National food and nutrition
research and development and technology transfer strategy
October 2013
National Food and Nutrition Research and Development and Technology Transfer Strategy
October 2013

Acknowledgements

The National Food and Nutrition Research and Development and Technology Transfer (RD&TT) Strategy is a cross-sectoral joint initiative of the food and nutrition sector stakeholders. Nominated by the Primary Industries Standing Committee (PISC) Research, Development and Extension (RD&E) Subcommittee, development of the strategy was led by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) as a representative of PISC agencies, the Australian Food and Grocery Council (AFGC) as a representative of industry, and Meat and Livestock Australia (MLA) as a representative of the Rural Development Corporations.

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Forum Members

The National Food and Nutrition Leaders Science Forum is made up of food and nutrition sector stakeholders representing federal and state government departments, tertiary education, non-government organisations and the food industry, including Rural Development Corporations (RDCs), Cooperative Research Centres (CRCs), food companies and retailers, and regulatory agencies. Membership of the Forum has been fluid and has evolved as different organisations contributed throughout the strategy development, reflecting the interest and diversity of the Australian jurisdictions. (For a list of extended Forum members see Appendix 2).
Executive summary

This National Food and Nutrition RD&TT Strategy forms part of the National Primary Industries’ RD&E Framework, which aims to develop a coherent research framework for Australia’s primary industry and related sectors. The Food and Nutrition Sector (as defined for this strategy) includes all post-farmgate handling of food and its transformation to foods and ingredients for consumption by Australians and its export customers. It encompasses the nutritional impact of food on health and research and education related to food and diet.

This strategy is possibly the first endeavour to develop a coherent national research strategy for the entire food and nutrition sector. While there are a number of organisations representing important parts of this sector, (for example the Australian Food and Grocery Council and the Australian Institute of Food Science and Technology), there is no one organisation that represents this huge portion of the economy in its entirety.

To address the lack of an overarching organisation or body, initial meetings of stakeholders in 2008 recommended and instigated the formation of the National Food and Nutrition Leaders Science Forum (The Forum) to act as a platform for coordination, consultation and information-sharing among stakeholders and to develop this cross-sectoral strategy. Activities initiated by Australian and State government departments to support the development of food processing industry policies have also provided context and focus to this document.

The Forum conducted a number of meetings, workshops and conference presentations to consult with a wide range of stakeholders, including RDCs and CRCs, food companies and universities. The Forum then facilitated workgroups in six priority areas to develop priority outcomes and appropriate goals and objectives for research, technical transfer and training.

Food and Nutrition Sector

The Australian food and nutrition sector provides Australia’s consumers and export customers with their everyday supply of safe, convenient and nutritious food. Australia’s farm produce, renowned for its clean and green credentials, is transported, stored or processed to provide a reliable healthy supply of fresh or packaged food that is backed by Australia’s outstanding record for food safety and biosecurity. Food processing is Australia’s largest manufacturing sector, employing 220,000 people. The total food supply chain (encompassing the farming, post-farm storage, processing, wholesale, retail, and food and beverage service sectors) employs some 1.68 million people. The food supplied through these industries has a major impact on the health and wellbeing of all Australians.

Global change forces provide both opportunities and challenges for the Australian food industry. Australia currently produces far more food than it consumes and has the potential to increase both the production and manufacturing of value-added food to help feed the world’s growing population. The era of the Asian century provides new opportunities for Australian food processors to increase exports of packaged consumer foods to a growing Asian middle class (currently 500 million people and forecast to grow to 3 billion in the next decades). This group of consumers is expected to increase their demand, especially for value-added, health-promoting and high protein food. Already Asian consumers are increasingly demanding foods with the consumer benefits of convenience, health and safety, with an assurance of provenance.

In the past, Australia has struggled to increase export of value-added food. In general the transformation of most of the $30.5 billion (2011-12) Australian food exported has often been carried out only to the degree necessary for preservation and shipping. It is for this reason that...
Australia, although an important supplier of food commodities to Asia has not been viewed as a high-value food innovator. Food industry leaders are working to change this perception.

The growth of the giant Asia-Pacific regional consumer market now forming on Australia’s doorstep (including Australia itself) will provide an opportunity for food processors to increase the export of minimally processed and packaged food products. However, food processors, like all Australian manufacturers, face issues such as high costs associated with the small scale of the Australian market, rising energy costs and scarcity of resources, as well as increasing competition from the importation of processed food (currently valued at $11.3 billion). New business models, together with world leading research and development, will be needed to drive innovation and develop the technologies and manufacturing scale needed to build a food industry that is globally competitive and able to compete in the regional markets, as well as against imports.

This will require closer engagement and increased market intelligence to develop integrated supply chains across the Asian-Pacific region. It will also require improved means of technology transfer to share new processing and supply chain approaches with innovative companies. Australia must improve graduate training in these industries and attract more skilled people to drive these changes.

In keeping with the rest of the world, Australia faces increased numbers of food related heath diseases that are associated with the overconsumption of food, sedentary lifestyles and the challenges of an ageing population. We must produce and manufacture healthier foods that are palatable, convenient, affordable and acceptable to the consumer. It is also critical that we understand why consumers request healthier foods but do not always choose them, and how the food industry can contribute to a healthier population.

We need to use natural resources and other inputs into Australia’s food manufacturing and retail system chain more effectively. In particular, the significant reduction of food loss and waste throughout the food supply chain offers the potential for large savings for producers, manufacturers, retailers and consumers. Australia must maintain its reputation for clean green production and superior food safety credentials by meeting the challenge to keep food supplies pristine in a complex global economy; the risk we face is amply illustrated by recent cases of chemical contamination. We must be able to guarantee the future safety and integrity of the Australian food supply chain to maintain and protect the reputation of Australian food.

Research and development have contributed strongly to the development of Australia’s food industries in the past, from the first shipments of chilled meat to the UK to today’s sophisticated handling and processing of food. Studies of past research show very high returns to all contributors along the food supply and the community from investment in research. Australian research and development is now expected to support the growth and competitiveness of the Australian processing industry to take advantage of new market opportunities. It is expected to deliver safe, healthy and sustainable foods and diets for Australians and our export customers.

A preliminary survey of research and development resources dedicated to the food industry estimates that $660 million (private and public sector resource analysis) is invested per year. This strategy identifies national priorities for this research expenditure and ways in which research can be coordinated for the national interest.

The sheer size and diversity of the industry makes it a challenge to find a representative voice. That is why this National Food and Nutrition RD&TT Strategy represent important opportunities to create a vision for the entire industry that will foster growth in the food and nutrition sector through focussed collaborative research, and establish the representation needed to guide it into the future.
Strategic Priorities
A portfolio approach is recommended to improve coordination and collaboration and to achieve the best return from public and private expenditure in research and development. The Forum and the six priority working group selected the following priorities for a national food and nutrition research portfolio:

1. Establish a collaborative (industry and public) research agenda based on strategy that transforms the Australian food industry into a globally competitive, Asia-Pacific regionally integrated and value-added supplier, while underwriting Australia’s continued reputation as a safe, sustainable supplier of healthy food.

2. Develop the national research portfolio by building the Asia-Pacific regional food market and consumer insights to identify growth opportunities, with research that focuses on developing value-added, safe and healthier food to the Asian consumer.

3. Address, priority action areas through the national research portfolio:
   - Develop market insights and establish Asia-Pacific regional opportunities for Australian agriculture and food manufacturing throughout the food supply
   - Determine Asia-Pacific regional nutrition and dietary needs and opportunities to provide healthier food choices that are easy for consumers
   - Develop tools and technologies to measure and understand impact of climate change on food manufacturing and on through chain food supply for more efficient use of energy and water and to reduce waste
   - Develop science evidence based systems that guarantee food safety, biosecurity and market access
   - Build strategic partnerships to deliver technologies and innovation (national and international) and build science based input for regulation of the Australian food industry
   - Deliver training and development to build skills and capacity within the food industry to enhance innovation in food and nutrition.

Recommendations
In the past the food and nutrition sector has lacked any one organisation that could establish a vision and plan for the entire sector, oversee the next steps, and coordinate progress towards delivering a national portfolio. In order to implement this strategy we propose to:

1. Establish an implementation committee reporting to the PISC RD&E subcommittee, with membership from government and industry, to deliver the objectives of this strategy.

2. Have Food Innovation Australia Ltd (FIAL) represented on the committee and integrate its capacity to link businesses and bring industry, researchers and governments together to solve industry problems and capture opportunities for export into Asia. This will include training and the development of relevant skills for the food and nutrition sector, and will build capability by establishing a capability and infrastructure plan.

The implementation strategy will initially focus on:

3. Establishing a national food safety forum to develop food safety systems that will maintain Australia’s reputation and safety requirements, conduct strategic research to respond to emerging threats, and support market access to the Asian Region.

