<i>Achievement date:</i> June, 2011

<b>CRC Outcome: ALL</b>		
<b>Output 4.7</b> Convene combined national research conferences in partnership with the Pan Pacific Pork Expo and the Australasian Pig Science Association.  <i>Delivery Targets:</i> Effective communication of Pork CRC outcomes.	<i>Delivery date:</i> December 2005 onwards	<i>Relevant research programme:</i> 4
<b>Milestone 4.7.1</b> Satellite meeting convened in conjunction with the 2005 APSA biennial conference	<i>Achievement date:</i> December, 2005	
<b>Milestone 4.7.2</b> Concurrent technical session convened in association with the 2006 Pan Pacific Pork Expo.	<i>Achievement date:</i> May, 2006	
<b>Milestone 4.7.3</b> Concurrent conference convened with APSA.	<i>Achievement date:</i> December, 2007	
<b>Milestone 4.7.4</b> Concurrent conference convened with APSA.	<i>Achievement date:</i> December, 2009	
<b>Milestone 4.7.5</b> Concurrent conference convened with APSA.	<i>Achievement date:</i> December, 2011	

## 1.4 Research Programmes

### 1.4.1 Overall Programme Structure

#### ***Programme 1: Securing more reliable and consistent supplies of protein and energy for pig diets***

Securing more reliable and consistent protein and energy supplies for pig diets via innovative grain and pulse production, quality assessment and co-product utilisation will result in a) reduced variation in the annual cost of pig feed, b) reduced total cost of pig feed, c) a wider range of feed ingredients available to more producers, and d) a closer match of diet

specifications to pig requirements. The program leader will be Dr Mike Taverner and the program will comprise 3 subprograms including:

*Subprogram 1a:* Innovative grain production for the pig industry.

*Subprogram Leader:* Dr Mike Taverner (fully funded Program Consultant to the CRC)

*Key deliverables:* Commercial quantities of cereals (triticale and barley) and pulses (peas and lupins) that grow close to pig-producing regions, and that have a high yield, cost-effective agronomy and acceptable nutritional characteristics for pigs.

*Subprogram 1b:* Quality assessment of feed ingredients

*Subprogram Leader:* Professor John Black (fully funded Program Consultant to the CRC).

*Key deliverables:* a) Adoption, implementation, enhancement and maintenance of near infrared spectroscopy (NIRS) calibrations for measurement of the nutritional quality of cereals for pigs; b) rapid and objective analytical methods for the measurement of nutritional quality in pig feed ingredients (other than cereals); and c) processing methods to increase the nutrient yield from target grains (eg enzyme applications).

*Subprogram 1c:* Identification and characterisation of a wider range of available feed ingredients for the pig industry.

*Subprogram Leader:* Mr Andrew Philpotts (QAF Meat Industries)

*Key deliverables:* a) Identified potential for production of non-traditional or alternative protein and energy sources for pigs within existing grain production systems across Australia; b) assessment of the nutritional potential of novel protein and energy sources; and c) production and delivery of non-traditional and alternative protein and energy sources for the pig industry.

## ***Programme 2: Improving herd feed conversion efficiency***

Improving herd feed conversion efficiency will optimise production efficiency through improved health, metabolic efficiency and reproductive capacity and will result in a) the capacity to routinely and accurately measure feed intake in individual animals and groups; b) products and management strategies that allow manipulation of feed intake/feeding efficiency in pigs; c) reduced reliance on antibiotics in production systems; d) cost-effective nutritional and/or prophylactic treatments for the prevention of disease; e) products and/or strategies to improve production efficiency; f) reduction in sow culling rates; and g) reduced overall costs of production through improved pigs/sow/year, reduced sow turnover, and more efficient reproductive performance. The program leader will be Professor Frank Dunshea and the program will comprise 5 subprograms including:

*Subprogram 2a:* Innovative products and strategies for the measurement of feed intake.

*Subprogram Leader:* Dr Bruce Mullan, Department of Agriculture, WA.

*Key deliverables:* a) A method for the practical and continuous measurement of feed disappearance to pigs in groups; b) a method for the practical and continuous measurement of feed wastage in groups; c) novel methods for the measurement of actual feed consumed by individuals within a group; and d) prediction of disease onset through the application of feed intake measurements. The research strategy addresses measurements in order of complexity. Feed disappearance is gross use of feed and does not account for waste or individual variation, feed wastage coupled with feed disappearance does not account for individual variation, and actual feed intake is difficult to measure without individual animal intervention. In commercial production, even feed disappearance is rarely measured in real time (except in liquid feeding systems) and it is far too insensitive a measure to predict the onset of disease.

*Subprogram 2b:* Innovative products and strategies for the manipulation of feed intake.

*Subprogram Leader:* Associate Professor John Pluske, Murdoch University.

*Key deliverables:* a) Novel molecules and feed ingredients (eg grains, plant extracts, inherent plant compounds) that can be used to stimulate or suppress feed intake in pigs; b) elimination of post-weaning growth checks and the promotion of gut development through stimulation of feed

intake; c) improved carcase quality through manipulation of feed intake in growing pigs; and d) identified gene markers, quantitative trait loci and genetic receptors for feed intake.