4. Building a national nutrition partnership (an industry-government-academic nutrition and health platform) to facilitate a regional approach to priority setting and the delivery of outcomes for the industry that will encourage healthy dietary intakes for the Asia-Pacific region.
5. Convening an annual food industry forum to review and refresh the priorities of the National Food and Nutrition RD&TT Strategy, guide research and provide future leadership, vision and planning for the Australian food and nutrition sector.
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Introduction

Context

This cross-sectoral National Food and Nutrition RD&TT Strategy is part of the National Primary Industries RD&E Framework to develop a coherent set of industry strategies for fourteen agricultural sectors (beef, grains, dairy, cotton, fisheries and aquaculture, forestry, horticulture, pork, poultry, sheepmeat, sugar, wine, wool, and new and emerging industries) and seven cross sector strategies (animal biosecurity, climate change and variability, food and nutrition, plant biosecurity, animal welfare, biofuels and bioenergy, soil and water use in agriculture) (http://www.npirdef.org/strategies).

Aim

The aim of the National Food and Nutrition RD&TT Strategy, which from signoff has a 20 year horizon, is to identify the key challenges and develop research and development (R&D) priorities and an implementation plan for the food and nutrition sector that will enable the sector to improve sustainability, productivity and global competitiveness and deliver benefits for consumer’s nutrition, health and wellbeing. The strategy will facilitate greater coordination and collaboration between national organisations, will identify research capability required for the future and will strengthen the national research capability to address better the cross-sectoral food and nutrition issues. This Strategy will deliver an implementation plan to support the recommendations and will link with, and support, other strategies within the primary industries RD&E framework.

Scope of National Food and Nutrition RD&TT Strategy

The National Food and Nutrition RD&TT Strategy considers the entire food supply chain from farmgate to the consumer but has focused primarily on post farm activity, while ensuring a close alignment with the sectoral commodity plans that cover on-farm production. The strategy will link closely to the sectoral strategies, focusing on those common issues identified in post farm-gate to ensure impact across the entire value chain (see Appendix 3). The scope includes the interface between future food production and manufacturing in Australia and the role and future of Australian manufacturing to produce products in a sustainable way that are safe, nutritious, and healthier, providing better choices for Australian, Asian and world consumers. Research and innovation to underpin and address these challenges will be sought both nationally and internationally and will be delivered through collaborations and global networks.
Figure 1 Scope of the food and nutrition RD&TT strategy

**Process to Develop the Strategy**

**Governance**
CSIRO, as a representative of PISC agencies and the AFGC, as a representative of industry, led the development of the Food and Nutrition RD&TT Strategy, with guidance from a Steering Committee composed of representatives from state agencies, CSIRO, the tertiary sector, industry, and the federal government. MLA and CSIRO will jointly coordinate development and implementation of this strategy.

**The Forum**
The first step towards the development of a national vision and strategy for food and nutrition RD&TT was the formation of The Forum to act as a platform for coordination, consultation and information sharing among stakeholders and to develop the strategy.

**Priority working groups**
At the first meeting of The Forum, the following six priority areas were identified:

1. Future markets and industry competitiveness
2. The intersect between food, nutrition and health
3. Climate change and resource efficiency - sustainability
4. Food safety – integrity and traceability
5. Technology translation and adoption – barriers and mechanisms

Working groups were established by the Forum to further describe the six priorities and to identify the specific drivers, opportunities, challenges and issues that can be addressed by RD&TT.
Industry Consultation
Development of the strategy was conducted through a broad consultation process with state and federal government, universities, food industry and regulatory jurisdictions, via industry workshops, interviews with RDCs and CRCs and through quarterly face-to-face meetings of The Forum.

The primary mechanisms for communication with industry and community representatives to support the development of a vision and plan for Australia’s food and nutrition research were the quarterly meetings of The Forum and the 2011 and 2012 AIFST conferences. The Forum and Steering Committee commissioned several background pieces of work, which provided the foundation and parameters for the strategy and will inform future work.

Key stakeholder engagement and consultation activities
AIFST July 2011 conference: A National Food Sector Vision workshop session was conducted to “review the evidence available and prepare an assessment of the state of risks and opportunities for the Australian food supply chain and potential R&D questions.”

National Food and Nutrition Forum quarterly meetings March 2011- August 2012 (total 6 meetings): Face to face meetings with 20-30 food and nutrition stakeholders to workshop; provide advice and support analysis and synthesis of priority area outputs.

Food Industry Workshop March 2012: Workshop to identify food sector hurdles to working with external R&D providers for innovation, research, development and technology transfer (see Appendix 4).

Interviews with RDCs and selected CRCs June/August 2012: to ensure integration of cross-cutting priorities with sectoral strategies).

PISC R&D Subcommittee consultation (August 2012): to update on progress and the status of strategy development.

AIFST July 2012 conference: Strategy introduced, priority area challenges and R&D priorities discussed and a broad stakeholder panel with representatives from all jurisdictions to debate, comment and discuss the strategy.

Consultation with the Australian Council of Deans of Agriculture (ACDA): provided a more complete analysis of national capabilities and capacity offered by universities. A significant number of state governments have now partnered with universities to deliver RD&TT and consultation with ACDA was an effective mechanism to capture these resources in this national strategy.

Endorsement and sign-off process
The draft strategy was circulated to the steering committee for final clearance after the consultation phase and then circulated to the PISC R&D subcommittee for endorsement through their organisations. The strategy was formally submitted to the R&D subcommittee for final sign-off.
Current Australian Policy Context for food and nutrition

This first National Food and Nutrition RD&TT Strategy was developed simultaneously with a number of federal and state governmental policy and strategy initiatives for the food industry. This activity by government demonstrates its support for the largest manufacturing sector in Australia, by providing opportunities for the industry and stakeholders to jointly develop strategic plans and policies (Eyles, 2012). The following chapter describes the main government initiatives in food and nutrition, with a focus on the most relevant food initiatives against which this strategy and its priority areas have been developed.

**Government and Policy Initiatives in Food**

A number of recently published food strategies and initiatives made recommendations (Figure 2) consistent with the goals of this strategy and its priority areas. These initiatives include:

- **State governments** – supported the development of policies that draw attention to the value and importance of the food industry and its contribution to the economy, health and wellbeing of Australians. Many of the State strategies on food and food policy position them to help meet the growing Asian and wider global demand for food.

- **Sectoral and Cross sectoral strategies** - A number of sectoral and cross-sectoral strategies intersect with the priorities of this strategy (see Appendix 5), and interface strongly with the national food priority issues: competitiveness and productivity, food security and sustainable food industry.

- **Prime Minister's Science, Engineering and Innovation Council** - provides independent advice to the Commonwealth Government on major national issues in science, engineering and technology and contributes to the economic and social development of Australia. The Council recommends building research capability for the Australian food production sectors.

- **The Food Processing Industry Strategy Group** - comprised of representatives from industry, trade unions, research and academia, the group was tasked with developing a strategy to improve the competitiveness and sustainability of the food processing industry and its productivity.

- **The Prime Minister's Manufacturing Taskforce** – non-government members including business and union leaders. The taskforce established a shared vision for the future of the manufacturing sector and identified five priorities:
  - Assessing the nature of the adjustment now facing manufacturing firms
  - Attracting investment to Australia for innovation and technology, high value research and development industries
  - Defining the role of government in providing macro stability, supporting investment and market opportunities promoting flexibility and improving capabilities
  - Understanding how Australian manufacturing firms access Asian and other markets
  - Understanding the role of manufacturing industry in building a stronger, more resilient sector.
A recommendation from both The Food Processing Industry Strategy Group and The Prime Minister’s Manufacturing Taskforce was the establishment of a National Food Innovation Hub/Network (NFIHN) to support and boost innovation within the Australian food manufacturing industry and improve growth and competitiveness.

The government response was announced in the Industry and Innovation Statement as part of the $1 billion Building on Australia’s strengths package (DIICSRTE 2013).

**Industry Innovation Precincts**

In 2013 the Government announced they will invest approximately $504 million over five years in Industry Innovation Precincts ($238.4 million for precincts; 236.3 million for the Industrial Transformation Research Program (ITRP); $29.8 million for the Manufacturing Technology Innovation Centre (MTIC). The Precincts will bring together knowledge and expertise from businesses, advisors with business know-how, higher education, vocational education and training and research institutions to work together to develop the capabilities needed for business success and to capture major opportunities in the Asian Century. They will facilitate collaboration between firms and researchers, and amongst each other, to share and improve knowledge and skills, to deploy technology, to create new products and services and to take advantage of business opportunities. Led by industry in partnership with research providers, the precincts will drive innovation, productivity, and growth.

**National Food Innovation Precinct (Food Innovation Australia Ltd)**

The National Food Innovation Precinct (FIAL), which was incorporated on the 26th June 2013, will focus on Australia’s food and beverage industries and is, in principal, a form of the National Food Innovation Hub/Network. The launch of the Precinct responds to the realisation that the food and beverage manufacturing industry (despite having much infrastructure and generate a significant contribution towards Australia’s economy) are very fragmented; lack critical focus; the R&D spend
represents a small percentage of the total turnover of the industry, and there is poor collaboration between researchers and industry. The objectives of the Precinct are to:

- Help build the quality and scale of industry in areas of competitive advantage and emerging opportunities
- Form a cohort of growth orientated businesses
- Foster new collaborative partnerships that build trust, lead to innovation and deliver commercial benefits
- Achieve greater alignment between the strategic needs of industry and government investment in research as well as business support and innovation
- Establish a stronger culture of innovation and collaboration amongst Australian firms
- Improve and accelerate the translation of Australia’s research investments into positive economic, social and environmental outcomes
- Establish new trade and innovation relationships, enhance and forge new international networks and collaborations, and improve Australia’s reputation overseas.

The Precinct is kindly being hosted by La Trobe University in Bundoora with the support of RMIT, and aims to take advantage of the critical mass of industry and research activities located in the area. It will be networked nationally, linking with existing R&D hubs/networks, infrastructure and capability. The Chairman is Mr Peter Schutz and the Managing Director is Dr Mirjana Prica who envisage the Precinct as being a key vehicle in the delivery and implementation phase of the recommendations developed by this strategy which align strongly to the goals of the Precinct. A key focus of the Precinct will be on SMEs and to encourage SMEs to work together with large companies, universities and researchers who would not otherwise have been able to access these benefits because of time, cost and resources. Strong emphasis will be placed on technical support through R&D and pilot plant facilities, and provide pre-competitive consumer insights to firms to exploit the information in the context of their own business. The Precinct through its networks and affiliations will be providing answers to business needs as they need them.

Other initiatives delivered through the Australian government’s Australian Research Council have also had a keen focus on supporting the food industry through two significant schemes:

**Industrial Transformation Research Hubs**

The objectives of the hubs are to:

1. Encourage collaborative R&D projects to address challenging industry issues solved through innovative research relevant to the Industrial Transformation Priorities
2. Attract investment from the global and international business community by underpinning the internationally-recognised excellence of Australian universities and their industry partners
3. Leverage private and international investment in targeted industry sectors.

**Industrial Transformation Training Centres**

The objectives of the centres are to:

1. Foster opportunities for Higher Degree by Research candidates and postdoctoral fellows to pursue industrial training and to enhance competitive research in collaboration between universities and organisations outside the Australian higher education sector
2. Strengthen Australia’s Industrial Transformation Priorities to supplement the needs of industries and other research end-users.
**Summarising points**

A number of common objectives were identified in the government food policies and priorities. They are to:

- Support the global competitiveness and productivity growth of the food supply chain, including through research, science and innovation
- Reduce barriers to a safe and nutritious food supply that responds to the evolving preferences and needs of all Australians and international consumers (with focus on Asia) and supports population health
- Contribute to economic prosperity, employment and community wellbeing including training and development for the food industry in regional Australia.

The National Food and Nutrition RD&TT Strategy will be an important mechanism in supporting the delivery of food policy for Australia and will support a range of government food industry initiatives.

The reason for the current high political profile of the food processing industry is that Australia has hitherto been viewed as a critical supplier of food commodities to Asia but not a high-value food innovator. Food industry leaders have started, with some urgency, to try to change this perception. It is understood that we should start not from the point of view of what we are already producing, but instead from that of our target consumers. At the recent Global Food Forum 2013 the food industry commented that this was an exciting time for food innovation because the Australian economy was moving from the mining boom to the ‘dining boom’. Here at last is a way for Australia to reinvent its manufacturing base and add value to its agricultural produce. The primary purpose of the National Food and Nutrition RD&TT Strategy is to mobilise Australia’s R&D capacity to promote and develop new food innovation to assist the food industry to meet this ‘dining boom’ opportunity in the Asia-Pacific region and, in so doing, ensure competitive advantage to the Australian food industry.
Australia’s Food and Nutrition Sector

Food and Nutrition’s role in Australia

This food and nutrition strategy covers all post-farmgate handling of food and its transformation to foods and ingredients for consumption by Australians and our export customers. It encompasses the nutritional impact of food on health and research and education related to food and diet. The Australian food and nutrition sector provides Australia’s consumers and export customers with their everyday supply of safe, convenient and nutritious food. Australia’s farm produce, renowned for its clean and green credentials, is transported, stored or processed to provide a reliable supply of fresh or packaged food that is backed by Australia’s outstanding record for food safety and biosecurity.

Food Value Chain Overview

The food value chain, from farming, post-harvest storage and processing to the wholesale, retail, and food and beverage service sectors, employs 1.64 million people, or 15% of Australia’s total workforce. The food industry is Australia’s largest manufacturer and food production and processing reaches all corners of the continent. The food processing industry is a significant contributor to the Australian economy. It currently employs around 300,000 people, half of them in rural and regional areas, and pays about $14 billion in wages (Senate Food Process Inquiry Report 2012).

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<td>Value</td>
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<tr>
<td>Farm and Fisheries food production</td>
<td>$42.6 billion</td>
</tr>
<tr>
<td>Food and Beverage manufacturing</td>
<td>$91.2 billion (2010/11)</td>
</tr>
<tr>
<td>Food Retail sales</td>
<td>$135.8 billion</td>
</tr>
<tr>
<td>Food Exports</td>
<td>$30.5 billion</td>
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<tr>
<td>Food Imports</td>
<td>$11.3 billion</td>
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<tr>
<td>Total Value</td>
<td>$170 billion per annum</td>
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| Employment                          |                      |
| Agricultural production             | 300,000 persons      |
| Food and Beverage manufacturing    | 227,750 persons      |
| Wholesaling and Retailing          | 395,000 persons      |
| Food Service                        | 650,750 persons      |
| Total Employment                    | 1.64 million persons |

| Consumer Spend                      |                      |
| Weekly household expenditure food and beverage | $244 (2010/11) |

| Position Globally                   |                      |
| Food Exporter                       | Australia ranked 16th (2011) |
| Food Importer                       | Australia ranked 25th (2011) |
| Food Trade surplus                  | Australia ranked 10th (2011) |

Australia’s Food Industry 2011-12 (DAFF 2012)
Founded on Australia’s farm produce

The foundation of the Australian food value chain is a vigorous and competitive agricultural sector. Meat was Australia’s largest on-farm sector in 2011-12, generating 34% of the total $42.6 billion agricultural food revenue. The beef industry dominates this sector, followed by sheep and pig meat. Grains and oilseeds (29%) was the next largest sector, dominated by wheat production. Next were horticulture (18%), milk production (10%) and seafood (5%).

Food processing, Australia’s largest manufacturing industry

Most Australian meat is processed and packed for local and export consumption, while grains go to Australian flourmills or are exported in bulk. The majority of horticultural products, fruit and vegetables, go directly into the retail chain for Australian consumption (DAFF, 2012). Around 45% of Australian milk production is processed for export, with the balance processed into dairy products such as fresh milk, cheese, butter and yoghurt for local consumption (Dairy Moving Forward, 2009).

Food processing is Australia’s largest manufacturing industry, employing 227,750 people in 2011-12 while providing 20% of the gross value added by the manufacturing sector. Australia’s largest food processing industries are the meat industry (24% of the $91.2 billion food and beverage processing in 2011-12) and the dairy industry (16%). Beverages come next (13%) followed by flour and cereals (8%) (DAFF, 2012). By far the majority of food eaten by Australian consumers has been processed to some extent.

Food export focus increasingly on Asia-Pacific region

Australia has significant shares of international trade in wheat, beef and meat products, dairy, sugar and beverages. Meat products dominate Australia’s food and beverage exports (26% in 2010-11), followed by grains (18%), dairy products (9%), wine (7%) and seafood (4%). Japan was Australia’s largest customer for food in 2010-11 ($4.2 billion), with the USA and the emerging Indonesian market vying for second place ($2.1 billion). The twenty-one Asia-Pacific Economic Cooperation (APEC) Pacific Rim countries took $18.2 billion of the total $30.5 billion food exports, making this the largest export region (DAFF, 2012). Food exports grew during the 1990s then dropped and eventually plateaued due to the drought and cyclones of the 2000s.

Australia’s food trade surplus is decreasing as imports grow

In contrast, imports have grown steadily for the past twenty years from $3.9 million in 1990-01 to the current level of $11.3 million in 2011-12. Imported foods tend to be more processed than our exports. Australia’s largest food imports are beverages (19%), horticultural products (17%) and seafood (12%) (DAFF, 2012).