*Subprogram 2c:* Alternative therapies, products and/or strategies to improve pig production efficiency and reduce mortality of all growth phases.

*Subprogram Leader:* Dr William Hall, Australian Pork Ltd.

*Key deliverables:* a) Nutritional, genetic, immunological and management solutions for the control and/or reduction of disease and mortality in pigs as an adjunct or alternative to existing medication programs in all growth phases; b) development of nutritional strategies and further improvement of metabolic modifiers and their mode of application (eg ractopamine, porcine somatotropin) to improve lean tissue deposition.

*Subprogram 2d:* Extend and enhance the productive life of the breeding female through novel management and system design.

*Subprogram Leader:* Mr Rob Smits, QAF Meat Industries Pty Ltd.

*Key deliverables:* a) Nutritional, genetic and management strategies to improve the productive capacity of the gilt over her lifetime, and b) intervention strategies to reduce seasonal infertility.

*Subprogram 2e:* Advanced reproductive technologies.

*Subprogram Leader:* Associate Professor Mark Nottle, University of Adelaide

*Key deliverables:* a) Novel genetic and reproductive tools and technologies to enhance production efficiency including cloning and semen sexing, and b) a practical system for the prediction of the time of ovulation.

### ***Programme 3: Enhancing capacity to deliver nutrients that promote health and well-being through pork***

Enhancing capacity to deliver nutrients that promote health and well-being through pork will enhance the value and versatility of pork products resulting in a) an increased range of viable pork products and market opportunities for the Australian industry; and b) demonstrated benefits from consumption of pork products by consumers. The program leader will be Mr David Henman (QAF Meat Industries Pty Ltd):

*Key deliverables:* a) Fresh pork products desired by consumers which can provide a significant proportion of the daily omega-3 fatty acid requirements of consumers, b) fresh pork products ready for retail with specific nutritional attributes relative to the daily requirements of consumers (eg selenium, iron, bioactives), and c) assessment of these fortified pork and conventional pork products for health claims using accepted models.

### ***Programme linkages***

Wherever possible the Pork CRC Ltd programmes will be linked. Many of the perceived outcomes from one Programme are relevant to another and to ensure finances and resources are used as effectively as possible, Programme linkages are essential. For example, the programs designed to develop new feed grains and enhance nutrient availability are very complimentary and findings from either would be expected to contribute positively to the other. Novel findings from research in these areas and in particular the identification of grains and/or components of grains which affect feed intake will be utilized in Programme 2 and contribute to the outcomes listed under 2.4. In a similar manner and for the same reasons post graduate students will be encouraged to complete part of their work within the facilities of one or more of the commercial participants. The latter will allow postgraduate and other students/trainees to better understand the bottom line effects of their research and the difficulties often experienced in implementing academic findings in commercial situations.

The R&D Subcommittee comprising Board representatives, industry experts and program managers will review all proposals and projects and link those where there are obvious advantages to be gained from a cooperative and integrated approach to research and technology development.

#### 1.4.2 Programme Description and Specified Personnel

<b>Research Programme 1: Securing more reliable and consistent supplies of protein and energy for pig diets</b>	
<b>Specified Personnel - Programme Leader</b>	<b>Time Commitment (/annum)</b>
Michael Taverner	0.1
John Black	0.1
Andrew Philpotts	0.1
<b>Specified Personnel - Key Researchers</b>	<b>Time Commitment (/annum)</b>
Glen Fox	0.1
Robert van Barneveld	0.1
Mike Gidley	0.2
Peter Sharp	0.1
<b>Private Sector Participants</b>	
Alltech Biotechnology Pty Ltd	
Australian Pork Farms Group	
Australian Pork Ltd	
Betterblend Stockfeeds Pty Ltd	
Elanco Animal Health	
Feedworks Pty Ltd (representing Danisco International, Diamond V and Quadlitech	
Grains Research and Development Corporation	
Grainsearch Pty Ltd	
Kemin Industries (Asia) Pte Limited	
New Zealand Pork Industry Board	
QAF Meat Industries Pty Ltd	
Ridley Agriproducts Pty Ltd	
The CHM Alliance	
WA Agriculture Produce Commission Pork Producers Committee	
<b>Description:</b> Securing more reliable and consistent protein and energy supplies for pig diets via innovative grain and pulse production, quality assessment and co-product utilisation will result in a) reduced variation in the annual cost of pig feed, b) reduced total cost of pig feed, c) a wider range of feed ingredients available to more producers, and d) a closer match of diet specifications to pig requirements.	
<b>Outputs</b>	
1.1 ,1.2 ,1.3, 1.4, 1.5	