Food retailing

Food sales in Australia mainly occur through supermarkets and grocery stores (62% in 2010-11 according to Australian food statistics, DAFF 2010/11) with the balance provided by food service, cafes and restaurants and takeaway outlets. Household expenditure on food and beverages as a proportion of total household expenditure was 19.1% in 2009-10. This percentage has continued to decline as rising food manufacturing productivity has made food less expensive. Food prices are not expected to rise significantly by 2050 (ABARE Outlook conference 2009). Restaurant and takeaway food consumption are still increasing. Quite a large proportion (14.8% in 2005-06) of processed food re-enters the food chain as an ingredient or goes into other industrial uses (Borrell, et. al., 2012).
Food and nutrition sector strengths

Australian food processors are in a good position to profit from an abundant and competitive supply of high quality raw material, produced under Australia’s stringent environmental, food safety and biosecurity standards. World population increase and rising incomes seem likely to underpin future increased demand for food commodities, especially meat, dairy and wheat. Dalton and Keogh, in their paper “The Implications for Australian Agriculture of Changing Demand for Animal Protein in Asia” recommend that higher value markets that have “more stringent quality and food safety requirements” are targeted, highlighting the superior safety and quality of Australian produce. The increase in supermarkets and chilled food distribution in Asia should present opportunities for value-added agricultural products from Australia, targeted at the growing middle classes of Asia (Dalton & Keogh, 2007).

This has been echoed by “John Doumani, chairman of the Australian Food and Grocery Council (AFGC) who says that “despite current problems there is opportunity for industry in Australia; with an economy in better shape than most, a low unemployment rate, a world-class regulatory system, great primary produce at competitive prices and close proximity to the growing Asian market” (AFGC and KPMG, 2011).”

The key points identified were that the Australian food industry has strong natural advantages to leverage from (e.g. our excellent food safety status); is good at growing food; has an educated workforce and an entrepreneurial spirit.

A key focus however, will be the continued importance of growing and retaining market access and devising strategies to develop innovative food to target premium markets. Australia can’t rely on proximity to Asia to offer a significant freight costs advantage or any advantage based on our clean green image alone.

Asian markets provide opportunities for Australian packaged consumer products

The growth of large consumer markets closer to Australian shores may overcome the packaged consumer manufacturer’s problems of the small-scale Australian market and distance to export consumer markets. Conversely it could represent a further risk of imports from large-scale manufacturers based within the Asian markets. This is especially so at the current time, when the industry is dealing with the issues of high costs that, in tandem with the high value of the Australian dollar, has resulted in a reduction of trade competitiveness. Additionally, a complex regulatory environment exacerbated by the state structures and a highly concentrated retail sector along with growth of private label products provide ongoing challenges (AFGC 2011, A.T. Kearney Aus. Pty Ltd).
Australia Food Industry Drivers and Challenges

The food and nutrition system is experiencing unprecedented change arising from complex interactions of economic, social and environmental factors and the fact that the global food industry is driven by strong competitive forces shaped by population growth, consumer demands and the megatrends identified below (Cole & Ball, 2010, Cribb 2010, Foresight UK Government 2011).

Figure 3 Global Megatrends

- Critical global food supply issues
- Food price volatility
- Climate change
- Competition for key resources
- Plateau in agricultural productivity
- Environmental degradation

- Rise of the Asian nations
- Sustainability of business post GFC
- Increasing ethical concerns (GM, fair trade, animal welfare etc.)
- Environmental impacts from waste and emissions
- Trade regulations and compliance

- Aging population
- Increasing obesity and chronic disease in developed nations
- Emergence of food/nutrient x genome x health integration
- Keeping up with regulation and policies

- Integrated food supply chains
- Disease resistance in pests and pathogens
- Traceability and provenance
- Global trade regulations and policies
- Animal to human disease threat

Response from global food companies

Large multinational companies are increasingly interested in innovation to support their long-term competitiveness. With a focus on substantial cost reduction and efforts to minimise environmental impact, they are looking to new transformational production processes to increase productivity and sustainability. New personalised products (so called ‘functional foods’ that increase mental and cognitive function, physical performance, immune performance, stress prevention, etc.) will provide health benefits, promote wellbeing and performance outcomes, and increased convenience. Their research and development concentrates on substantiated food and ingredient effects on health and wellness (using both genomic and physiological approaches), long-term sustainability, food safety, quality and the sensory properties of foods (Lundin et. al., 2010). The impact on the primary sector will be increasing demand for high quality raw materials and potential for joint innovation in delivering desired functional and behavioural properties in food through both food production and manufacturing.

The industry sectors’ long-term plans are clearly driven by the multinational ingredient and manufacturing companies. A survey commissioned for this strategy found that Australia’s national and SME manufacturers (given the current challenging business environment) lack strategic focus, and their main strategy for innovating is by ‘fast following’ the global companies, adopting international trends for the local market and through collaboration with their ingredient suppliers and sometimes equipment suppliers (Atholl Business Consulting 2012).

Food security is a global issue

Food security is both a global issue and a local issue for many countries. Australia currently produces far more food than it consumes and has the potential to increase production to help feed the
world’s growing population. In 1996 the FAO defined food security as follows: “Food security is achieved when all people at all times have physical and economic access to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active and healthy life.” This requires that food is available, accessible, and acceptable to the consumer and provides adequate nutrition. To achieve this, stable food production and distribution systems are necessary. Pressure on food security from increasing populations will require farmers to adapt and innovate to deal with climate changes, decreasing biodiversity, greenhouse gas emissions, low carbon, energy and water utility, while responding to demand to produce more food.

**Need to reverse slowdown in on-farm productivity growth**

Real agricultural output more than doubled over the four decades to 2003-04 and agricultural exports have almost tripled in value since the mid 1970’s, with the industry becoming more export orientated, less reliant on wool and more on processed products such as wine and cheese (Productivity Commission, 2005). However the Australian industry now faces a decline in productivity growth and reversing this worldwide trend will present a huge challenge for the industry and for researchers as it looks to feed a growing population.

**The Asian Century creates new export opportunities**

The Asian Century will create new export market opportunities for the Australian food industry. Asia’s demand for food is expected to outpace its local food production, leading to higher imports to the region (Commonwealth of Australia 2012). Increasing Asian incomes will also mean increasing demand for higher quality and differentiated foods, including high dietary protein foods. A study of 12 Asian nations by Dalton and Keogh estimates that between 2007 and 2020, beef consumption will increase by 50% (1.9 million tonnes), pork by 30%, chicken meat close to 40% and dairy product consumption by 55% (Dalton & Keogh, 2007). Australia’s leading commodity exports are highly competitive and Australia’s high bio-security and food safety standards are a major factor in their success. While this increased demand is an opportunity for Australia, the market situation is complex and Australian businesses will face strong competition from other food exporting nations (ANZ 2012).

**Australian food exports are generally “minimum value-added”**

Growth in commodity exports in the past has not led to a corresponding growth of export of packaged consumers goods. A 2006 study of the relative competitiveness of industry sectors showed that commodity beef, sheep meat, dairy, wheat and barley and high value seafood exports were very competitive internationally. However, the same study found that exports of packaged consumer foods, other than wine, had relatively low competitiveness. Trade in horticulture products has proven difficult due to fragmented production and high labour costs and a new approach will be required to make this sector competitive (Short, et. al., 2006).

Although the processing involved is very sophisticated, the transformation of Australia’s exports is most often only carried out to the degree necessary for preservation and shipping. Export statistics list products such as packaged meat, milk powder and flour as “substantially transformed” food and these are included in the totals reported for processed foods despite a minimal degree of processing. Exports of packaged consumer goods such as confectionary and baked goods are described as “elaborately transformed” products and, with a few exceptions, Australian exports in this category are minimal, running at levels of around 2% of total exports over the past fifteen years (DAFF, 2000; DAFF, 2012).

**Proximity of large consumer markets opportunity for food processors**

The relatively small scale of the Australian market and the distance to world markets has hampered development of the Australian processing industry and exports of packaged consumer products.
With the rise of Asia, larger markets are becoming more accessible, abetted by the development of supermarkets and refrigerated supply chains. The Australian grocery market ($99 billion in 2011) is dwarfed by the Chinese grocery market (estimated at $1,058 billion). The growing Indonesian market, worth $157 billion in 2011, is expected to grow to $231 billion in 2012 to become the world’s tenth largest market (IGD, April 2012). The growth of large consumer markets closer to Australian shores may help to overcome the problems of the small-scale Australian market and distance to export consumer markets for packaged food manufacturers. Conversely, it could present a further risk from imports from large-scale manufacturers based in Asia.

**Australian food processors face many challenges**

The challenges faced by Australian food manufacturers are highlighted by the steady growth in imports, from $3.9 billion in 1990-01 to the current level of $11.3 billion in 2011-12. Currently, the industry is dealing with the issues of a high cost structure including high utility costs, high commodity costs and high labour rates driven by the mining boom. This is exacerbated by the historically high value of the Australian dollar, a high degree of retail concentration and the rapid growth of private labels, and a complex regulatory environment (Australian Food Processing 2012, DIICCSRTE). This has reduced trade competitiveness and favoured imports (AFGC and A.T. Kearney Aus. Pty Ltd, November 2011). Reflecting these difficult trading conditions as well as current business plans, a recent survey of Victorian food manufacturers found that many companies were concentrating on defensive innovation with an emphasis on staying in business. This suggests that at least one strategy may be to increase the accessibility to science and new technologies overseas. (Commissioned by DEPI, DBI and DIICCSRTE; undertaken by Atholl Business Consulting, 2012).

It is unlikely that the Australian food processing sector will survive by solely supplying the Australian market and defending itself against imports. It must also be internationally competitive and involved in the global market. The new Asia-Pacific regional markets provide opportunity for Australian producers to develop large scale, market and consumer-led, exports of packaged consumer foods and customised ingredients from Australia’s most competitive industries (wheat, beef and dairy) within an integrated regional value chain (Ball 2012).
RD&TT priorities

The strategy’s RD&TT priorities were identified by the Forum as they sought to understand what needed to be done to address the opportunity presented to the Australian manufacturing and nutrition sector to exploit the Asia-Pacific regional markets (Table 2, Appendix 4).

Future markets and Industry competitiveness

Vision, future markets and consumer insights

The Forum recommended that increased industry vision and leadership was required. A number of Federal government departments handle food and the industry lacks a united voice. The Forum found that there was a general lack of focus on consumer insight and new market opportunities that would ultimately hinder entry into new markets in the Asia-Pacific region. The challenges to be addressed are the need to:

- Ensure effective collection and use of market and demographic data and models by all stakeholders to identify new markets, foresight market challenges and opportunities, and prioritise effective and timely RD&TT investment to meet market needs
- Encourage long-term planning and foresight
- Ensure coordinated, collaborative, large-scale R&D programs are planned to meet the opportunities identified.

The intersect between food, nutrition and health

Value-added food for health and well-being

Australia, and increasingly all other Asia-Pacific countries, face a number of food related health diseases associated with the overconsumption of food and the challenges of a sedentary lifestyle and an ageing population. This has led to negative economic and social impacts on Australia and there is now an urgent need to focus on health outcomes that can be positively influenced by having ready access to innovative value-added healthier food, meals and diets that provide the appropriate nutrition throughout the life course.

The difficulty is that the consumer is faced with a plethora of food choices and many of these are highly palatable, relatively cheap, energy dense and, in some cases, nutrient poor. While consumers often know this is the case they frequently select these types of food in preference to healthy options. While at least two-thirds of Australians say eating healthily is important, very few eat according to national dietary guidelines (e.g. as measured by fruit and vegetable consumption).

We need to better understand the influences and determinants of food and beverage choices in our region. The challenge is to understand how to convince consumers to increase their intake of healthier foods when we know it will require more than just providing information and education. There is a lack of behavioural research on Australian consumer food choice and a corresponding need to innovate and develop new value-added consumer products that are healthier, palatable, convenient, affordable and acceptable by the consumer. Part of the R&D challenge will be to understand why consumers request healthier foods but do not always choose them; how to develop innovative products for future consumers and new markets; and how the food industry can support health and well-being and contribute to a healthier population.

Climate change and resource efficiency - sustainability

Food manufacturing efficiency and waste reduction

The global resources of energy, water and land are finite, while at the same time, the demand for fresh and processed foods is increasing because of the rapid rise in the global population (9 billion by 2050) and increasing affluence in countries like China and India.
Transforming agricultural raw materials into value-added foods with the required functionality, safety and shelf life requires significant amounts of energy and it has been estimated that up to 40% of value added to agricultural products is achieved by energy intensive manufacturing such as sterilisation, drying, evaporation, freezing and refrigeration. Furthermore, the storage and transport of chilled and frozen foods consumes large amounts of energy.

Although the amount of water used in post farm operations is small compared to levels of water used in agriculture, the demand for water and the cost of fresh water is increasing while the availability decreases. This means that increasing the efficient use of natural resources through development of new technologies and reducing waste in post-farm operations for the agri-food supply chain will be vitally important to our efforts to achieve sustainability. In order to do this we must:

- Develop strategies to reduce the consumption of water and increase the use of recycled water
- Reduce waste significantly through the food supply chain so that there is less impact on food quality, safety, environment and economic development
- More effectively use natural resources and inputs in Australia’s food processing and retail system chain
- Lead the response to stakeholder demand for disclosure around environmental footprint
- Mitigate the potential impact of climate change stresses on food quality and acceptability.

**Food safety – integrity and traceability**

**Safe-guarding Australian food supply and provenance**

Food borne pathogens continue to be a significant problem with economic consequences for both industry and the public health system, estimated to cost $1.2 billion pa in Australia alone (Abelson et al 2006). Major pathogens of public health significance related to food include Salmonella and Campylobacter (OzFoodNet 2008) while pathogenic E. coli is a major issue for market access and food exports. The complexity of the food supply chain and the introduction of new technologies to food processing increases the food safety risk. It also creates significant challenges for the food safety systems required to safe-guard the Australian food supply and consumers. We must ensure that the needs for innovation, productivity, sustainability and profitability are matched with the continued delivery of safe, nutritious food by:

- Guaranteeing the safety and integrity of the Australian food supply chain
- Protecting food from microbiological, chemical and other potential sources of contamination
- Enhancing capacity and (international) linkages in food safety R&D and policy to respond promptly to food safety incidents
- Reducing the contribution by the food supply of foodborne disease with the greatest impact or risk e.g. Salmonella, Campylobacter and some viruses
- Ensuring market access and meeting food safety (microbial and natural toxicants) and regulatory requirements to support existing and potential new export markets
- Verifying the provenance of Australian food to international consumers.

**Technology translation and adoption – barriers and mechanisms**

**Innovation and adoption of new technologies**

The food industry identified a number of the issues that influence their ability to innovate and take up new technologies. In the business environment, for example, success is defined by commercial delivery and ongoing profits. Companies therefore often consider the adoption or adaption of new technology unaffordable, making it difficult to demonstrate their value in the processing sector.
Often there is difficulty fitting together the pieces of the puzzle and understanding how to connect, or make the most of, a new opportunity. This, for many companies, is compounded by uncertainty about where to find researchers and innovators. In many cases a multitude of stakeholders are required to make the most of any innovation, and collaboration as well as cohesive investment is required.

At the SME level there is often a very short timeframe between the delivery of an idea and its commercialisation. SMEs find it difficult to access the support they need to take advantage of opportunities in a timely manner. Understanding the different drivers for each of the stakeholders in the innovation cycle is critical, and it will be important to determine how to:

- Shift the emphasis from derivative defensive innovation (i.e. ‘fast follower’ strategy for innovation) to the more strategic innovation that is often required to grow the business or market
- Maintain a critical mass of skilled researchers to halt the decline in food manufacturing, especially for value-added products for export markets
- Focus the food industry on the future rather than on current cost saving and immediate business needs
- Provide clear points of access for food companies to access the researchers and technologies they need
- Fund technology transfer activities.

Skills and training

**Industry ready graduates and skilled workforce**

Skill and education shortages were identified, particularly in specialised industry know-how. New graduates are not industry-ready and the food manufacturing workforce will need up-skilling as new technologies develop, e.g. computing and information technology, business awareness and innovation, leadership, and risk management skills. New graduates generally tend to have little practical hands-on technical experience due to the inadequate equipment and facilities available within universities, and struggle to apply their technical know-how gained from their degrees in the real world. There are also difficulties in attracting students to do food science degrees or high quality staff to regional processing sites due to the poor incentives offered by industry.

Skill levels play a key role in leveraging opportunities for new technologies and innovation; however the Australian food industry is currently experiencing a skills shortage as well as demographic challenges. The ageing workforce in dairy processing, for example, is a major issue for work safety. Repetitive strain and back injuries have increased and it is recognised that innovations such as robotic dairying will be required to ensure ongoing workforce participation.

Additional skills development on farms and in manufacturing is needed. Education courses for food industry skill development in regional Australia, where the majority of food companies are located, would provide networks and clusters of innovation. Specific needs include:

- The development of food researchers who understand business, (including business drivers and constraints, knowledge transfer, ‘path to impact’) and who operate well in cross-functional teams
- Ensuring that companies (especially SMEs) are “change ready” with the ability to prioritise and manage innovation projects and foster an entrepreneurial/innovative culture
- Support for companies to more effectively leverage their own in-house capabilities, market intelligence and business networks (suppliers and instrument manufacturers) for innovation
- Increased focus on food science degree training to halt the decline in numbers and provide students with skills that are more relevant to food industry needs
• The development of a partnership approach between industry and the tertiary sector to build diverse career pathways into the RD&TT system for food and nutrition, and to ensure those careers are attractive to top graduates
• Strong links between training providers (including overseas institutions) and industry so the desired workforce skills are provided.