<b>Research Programme 2: Improving herd feed conversion efficiency</b>	
<b>Specified Personnel - Programme Leader</b>	<b>Time Commitment (/annum)</b>
Frank Dunshea	0.2
Bruce Mullan	0.5
John Pluske	0.3
William Hall	0.1
Robert Smits	0.1
Mark Nottle	0.8
<b>Specified Personnel - Key Researchers</b>	<b>Time Commitment (/annum)</b>
David Hampson	0.2
David Pethwick	0.1
David Henman	0.1
Brain Luxford	0.1
Christopher Moran	0.4
<b>Private Sector Participants</b>	
Alltech Biotechnology Pty Ltd	
Australian Pork Farms Group	
Australian Pork Ltd	
Elanco Animal Health Pty Ltd	
Feedworks Pty Ltd (representing Danisco International, Diamond V and Qualitech)	
Kemin Industries (Asia) Pte Limited	
New Zealand Pork Industry Board	
QAF Meat Industries Pty Ltd	
Ridley Agriproducts Pty Ltd	
The CHM Alliance	
WA Agriculture Produce Commission Pork Producers Committee	
<b>Description:</b> Improving herd feed conversion efficiency will optimise production efficiency through improved health, metabolic efficiency and reproductive capacity and will result in a) the capacity to routinely and accurately measure feed intake in individual animals and groups; b) products and management strategies that allow manipulation of feed intake/feeding efficiency in pigs; c) reduced reliance on antibiotics in production systems; d) cost-effective nutritional and/or prophylactic treatments for the prevention of disease; e) products and/or strategies to improve production efficiency; f) reduction in sow culling rates; and g) reduced overall costs of production through improved pigs/sow/year, reduced sow turnover, and more efficient reproductive performance.	
<b>Outputs</b>	
2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15, 2.16	

<b>Research Programme 3: Enhancing capacity to deliver nutrients that promote health and well-being through pork</b>	
<b>Specified Personnel - Programme Leader</b> David Henman	<b>Time Commitment (/annum)</b> 0.2
<b>Specified Personnel - Key Researchers</b> Ewa Ostrowska	<b>Time Commitment (/annum)</b> 0.2
<b>Private Sector Participants</b> Alltech Biotechnology Pty Ltd Australian Pork Farms Group Australian Pork Limited Bartlett Grains Pty Ltd Elanco Animal Health Pty Ltd Kemin Industries (Asia) Pte Limited New Zealand Pork Industry Board QAF Meat Industries Pty Ltd Ridley Agriproducts Pty Ltd The CHM Alliance WA Agricultural Produce Commission Pork Producers Committee	
<b>Description:</b> Enhancing capacity to deliver nutrients that promote health and well-being through pork will enhance the value and versatility of pork products resulting in a) an increased range of viable pork products and market opportunities for the Australian industry; and b) demonstrated benefits from consumption of pork products by consumers.	
<b>Outputs</b> 3.1, 3.2, 3.3, 3.4	

#### 1.4.3 Outcomes, Outputs and Milestones

<b>CRC Outcome 1: Reduced production costs for high quality pork through more reliable and consistent protein and energy supplies via innovative grain production, co-product utilisation and quality assessment.</b>		
<b>Output 1.1</b> New and adapted cereal varieties with outstanding yield, excellent disease resistance, wide adaptation and improved feed quality characteristics.  <i>Delivery targets</i> – 3-5 cereal cultivars with favourable yield, disease resistance, growing range and nutritional attributes for pigs available from 2008.	<i>Delivery date:</i> June, 2012	<i>Related research programme:</i>  1
<b>Milestone 1.1.1</b> Triticale breeding program focussing on rust resistance, yield and extended growing environments incorporating existing cultivars to produce between one and three new commercially available cultivars for the Australian pork industry.	<i>Achievement date:</i> June, 2012	
<b>Milestone 1.1.2</b> Barley breeding program focussing on yield, nutritional contributions, disease resistance and extended growing environments to produce between one and three new commercially available cultivars for the Australian pork industry.	<i>Achievement date:</i> June, 2012	
<b>Milestone 1.1.3</b> Feed wheat breeding program focussing on yield, nutritional contributions, disease resistance and extended growing environments using existing cultivars to produce between one and three new commercially available cultivars for the Australian pork industry.	<i>Achievement date:</i> June, 2012	
<b>Milestone 1.1.4</b> Agronomic information on production	<i>Achievement date:</i> June, 2012	

areas, crop planting times and husbandry of existing and new triticals, barleys and wheats.		
<p><b>Output 1.2</b> Extended access to legumes as proteins for use in pig diets.</p> <p><i>Delivery targets:</i> Improved varieties of legume cultivars available. Agronomic practices suited to effecting yield and feed quality improvements.</p>	<p><i>Delivery date:</i> June, 2012</p>	<p><i>Related research programme:</i>  1</p>
<p><b>Milestone 1.2.1</b> Initial agronomic trials of existing and potential pea lines on at least 3 sites in the north.</p>	<p><i>Achievement date:</i> December, 2007</p>	
<p><b>Milestone 1.2.2</b> Updated agronomic trials of existing and potential pea lines on at least 3 sites in the north.</p>	<p><i>Achievement date:</i> December, 2011.</p>	
<p><b>Milestone 1.2.3</b> Initial crossing, selection and seed increases of peas, and evaluation of pearl lupins.</p>	<p><i>Achievement date:</i> December, 2007.</p>	
<p><b>Milestone 1.2.4</b> Annual crossing, selection and seed increases of peas, and pearl lupins</p>	<p><i>Achievement date:</i> December, 2011.</p>	
<p><b>Output 1.3</b> Enhanced and updated near infra-red spectroscopy (NIRS) calibrations for predicting the nutritional quality of feed ingredients for pigs.</p> <p><i>Delivery targets:</i> Initial NIRS calibrations for pig ileal digestible energy, faecal digestible energy, intake of available energy, chemical and physical characteristics of feed ingredients completed by June 2009 with annual updates including additional grains (particularly weather damaged) completed to June 2012.</p>	<p><i>Delivery date:</i> June, 2012</p>	<p><i>Related research programme:</i>  1</p>
<p><b>Milestone 1.3.1</b> High protein sources treated and reactive lysine measured in several hundred canola samples</p>	<p><i>Achievement date:</i> June, 2007</p>	
<p><b>Milestone 1.3.2</b> NIR calibration developed for measuring reactive lysine in canola meal</p>	<p><i>Achievement date:</i> June, 2007</p>	
<p><b>Milestone 1.3.3</b> Voluntary intake and digestibility by pigs and chemical/physical composition determined for at least 200 grains.</p>	<p><i>Achievement date:</i> June, 2012</p>	
<p><b>Milestone 1.3.4</b> Near infrared spectroscopy (NIRS) calibrations for cereal grains developed and updated using measurements on at least 200 grains.</p>	<p><i>Achievement date:</i> June, 2012</p>	
<p><b>Milestone 1.3.5</b> Digestibility and chemical/physical analyses completed for at least 100 high protein feed ingredients.</p>	<p><i>Achievement date:</i> June, 2012</p>	
<p><b>Milestone 1.3.6</b> NIRS calibrations for measurements for protein feed ingredients developed and upgraded using information from at least 100 grains</p>	<p><i>Achievement date:</i> June, 2012</p>	
<p><b>Output 1.4</b> Novel methods for improving the utilisation of feed ingredients by pigs.</p> <p><i>Delivery targets:</i> Novel or improved methods of processing feed ingredients to increase economically their nutritional value for pigs from June 2008 to June 2012.</p>	<p><i>Delivery date:</i> June, 2012</p>	<p><i>Related research programme:</i>  1</p>
<p><b>Milestone 1.4.1</b> Novel or improved processing techniques that enhance economically the nutritional quality of cereal grains for pigs</p>	<p><i>Achievement date:</i> December, 2008</p>	
<p><b>Milestone 1.4.2</b> Investigate alternative processing</p>	<p><i>Achievement date:</i> December,</p>	

technique for oil extraction of canola seeds to increase the bioavailability of lysine	2008	
<b>Milestone 1.4.3</b> Experiments evaluating the effects of enzyme treatment of sorghum on starch digestibility by pigs completed	<i>Achievement date:</i> December, 2008	
<b>Milestone 1.4.4</b> Scale up of new processing technology by industry and delivery of cereal grains with increased nutritional quality	<i>Achievement date:</i> June, 2012	
<b>Milestone 1.4.5</b> Investigate processing techniques that increase the bioavailability of lysine for a range of heat treated protein sources used in pig feeds	<i>Achievement date:</i> June, 2012	
<b>Output 1.5</b> Identification of novel feed ingredients. <i>Delivery targets:</i> New range of feed ingredients for the pig industry by June 2010.	<i>Delivery date:</i> June, 2010	<i>Related research programme:</i>  1
<b>Milestone 1.5.1</b> Workshop of pig nutritionists, food and agricultural technology industry members and associated engineers identifies potential co-products	<i>Achievement date:</i> December, 2005	
<b>Milestone 1.5.2</b> Potential co-products/composite 'designer blends' reviewed for feasibility of production, delivery and cost competitiveness by subgroup from workshop	<i>Achievement date:</i> December, 2005	
<b>Milestone 1.5.3</b> Research quantities of 12 priority target grains grown, harvested, processed and stored for further pig assessment and research	<i>Achievement date:</i> December, 2008	
<b>Milestone 1.5.4</b> Co-products assessed for their nutritional suitability as pig feed using digestibility and availability techniques.	<i>Achievement date:</i> June, 2012	

<b>CRC Outcome 2</b> <b>Reduced production costs for high quality pork, through improved herd feed conversion efficiency.</b>	
<b>Output 2.1</b> Method for the practical and continuous measurement of feed disappearance in groups (i.e. a pen of pigs at least daily).  <i>Delivery targets:</i> A demonstration model will be available by December 2007 and commercially available by January 2009.	<i>Delivery date:</i> January, 2009
<b>Milestone 2.1.1</b> Demonstration equipment available for measuring feed disappearance	<i>Achievement date:</i> December, 2007
<b>Milestone 2.1.2</b> Equipment for measuring feed disappearance commercially available	<i>Achievement date:</i> January, 2009
<b>Output 2.2</b> Method for the practical and continuous measurement of feed wastage in groups.  <i>Delivery targets:</i> Technology development completed by July 2007, with commercial package available to industry by the end of 2010.	<i>Delivery date:</i> December, 2010
<b>Milestone 2.2.1</b> Technology developed for the	<i>Achievement date:</i> July, 2007