**Good return from research investment**

Research and development have contributed strongly to the food industries’ development in the past, from the first shipments of chilled meat to the UK to today’s sophisticated handling and processing of food. Studies of past research show very high returns to the community from investment in research. Two studies undertaken while developing this strategy show Australian research and development is now expected to support the growth and competitiveness of the Australian processing industry to take advantage of new market opportunities. The industry is expected to deliver safe, healthy and sustainable foods and diets for Australians and our export customers. Carefully targeted research will be needed to meet the food industry vision of a profitable and sustainable Australian food and nutrition sector that is supported by the National Food and Nutrition RD&TT Strategy.

Extensive work carried out on economic return on agricultural research (Mullen, 2007; Mullen et al, 2011) has shown that “investment in agricultural research has generated a stream of benefits far exceeding costs and that these benefits have been shared by farmers, processors and consumers in Australia and elsewhere”. The Productivity Commission (2011) has recently agreed with this view.

In 2011 DEPI Victoria and CSIRO commissioned a review of the entire food value chain to determine the impacts and benefits of research and development investment through case studies (3 technologies) in post farmgate dairy processing research. The study found that the development of technologies returned several times the research investment and provided gains in social capital in the form of scientific understanding and capacity as well as environmental and human health benefits (Mullen et al, 2011).

As part of this work The Centre for International Economics (The CIE) also developed a food value chain model that captures the behaviour of farmers, processors and consumers in relation to supply and demand for fresh and processed products. The model can be used to inform where best R&D investment should be made (Borrell et al, 2012).
Thirty percent of the contribution of the total gross value of the Australian supply chain (around $172 billion) comes from primary production, while seventy percent arises from manufacturing and distribution processes. The factory-gate value of processed foods is around four and a half times the total value of agricultural inputs. The model also indicates that consumers predominantly eat food that has been processed to some extent (including home processing). However, examination of individual value chains has shown big differences between agricultural products. In the dairy supply chain, for example, eighty percent of value is generated through processing while in the beef sector processing adds thirty percent of value (Borrell et al. 2012).

Analysis of R&D investment and the distribution of potential pay-offs along the value chain has shown that where research can successfully expand export demand it provides the greatest benefits to the farming and processing sectors, and that expansion and productivity gains anywhere along the value chain are good for the whole economy and mean that fewer resources are needed to produce the same amount of food.

An understanding of the market economic dynamics and their relationship across the value chain will be important when deciding what research to conduct and where to invest R&D funds. Successful R&D has potential benefits for all players across the value chain and part of the decision

*FEPC stands for feed, energy, packaging and chemicals.
Exports valued at free-on-board (FOB) basis and imports on a cost-insurance-freight (CIF) basis.
Data source: CIE estimates based on Australian Bureau of Statistic 2005-06. (DAFF 2007)
to invest in R&D must therefore take into account any potential benefits and opportunities across the entire food supply chain.

**Opportunities**

Australian research and development should grow innovation where research design, product development and process evolution benefit the Australian processing industry by addressing industrial-innovation gaps. This activity will result in a growing, profitable and sustainable food and nutrition sector.

The Forum considered the opportunities highlighted by a SWOT analysis undertaken of the food industry, (See Appendix 4), which indicated the areas of innovation where RD&TT can substantially contribute. The time for investment in innovative food manufacturing is now, while the Australian government places a priority on food and agriculture policy.

The opportunities identified for Australian food manufacturing are to:

- Increase Asian demand for dietary protein and processed food
- Increase exports of premium value-added healthy foods
- Strengthen and reinforce food safety and provenance, particularly for China
- Reduce food chain waste and increase resource efficiency
- Improve the integration of government and state strategies and investment in food and nutrition research
- Encourage SME innovation through networks and hubs
- Increase consumer understanding of new technologies and promote their acceptance
- Promote food science and agricultural education by engaging stakeholders (schools, VET and Universities) to promote careers in the food industry.

There is a short window of opportunity for Australia’s manufacturing industry to adopt the new technologies and products necessary to satisfy the Asian food boom, in particular the growing demand for dietary protein. The products of Australia’s globally competitive value chains in meat, dairy, and grains are exported primarily as commodities (or minimally transformed) and generally do not attract much added value. Increased production of elaborately transformed food with the desired attributes of convenience, improved health and nutrition, safety, and assured provenance has the potential to capture significant additional value for the Australian food industry and to increase returns on investment across the value chain.
The Strategy

**National Food and Nutrition RD&TT Strategy Aim**

The aim of the National Food and Nutrition RD&TT Strategy, which from signoff has a 20 year horizon, is to identify the key challenges and develop R&D priorities and an implementation plan that will enable the sector to improve sustainability, productivity and global competitiveness and deliver benefits for consumer’s nutrition, health and wellbeing. The strategy will facilitate greater coordination and collaboration between national organisations, and will strengthen the national research capability, allowing it to better address cross-sectoral food and nutrition issues. This strategy will inform and support the objectives of other strategies within the primary industries RD&E framework.

**Vision for Australian food and Nutrition Sector in 2030**

**Our vision:** An innovative, profitable and sustainable food industry (that is growing), admired (trusted) by markets and communities, and producing food for consumers’ nutrition and enjoyment.

**Our strategy mission:** To create a sustainable competitive advantage for Australia’s food industry through a highly effective and vibrant RD&TT system that attracts investment, fosters innovation and delivers high quality products, services and solutions.

**Strategic Priorities**

A portfolio approach is recommended to improve coordination and collaboration and to achieve the best return from public and private expenditure in research and development. The Forum and the six priority working groups selected the following priorities for a national food and nutrition research portfolio:

1. Establish a collaborative (industry and public) research agenda based on strategy that transforms the Australian food industry into a globally competitive, regionally integrated and value-added supplier, while underwriting Australia’s continued reputation as a safe, sustainable supplier of healthy food.

2. Develop the national research portfolio by building the Asia-Pacific regional food market, identifying growth opportunities through improved understanding of consumers, and providing research that focuses on developing value-added, safe and healthier food for Asian and Australian consumers.

3. Address priority action areas through the national research portfolio to:
   - Develop market insights and establish Asia-Pacific regional opportunities for Australian agriculture and food manufacturing throughout the food supply chain
   - Determine Asia-Pacific regional nutrition and dietary needs and opportunities to provide healthier food choices that are easy for consumers to adopt
   - Develop tools and technologies to measure and understand the impact of climate change on food manufacturing and on the through-chain food supply to achieve more efficient use of energy and water and reduce waste
   - Develop scientific evidence-based systems to guarantee food safety, biosecurity and market access
   - Build strategic partnerships to deliver technologies and innovation (national and international) and provide advice on regulation for the Australian food industry that is based on sound science
- Deliver training and development to build skills and capacity within the food industry to enhance innovation in food and nutrition.

Recommendations
In the past the food and nutrition sector has lacked any one organisation that could establish a vision and plan for the entire sector, oversee the next steps, and coordinate progress towards delivering a national portfolio. In order to implement this strategy we propose to:

1. Establish an implementation committee reporting to the PISC RD&E subcommittee, with membership from government and industry, to deliver the objectives of this strategy.
2. Have FIAL represented on the committee and integrate its capacity to link businesses and bring industry, researchers and governments together to solve industry problems and capture opportunities for export into Asia. This will include training and the development of relevant skills for the food and nutrition sector, and will build capability by establishing a capability and infrastructure plan.

The implementation strategy will initially focus on:
3. Establishing a national food safety forum to develop food safety systems that will maintain Australia’s reputation and safety requirements, conduct strategic research to respond to emerging threats, and support market access to the Asian Region.
4. Building a national nutrition partnership (an industry-government-academic nutrition and health platform) to facilitate a regional approach to priority setting and the delivery of outcomes for the industry that will encourage healthy dietary intakes for the Asia-Pacific region.
5. Convening an annual food industry forum to review and refresh the priorities of the National Food and Nutrition RD&TT Strategy, guide research and provide future leadership, vision and planning for the Australian food and nutrition sector.
Future RD&TT plan
The strategy is structured around the Plan’s six cross-sectoral core priorities areas. In each priority area a number of key RD&TT priorities are identified.

Priority Research Areas
The National Food and Nutrition RD&TT Strategy identified six priority research areas to realise our vision. These are:
- Future markets and industry competitiveness
- The intersect between food, nutrition and health
- Climate change and resource efficiency - sustainability
- Food safety – integrity and traceability
- Technology translation and adoption – barriers and mechanisms
- Skills and training.