measurement of feed wastage	
<b>Milestone 2.2.2</b> Techniques for measuring feed wastage available for commercial use.	<i>Achievement date:</i> December, 2010
<b>Output 2.3</b> Novel methods for the measurement of individual feed intake within a group.  <i>Delivery targets:</i> Systems will be available by December 2007, and the correlation with measurement of individual feed intake will be completed by December 2009.	<i>Delivery date:</i> December, 2009
<b>Milestone 2.3.1</b> Electronic identification and feeding systems suitable for use in the pig industry commercially available.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.3.2</b> Alternate or new technologies for measurement of individual feed intake identified.	<i>Achievement date:</i> December, 2009
<b>Outputs 2.4</b> Prediction of animal performance through commercial application of “precision farming” techniques.  <i>Delivery targets:</i> Technology for integration of collected data available by December 2007, with established relationships between precision farming outputs and animal performance and appropriate monitoring software available by December 2010.	<i>Delivery date:</i> December, 2010
<b>Milestone 2.4.1</b> Technology capable of integrating collected environmental and animal data available for commercial use on farm.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.4.2</b> Established relationships between integrated collected data and animal status and performance (eg.health status, growth rate) available for testing on a pilot scale.	<i>Achievement date:</i> July, 2008
<b>Milestone 2.4.3</b> Commercial software package available for real-time monitoring of precision farming outputs and animal performance.	<i>Achievement date:</i> December, 2010
<b>Output 2.5</b> Strategies for achieving higher levels of feed intake in the post-weaning period.  <i>Delivery targets:</i> Demonstrate an increase in feed intake after weaning of 5-10% by 2011.	<i>Delivery date:</i> December, 2011
<b>Milestone 2.5.1</b> Dietary recommendations that allow for an increased feed intake after weaning.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.5.2</b> Recommendations and guidelines for liquid feeding of weaner pigs.	<i>Achievement date:</i> December, 2008
<b>Milestone 2.5.3</b> Commercialisation of novel techniques and products to increase post weaning intake.	<i>Achievement date:</i> December, 2009
<b>Milestone 2.5.4</b> Commercialisation of alternatives to growth promotants.	<i>Achievement date:</i> December, 2012
<b>Output 2.6</b> Manipulation of grower pig intake.  <i>Delivery targets:</i> Demonstrate control of feed intake in the grower period of + or –, 5 to 10	<i>Delivery date:</i> December, 2010

percent.	
<b>Milestone 2.6.1</b> Novel feed additives that elicit up to a 10 percent change in feed intake.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.6.2</b> Alternate dietary formulation strategies that elicit up to a 10 percent change in feed intake.	<i>Achievement date:</i> June, 2010
<b>Output 2.7 Control and/or</b> eradication strategies for production and welfare-limiting pig diseases.  <i>Delivery targets:</i> Development of effective control and/or eradication programs by year 2009.	<i>Delivery date:</i> December, 2009
<b>Milestone 2.7.1</b> Commercially effective control and eradication systems for Australian conditions.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.7.2</b> Publications on effective strategies.	<i>Achievement date:</i> June, 2011
<b>Output 2.8</b> Pigs selected for disease resistance.  <i>Delivery targets:</i> Commercial genotypes of pigs with selected disease resistance available to all Australian producers by 2012.	<i>Delivery date:</i> June, 2012
<b>Milestone 2.8.1</b> Novel quantitative traits and/or QTL's for immune competence.	<i>Achievement date:</i> June, 2011
<b>Output 2.9</b> Identified 'maternal factors' that improve growth and reduce mortality in gilt progeny.  <i>Delivery targets:</i> Identified traits of sows that can be applied to gilt management by 2010.	<i>Delivery date:</i> June, 2011
<b>Milestone 2.9.1</b> Dissemination of intervention studies to boost gilt progeny performance.	<i>Achievement date:</i> June, 2011
<b>Output 2.10</b> Control methods for respiratory and enteric disease.  <i>Delivery targets:</i> Alternative methods to control respiratory and enteric disease in pigs.	<i>Delivery date:</i> June, 2012
<b>Milestone 2.10.1</b> New methods for vaccine delivery.	<i>Achievement date:</i> June, 2009
<b>Milestone 2.10.2</b> Natural immunotherapeutics for control of disease in pigs.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.10.3</b> License of potential immunotherapeutics.	<i>Achievement date:</i> June, 2012
<b>Output 2.11</b> Improved growth and feed efficiency through manipulation of hormonal pathways.  <i>Delivery targets:</i> A 15% Improvement in Food Conversion Ratio via manipulation of endogenous and exogenous hormones.	<i>Delivery date:</i> December, 2011
<b>Milestone 2.11.1</b> New delivery methods for exogenous growth hormones.	<i>Achievement date:</i> June, 2011
<b>Milestone 2.11.2</b> Novel nutritional techniques for the manipulation of the growth hormone axis.	<i>Achievement date:</i> June, 2012
<b>Output 2.12</b> Reproductive tools to commercially enhance production.	<i>Delivery date:</i> June, 2012

<i>Delivery targets:</i> New methods for the transfer of genetic material from 2009.	
<b>Milestone 2.12.1</b> Commercialisation of embryo freezing techniques.	<i>Achievement date:</i> June, 2007
<b>Milestone 2.12.2</b> Commercial application of cloning techniques.	<i>Achievement date:</i> June, 2012
<b>Output 2.13</b> Strategies to maximise lifetime reproductive performance of the gilt and sow.  <i>Delivery targets:</i> Decrease in sow turnover rates from 2009 and increase sow productivity from 2011.	<i>Delivery date:</i> June, 2011
<b>Milestone 2.13.1</b> New industry reproduction manual to incorporate strategy for gilt breeding developed.	<i>Achievement date:</i> June, 2009
<b>Milestone 2.13.2</b> New industry reproduction manual to incorporate strategy for sow culling rate.	<i>Achievement date:</i> June, 2011
<b>Output 2.14</b> New genetic lines with superior reproductive performance.  <i>Delivery targets:</i> Superior maternal lines available to industry by June 2011.	<i>Delivery date:</i> June, 2011
<b>Milestone 2.14.1</b> Novel quantitative traits and/or QTL's for reproductive performance.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.14.2</b> Commercialisation of novel quantitative traits and QTL's.	<i>Achievement date:</i> June, 2011
<b>Output 2.15</b> Identification of mechanisms involved with seasonal components of sow infertility.  <i>Delivery targets:</i> Reduced seasonal variation in reproductive performance by 2011.	<i>Delivery date:</i> June, 2011
<b>Milestone 2.15.1</b> Commercialisation of novel products and strategies to overcome seasonal affects.	<i>Achievement date:</i> June, 2010
<b>Milestone 2.15.2</b> New mating techniques to overcome sow infertility.	<i>Achievement date:</i> June, 2011

<b>CRC Outcome 3: Increased demand for high quality, niche Australian pork products as a result of an enhanced capacity to deliver nutrients that promote the health and well-being of consumers via consumption of pork and pork products.</b>		
<b>Output 3.1</b> The natural attributes of pork which enhance human health will be identified and verified. <i>Delivery Targets:</i> The health advantages of pork will become part of the promotion of fresh pork by 2010.. Confirmation of consumer acceptance through to 2012.	<i>Delivery date:</i> June, 2012	<i>Related research programme:</i>  3
<b>Milestone 3.1.1</b> <i>Establish the cardiometabolic health effects of the low energy:protein ratio of pork</i>	<i>Achievement date:</i> June, 2009	
<b>Milestone 3.1.2</b> Confirmation of the high thiamine levels of Australian fresh pork and its advantages to type 2 diabetics.	<i>Achievement date:</i> June, 2009	

<b>Milestone 3.1.3</b> Establishment of the effects of pork on satiety and weight loss in humans.	<i>Achievement date:</i> June, 2009	
<b>Milestone 3.1.4 establishment of the effects of pork on the iron status of young women</b>	<i>Achievement date:</i> June 2009	
<b>Output 3.2</b> Feed formulations and feeding protocols for cost-effective production of a range of consumer preferred trace mineral enriched fresh pork products.  <i>Delivery Targets:</i> Demonstration of bioavailability and bio-efficacy of trace mineral enriched pork products produced using cost effective trace mineral enrichment with organic dietary trace minerals by December 2010.	<i>Delivery date:</i> December, 2010	<i>Related research programme:</i>  3
<b>Milestone 3.2.1</b> Development of selenium enriched fresh pork using dietary organic selenium.	<i>Achievement date:</i> June, 2009	
<b>Milestone 3.2.2</b> Demonstration of anticarcinogenic protective effects of pork bound selenium in a colon cancer model in the rat	<i>Achievement date:</i> December, 2008	
<b>Milestone 3.2.3</b> Development of iron enriched fresh pork products using dietary organic iron.	<i>Achievement date:</i> December, 2008	
<b>Milestone 3.2.4</b> Demonstration of anticarcinogenic protective effects of pork bound selenium in humans	<i>Achievement date:</i> December, 2010	
<b>Milestone 3.2.5</b> Demonstration of bioavailability of iron in pork relative to other meat and plant sources of iron in the human	<i>Achievement date:</i> December, 2009	
<b>Milestone 3.2.6</b> Demonstration of bioavailability of zinc in pork relative to other meat and plant sources of zinc in the human	<i>Achievement date:</i> December, 2009	
<b>Milestone 3.2.7</b> Development of zinc enriched fresh pork products using dietary organic iron.	<i>Achievement date:</i> September, 2010	
<b>Output 3.3</b> Development and refinement of feed formulations and feeding protocols for cost-effective production of a range of consumer preferred fresh pork products containing fat soluble bioactives.  <i>Delivery Targets:</i> Demonstration of bioavailability and bioefficacy of a number of fat soluble bioactives in pork and pork offal and development of enriched pork products produced using cost-effective dietary enrichment by June 2012.	<i>Delivery date:</i> June, 2012	<i>Related research programme:</i>  3
<b>Milestone 3.3.1</b> Improve intramuscular fatty acid and cholesterol content and improve tenderness using dietary lecithin	<i>Achievement date:</i> December, 2009	
<b>Milestone 3.3.2</b> Demonstration of most cost-effective feeding regime using dietary lecithin or other legume-derived compounds to produce tender cholesterol modified pork	<i>Achievement date:</i> December, 2009	
<b>Milestone 3.3.3</b> Define a cost-effective feeding regime to maximise health active components in intramuscular fat in pork.	<i>Achievement date:</i> June, 2011	