Figure 5 Mapping of the cross-cutting priorities against the global food mega trends and the food supply chain
**Summary of actions for Research Priority Areas:**

**Future markets and industry competitiveness**

**Goal:** To enable the Australian food processing industry to be competitive in the long-term and accelerate growth in new export markets

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<td>Government, industry, research providers</td>
<td>Identify the needs and wants of regional (Asia-Pacific) markets and consumers and improve the flow of market intelligence information through the whole supply chain</td>
<td>Ensure effective collection and use of market and demographic data and models by all stakeholders to identify new markets, foresight market challenges and opportunities, and prioritise effective and timely RD&amp;TT investment to meet market needs. Identify the AP region areas in which Australia will be competitive.</td>
<td>Focused RD&amp;TT to capitalize on industry strengths to increase competitiveness in the export market</td>
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<td>Government, industry, research providers</td>
<td>Improve the productivity and competitiveness of food manufacturing in Australia</td>
<td>Understand competitiveness factors in current and emerging markets (including how value is generated and captured and shared through the supply chain) in order to inform the development of products, processes, systems and policies. Improve clarity about the capacity of a SME-dominated industry to identify and respond to consumer trends and exploit future market through consumer and market insights. Coordinate R&amp;D within academia and the food industry so that it addresses the challenges of food manufacturing and allows us to compete with trans-national companies on a global scale. Strategically align assets across governments and industry to identify and engage with new markets and to increase scale and improve efficiency. Establish a mechanism to distribute intelligence and lessons learnt from those assets back to industry to enable them to develop their own strategies to move into export markets. Build innovation networks and systems to enable industry to engage in strategic research to expand into export markets.</td>
<td>An Australian food processing industry that is globally competitive, that can compete successfully against imports and is able to accelerate growth in new high value export markets</td>
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<td>Government, industry, regulators, R&amp;D providers</td>
<td>Produce scientific information to inform, influence and advise global food regulation policy design and food standards for</td>
<td>Understand changing and emerging market access requirements and provide scientific information to enable evidence-based food regulation, standards and policy design in order to grow and maintain access to high priority markets. Counter the lack of intelligence about the</td>
<td>Australia is an active participant in developing international food regulation policy</td>
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<td>Government, tertiary education, research providers, consumers</td>
<td>Develop strategies for public education of new production (e.g. GMO) and processing technologies</td>
<td>Collate information, packaged to suit the target audience and provide information to strengthen consumer, market and community understanding of Australia’s food system and new production (e.g. GMO) and processing technologies. Conduct a census on consumer views to new bio and processing technologies. Review how new technologies are implemented internationally.</td>
<td>Nationally agreed policy on introduction of new technologies in the food supply and an integrated approach to communication and education of the consumer</td>
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<td>Research providers, government, food industry</td>
<td>Implement mechanism to identify future innovation needs, wants and challenges - e.g. foresighting</td>
<td>Identify and prioritise future technologies based on opportunities for innovation in food products, processes and business models, through use of foresighting and other methodologies, and build capability for early access and adoption of these technologies. Enable access to new discoveries made overseas and build R&amp;D capability to access and adapt these technologies in the industry. Build effective translation mechanism for emerging R&amp;D developments into product innovations and R&amp;D capacity to address business problems and opportunities.</td>
<td>Increased foresighting capability (including consumer insight) and data transparency to understand the R&amp;D required addressing the trends and drivers for the future</td>
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The intersection between food, nutrition and health

**Goal:** To produce successful (safe, sustainable) healthier foods that add value to the food industry and are adopted by the consumer and that in the longer term will make a significant contribution to the regional population’s health

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<th>Who</th>
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<tr>
<td>Government, research providers, industry</td>
<td>Understand the drivers of consumer demand for healthy food choices for Asia-Pacific region</td>
<td>Interrogate national (and international) databases of consumer trends, perceptions of current and emerging food technologies, processes, industry practices and links to health; trends and current health &amp; nutrition status; eating behaviours (National Health Survey analysis and dissemination after 2013) to identify the best opportunities to improve nutritional status and inform new product innovation. Provide innovation and reformulation for healthier foods for key population groups and high risk individuals. Develop food products to promote the health and wellbeing of the Australian and regional Asian population and for high risk population groups.</td>
<td>Improved population health through food and nutrition for the Regional (Asian-Pacific) general population and for high risk groups</td>
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| **Government, industry, regulators** | **Capability to produce and manufacture foods that impact more positively on health and wellbeing** | **Develop palatable healthier foods that are available for and easily adopted by the consumer, and that contribute to addressing relevant national and regional (Asia-Pacific) health priorities.**  
**Build innovation capacity and/or develop new knowledge and technologies to manufacture reformulated and innovative healthier food products preferred by the consumer.**  
**Understand, improve and maintain nutritional quality of food throughout the supply chain.**  
**Support a growing food industry differentiated on healthier food production, manufacturing and service.** | **Foods and dietary patterns that improve overall population health for both the general population and for specific high-risk groups within Australia and for key export markets** |
| **Government, industry, research providers** | **Investigation and substantiation of nutrition & health effects of foods and diets** | **Develop scientific evidence based foods and dietary patterns for promoting wellbeing and targeted disease health outcomes.**  
**Capture new knowledge and information for future Nutrition Reference Values and dietary guidelines based on substantiated biological functionality.**  
**Develop foods and broader choices for individuals to use as strategies for improved health at all ages through life.** | **Increased scientific substantiation of nutrition & health effects of new and current food products and dietary components** |
| **Government, Consumers** | **Promote informed food choices and dietary patterns that contribute to overall population health** | **Understand consumer beliefs, attitudes, preferences and influencing factors on food-related behaviour and food choices.**  
**Industry implementation of a permissive nutrition, health and related claims standard (currently being finalised) that will enable food manufacturers to communicate the health benefits of food products to consumers on food packaging.**  
**Develop validated methods and models for effective communication to influence and induce behaviour changes.**  
**Build intervention strategies to induce long-term behavioural changes towards better food choices and dietary habits.** | **Consumers make healthy food choices their preferred choice** |
## Climate change and resource efficiency – sustainability for food manufacturing

**Goal:** To improve energy/water use efficiency, minimise food waste, and reduce the environmental footprint in food manufacture and match raw product input with processor and consumer needs

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<th>Who</th>
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<tr>
<td><strong>Government, industry, research providers</strong></td>
<td>Efficient use of natural resources inputs into food supply chain</td>
<td>Adopt a total systems approach to integrate the supply chain and eco systems so that energy, water and other resources in the whole system are used efficiently. Implement a ‘closed loop’ approach so that waste heat from one process will be utilised in another process.</td>
<td>Technologies to more efficiently use natural resources (water and energy) and inputs in the food supply chain including the retail system chain</td>
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<tr>
<td><strong>Government, industry, research providers, regulators</strong></td>
<td>Available tools and technologies to monitor and evaluate environmental impact</td>
<td>Develop tools and databases which enable food manufacturers to calculate the environmental footprints of products at little to no cost. Coordinate a national approach to the reporting of environmental data in the food and beverage industry. Identify a suitable public sector or other agency to be responsible for the abovementioned tools and databases and their use. Engage with international initiatives relating to environmental assessment of food and beverages to ensure Australian practices are internationally compliant and that Australian agricultural and food manufacturing practices are not disadvantaged. Continue to advance the science of life cycle impact assessment to ensure that environmental metrics are environmentally meaningful. Raise food industry awareness of the use of environmental footprint data to mitigate risks, reduce costs, access new markets and seek competitive advantage.</td>
<td>Harmonised methodology and tools for environmental assessment of food and beverage products</td>
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<td><strong>Government, industry, consumers</strong></td>
<td>Reduced inefficiencies and waste throughout the food supply chain</td>
<td>Understand the quantity, quality and type of waste and food losses generated throughout the supply chain and identify opportunities for product and process innovation to reduce waste. Develop waste utilization processes and technologies to convert by-products and bring about successful interventions to add value to the waste generated. Provide government led dissemination of information on waste management. (incl. consumer, food service and packaging waste) to all stakeholders in the food supply chain, i.e.</td>
<td>Technologies, processes and products developed to reduce waste and maximise value-addition through the supply chain</td>
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a national food waste policy.

| Research providers, Consumers | Monitor impacts and identify opportunities presented by climate change on food (including nutritional) quality and consumer acceptance of food | Research breeding and cultivar selection to avoid negative and optimise positive responses in crops. Develop models that predict changes in food quality as a result of climate stress and the implementation of strategies such as alternate growing areas or agricultural practices to avoid negative effects. Adaptation of processing technologies to process non-traditional crops into value-added food accepted by consumers. | Climate impacts on quality requirements for processing (processor links to production – management and environment) for value-added food |

**Food safety – integrity and traceability**  
**Goal:** To improve understanding and management of food safety hazards through the supply chain and provide assurance to consumers and markets that Australia’s food is safe, while providing the foundation to grow markets

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<tr>
<td>Government, research providers, regulators</td>
<td>Available risk management research and a system to maintain Australia’s reputation and requirements for safe products</td>
<td>Target capacity building around trade sensitive hazards. Implement mechanisms to enable stronger R&amp;D participation in Codex processes led by DAFF Biosecurity/FSANZ.</td>
<td>Industry, along with trade officials, effectively meet export technical market access requirements that substantiate the relative safety of Australian products, while providing industry with a competitive advantage</td>
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<tr>
<td>Government, industry, regulators, research providers</td>
<td>Available strategic research capacity to respond to emerging threats (viruses, hazards, pathogens)</td>
<td>Integrate food safety considerations with industry R&amp;D and technology change. Establish a national food safety forum to support all priority actions.</td>
<td>Improved linkages and collaboration among industry, government and R&amp;D providers to strengthen capacity in food safety research</td>
</tr>
<tr>
<td>Government, industry, research providers</td>
<td>Reduced foodborne diseases; research focused on those with greatest impact on public health</td>
<td>Take a risk based approach to identify, prioritise and reduce food safety risks (Campylobacter and Salmonella) from the farm and through the supply chain. Identify emerging hazards (public health and threats to trade) and agree on specific priorities. Develop rapid virus, toxins and contaminants detection and management systems. Increase adoption of new practices that</td>
<td>An integrated approach for RD&amp;TT to reduce food safety hazards with major public health and/or market access impact</td>
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reduce levels of pathogens and other food safety hazards.