## 1.5 Education and Training Programme

### 1.5.1 Description and Specified Personnel

<b>Education and Training Programme</b>	
<b>Specified Personnel - Programme Leader</b>	<b>Time Commitment (/annum)</b>
Ian Johnsson	0.1
John Pluske	0.1
<b>Private Sector Participants</b>	
Alltech Biotechnology	
Australian Pork Farms Group	
Australian Pork Ltd	
Elanco Animal Health Pty Ltd	
Kemin Industries (Asia) Pte Limited	
New Zealand Pork Industry Board	
QAF Meat Industries Pty Ltd	
Ridley Agriproducts Pty Ltd	
The CHM Alliance	
WA Agriculture Produce Commission Pork Producers Committee	
<p><b>Description:</b> The Education and Training Programme has been tailored to deliver education and training consistent with specific characteristics of the Australian pork production sector. This program will build on the established infrastructure for education and technology transfer within the industry to develop the human resource capital necessary to sustain and further develop the pork industry. The major elements of the Pork CRC Education and Training Programme will involve formal training opportunities to attract new entrants to the industry and retain expertise and innovation. The key elements of the program include:</p> <p><b>Secondary schools</b> Development of relevant course material for agriculture and related subjects in secondary schools, via the National Centre for Pork Industry Training and Education using outputs from the Pork CRC.</p> <p><b>Tertiary undergraduates</b> Summer scholarships for near-final year students for work experience within companies (Undergraduate Industry Awards) or for research experience and/or honours projects on CRC research projects (Undergraduate Research Awards) and development of relevant course material for tertiary agricultural, rural and veterinary science courses, and related subjects, via the NCPITE incorporating Pork CRC outputs.</p> <p><b>Postgraduates</b> Development of an external coursework-based MSc program through the NCPITE, based on the modular structure of the Australian Rural Leadership Program, designed for both research and commercial career paths, PhD and co-funded industry-based MSc scholarship programs in the fields of pig nutrition, reproduction, genetics, and pork quality with intakes of three cohorts of 4–5 PhD and 1–2 industry MSc students (full scholarships + 'top-up' scholarships) in 2006, 2007 and 2008, and development of postdoctoral scholarships to increase retention rates of promising young scientists in the pig industry. Other areas will include professional refresher courses (typically 1–5 days) for pig veterinarians (supporting the new VetEd scheme for continuing education – currently voluntary), nutritionists and technical managers, exploring video-conferencing and distance learning options.</p> <p><b>Pig producers and employees</b> Short knowledge-development courses to support life-long learning (LLL) initiatives for managers to provide a structured 'ladder of learning' for industry participants, integrated with the secondary and tertiary education modules and capable of providing formal qualifications, if required. Alternative delivery methods, including web-based learning and weekend block</p>	

release packages, will be evaluated following feedback from producers.

### 1.5.2 Outcomes, Outputs and Milestones

<b>CRC Education and Training Outcome: Enhanced pork industry capacity through education and training.</b>		
<p><b>Output 4.1:</b> Successful completion of 12 PhD programs in fields of nutrition, reproduction, genetics and meat science.</p> <p><i>Delivery Targets:</i> 12 individuals with PhD qualifications relevant to the pork industry.</p>	<p><i>Delivery date:</i> June, 2011</p>	<p><i>Relevant research programme:</i> All</p>
<p><b>Milestone 4.1.1</b> 4 PhD scholarships awarded</p>	<p><i>Achievement date:</i> January, 2006</p>	
<p><b>Milestone 4.1.2</b> 4 PhD scholarships awarded</p>	<p><i>Achievement date:</i> January, 2007</p>	
<p><b>Milestone 4.1.3</b> 4 PhD scholarships awarded</p>	<p><i>Achievement date:</i> January, 2008</p>	
<p><b>Milestone 4.1.4</b> PhD programs 1-4 completed</p>	<p><i>Achievement date:</i> June, 2009</p>	
<p><b>Milestone 4.1.5</b> PhD programs 5-8 completed</p>	<p><i>Achievement date:</i> June, 2010</p>	
<p><b>Milestone 4.1.6</b> PhD programs 9-12 completed</p>	<p><i>Achievement date:</i> June, 2011</p>	
<p><b>Output 4.2</b> Successful completion of 3 post-doctoral research programs in field of nutrition, genetics and reproduction.</p> <p><i>Delivery targets:</i> Entry of 3 post-doctoral level professionals into the pork industry.</p>	<p><i>Delivery date:</i> December 2011</p>	<p><i>Relevant research programme:</i> All</p>
<p><b>Milestone 4.2.1</b> First Postdoctoral fellowship awarded</p>	<p><i>Achievement date:</i> January, 2006</p>	
<p><b>Milestone 4.2.2</b> Second Postdoctoral fellowship awarded</p>	<p><i>Achievement date:</i> January, 2007</p>	
<p><b>Milestone 4.2.3</b> Third Postdoctoral fellowship awarded</p>	<p><i>Achievement date:</i> January, 2008</p>	
<p><b>Milestone 4.2.4</b> First Postdoctoral fellowship completed</p>	<p><i>Achievement date:</i> December, 2009</p>	
<p><b>Milestone 4.2.5</b> Second Postdoctoral fellowship completed</p>	<p><i>Achievement date:</i> December, 2010</p>	
<p><b>Milestone 4.2.6</b> Third Postdoctoral fellowship completed</p>	<p><i>Achievement date:</i> December, 2011</p>	
<p><b>Output 4.3</b> Successful completion of 21 undergraduate summer/honours scholarship programs.</p> <p><i>Delivery Targets:</i> Entry of 21 undergraduate students into the pork industry as a result of involvement in this programme.</p>	<p><i>Delivery date:</i> February, 2012</p>	<p><i>Relevant research programme:</i> All</p>
<p><b>Milestone 4.3.1</b> 3 undergraduate summer/honours scholarships completed (1-3)</p>	<p><i>Achievement date:</i> February, 2006</p>	
<p><b>Milestone 4.3.2</b> 3 undergraduate summer/honours scholarships completed (4-6)</p>	<p><i>Achievement date:</i> February, 2007</p>	
<p><b>Milestone 4.3.3</b> 3 undergraduate summer/honours scholarships completed (7-9)</p>	<p><i>Achievement date:</i> February, 2008</p>	
<p><b>Milestone 4.3.4</b> 3 undergraduate summer/honours scholarships completed (10-</p>	<p><i>Achievement date:</i> February, 2009</p>	

12)		
<b>Milestone 4.3.5</b> 3 undergraduate summer/honours scholarships completed (13-15)	<i>Achievement date:</i> February, 2010	
<b>Milestone 4.3.6</b> 3 undergraduate summer/honours scholarships completed (15-18)	<i>Achievement date:</i> February, 2011	
<b>Milestone 4.3.7</b> 3 undergraduate summer/honours scholarships completed (19-21)	<i>Achievement date:</i> February, 2012	
<b>Output 4.4</b> Development, assessment and delivery via various means of life-long learning courses completed through the National Centre for Pig Industry Training and Education.  <i>Delivery Targets:</i> Improved capacity of pork industry staff and enhanced staff retention.	<i>Delivery date:</i> December, 2011	<i>Relevant research programme:</i> All
<b>Milestone 4.4.1</b> Development and assessment of LLL courses developed through the NCPITE.	<i>Achievement date:</i> June 2006	
<b>Milestone 4.4.2</b> Web-based version of all LLL courses completed and launched through the NCPITE.	<i>Achievement date:</i> June 2006	
<b>Milestone 4.4.3</b> Revise and update educational materials (secondary schools, TAFE, universities, LLL with CRC and other information) via NCPITE.	<i>Achievement date:</i> June, 2009	
<b>Milestone 4.4.4</b> Revise and update educational materials (secondary schools, TAFE, universities, LLL with CRC and other information) via NCPITE.	<i>Achievement date:</i> June, 2011	
<b>Output 4.5</b> Development and implementation of a course work masters program specific to the pork industry.  <i>Delivery Targets:</i> Improved skills for pork industry professionals.	<i>Delivery date;</i> December, 2011	<i>Relevant research programme:</i> All
<b>Milestone 4.5.1</b> Launch of course work masters program and intake of 3 students.	<i>Achievement date:</i> January, 2007.	
<b>Milestone 4.5.2</b> Second intake of 3 coursework masters students	<i>Achievement date:</i> January, 2009	
<b>Milestone 4.5.3</b> Completion of first intake of coursework masters students	<i>Achievement date:</i> December, 2009	
<b>Milestone 4.5.4</b> Completion of second intake of coursework masters students	<i>Achievement date:</i> December, 2011.	
<b>Output 4.6</b> Development and delivery of refresher courses for professionals servicing the pork industry.  <i>Delivery Targets:</i> Improved skills for pork industry professionals.	<i>Delivery date:</i> February, 2011	<i>Relevant research programme:</i> All
<b>Milestone 4.6.1</b> At least 10 participants complete the first professional refresher course on a fee for service basis.	<i>Achievement date:</i> February, 2007	
<b>Milestone 4.6.2</b> At least 10 participants	<i>Achievement date:</i> February, 2009	

complete the second professional refresher course on a fee for service basis.	
<b>Milestone 4.6.3</b> At least 10 participants complete the third professional refresher course on a fee for service basis.	<i>Achievement date:</i> February, 2011