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<tr>
<th>Research providers, industry</th>
<th>Safety within the food supply chain; processing innovation</th>
<th>Identify opportunities for product/process innovation to reduce food safety risk. Improve preparedness and response to food safety incidents. Support rapid epidemiological traceback/attribution/virulence assessment. Develop tools to assist industry to assess food safety status (and reduce waste) and demonstrate equivalence. Validate potential interventions and impact assessments of regulation on risk.</th>
<th>Industry understanding of food safety status through their supply chains, especially when new and altered farm practices and technologies are introduced</th>
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<tr>
<td>Government, research providers</td>
<td>Bio-security risk management where it links to food safety for Australia</td>
<td>Increase interface and collaboration between food safety and biosecurity research and development to support one-Health.</td>
<td>Food safety R&amp;D inherent as part of biosecurity risk management</td>
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**Technology translation and adoption – barriers and mechanisms**

**Goal:** Efficient uptake of research outputs and awareness to commercialisation; people with the skills to connect science with business; and processes that facilitate learning, discovery and engagement

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<tr>
<td><strong>Government, research providers, industry</strong></td>
<td>Technology pushed to match market pull; the promotion of SME access to, and participation in, the innovation system</td>
<td>Establish a national food innovation network. Build partnerships and collaborations trans-nationally and across sectors based on understanding of value of technical innovation. Improve the translation of R&amp;D (domestics &amp; foreign) into successful products and processes (e.g. new packaging technologies).</td>
<td>Long term focus on: -Increased access to research capability, technologies and infrastructure for the food industry -Sustainable partnerships across public and private sectors -Building opportunities in domestic and export markets</td>
</tr>
<tr>
<td><strong>Government, industry, research providers</strong></td>
<td>Rapid information exchange; coordinated and focussed TT: Training, conferences, workshops, access to research</td>
<td>Increase the effective application of R&amp;D capacity to business problems and reducing the barriers for SMEs to use R&amp;D opportunities. Improve leadership in food manufacturing R&amp;D and build scale in Australian food and nutrition R&amp;D. Facilitate flow of information both ways along knowledge chain. Encourage full use of modern IT capability.</td>
<td>Strong institutions - skilled R&amp;D workforce, technicians and support - international level expertise in public and private sectors</td>
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<td><strong>Efficiently</strong></td>
<td>Establish systems to facilitate and manage</td>
<td>IP for Australia</td>
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Industry, research providers

delivered and responsive management of information

commercial sensitivities.

protected

Industry, research providers

Equitable risk and reward sharing across the supply chain

Enable access to new discoveries made overseas and build R&D capability to access and adapt these technologies across the whole supply chain.

Benefits to accrue to all members of the food value chain

Skills and training

Goal: Bridge the ‘people shortage’ (workforce and graduates) in skills and training based innovation

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<tr>
<td>Government, tertiary education, industry</td>
<td>Develop a national policy for skills and career paths in the food and nutrition RD&amp;TT system</td>
<td>Build career pathways for high performers in food and nutrition RD&amp;TT. Develop skills required for effective performance in multidisciplinary and cross-functional teams. Enable scientists to work with and be innovators. Support companies to leverage more effectively in-house capabilities, market intelligence and business networks (suppliers and instrument manufacturers) for innovation. Meet the skills and training needs of the post-farmgate food and nutrition RD&amp;TT system. Ensure succession planning in key capability areas. Enhance undergraduate and postgraduate training. Continue professional development for professionals in the system. Promote collaborative industry skills development. Promote and develop new ways of working. Ensure the availability of skills necessary to communicate health messages to consumers. (Not through broader food industry skills and training.)</td>
<td>People available with the skills required for the food industry’s R&amp;D and a critical mass of skilled researchers available to help prevent the current decline in food manufacturing</td>
</tr>
<tr>
<td>Government, industry, research providers</td>
<td>An industry/government capability gaps and needs assessment available; strategy implemented</td>
<td>Work with governments to contribute to policy development. Secure resources required to support agreed initiatives. Identify disciplinary capability gaps and strategies for filling them.</td>
<td>A workforce with the skills required for innovation and for an adapting food industry The ‘people gap’ in skills and training-based innovation</td>
</tr>
<tr>
<td>and reviewed</td>
<td>Ensure that companies have access to implementers. Provide professional training for the workforce to meet future food industry needs.</td>
<td>bridged</td>
<td>A guiding coalition to provide strategic coordination for stakeholder initiatives</td>
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RD&TT Resource Analysis

National Investment – Overview

Introduction
Total research and development investment in the post farmgate food and nutrition sector is estimated at $660 million, of which 60% is private sector with government expenditure at about $200 million. The major research investment is in the meat, dairy and grains industries.

A capability and capacity analysis of the RD&TT of the food and nutrition system was conducted and mapped against the National Food and Nutrition RD&TT Strategy priority and sub-priority areas. Information on R&D investment from government agencies (PISC, CSIRO), universities and medical research institutes (ARC and NHMRC grant program databases), and joint industry/government entities (RDCs and CRCs) through which R&D institutes and universities provide the human resource, was selected and analysed within the scope of this strategy.

Private Sector
National industry expenditure on food manufacturing industry R&D, including both levy funded industry research and private company research was about $428 million (Australian Bureau of Statistics (ABS) (2012)) in 2009/10, of which $2 million was spent on basic research, $29 million on strategic research, $123 million on applied research and $274 million on experimental development.

The meat, dairy and grains (bakery, flour milling and cereals) industries have the major investment in R&D. Meat and meat product processing spent $137 million on R&D in 2010/11, an increase of over 50% from $68 million in 2009/10; dairy product processing spent $106 million; flour mill and cereal food spent $50 million and bakery products spent $69 million. The total expenditure on research and development for the Australian processed food industry, including beverages and malt, was about $463 million for 2010/11 (DAFF 2011).

Public Sector
The RD&TT resource audit in 2009 indicated that the annual public sector R&D expenditure was $175m for post farmgate food and nutrition research. The contribution was from several government policy programs that provide support to the food industry in general and for RD&TT in particular. The public sector RD&TT capability is mostly held within CSIRO (31% of the estimated total public expenditure), state government research agencies (20%) and many universities and TAFE colleges (49%) (Food and nutrition RD&TT capability audit 2009).

The total university R&D investment in food science and nutrition and dietetics published in the Excellence in Research for Australia 2012 national report for 2008-2010 was $18.5m (ARC, 2012). One difficulty in trying to develop an audit of the RD&TT that supports food manufacturing and nutrition is that the ARC’s food science and nutrition and dietetics field of research (FoR) classification does not cover the extent and depth of research that is conducted for the food industry because much of the research programs involve other disciplines such as chemistry, materials science and other engineering disciplines. For example, only a very small proportion of the university research that is relevant to this strategy is tagged as food science and technology or nutrition. This is consistent with the view that the disciplines involved in the research needed by the food industry are diverse and it is the reason why the RD&TT audit carried out in 2012 mapped current research programs and activities against the R&D strategy priorities only.


**Mapping of investment against strategy R&D priorities**

The analysis for the Universities was based on individual current projects within the ARC and NHMRC databases that were within the scope of the strategy and relevant to the priority areas. RDC/CRC data was collated from a combination of current project information and their 2011-2012 annual reports for post farm research. CSIRO and state agencies analysis was based on project level data assigned to the relevant priority area that were focused on post farm food and nutrition research.

Databases and information given by the public sector was analysed at the project description level (to prevent double counting). Relevant projects were mapped onto the R&D priorities identified in this strategy. The Field of Research (FoR) and Socio-Economic Objective (SEO) associated with the project identified the science disciplines which were mapped to the strategy priorities and sub-priorities which formed the basis of the major, support and link responsibility matrix (see Appendix 8).

**Results - R&D Priorities**

The estimated total RD&TT investment in programs and activities that map to the Strategy priorities conducted in 2011/12 was about $200m, which is a similar figure to the public R&D investment of $175m indicated by the 2009 RD&TT audit.

It can be seen from Figure 6 that the combined RDC and CRC investment in research projects relevant to the National Food and Nutrition RD&TT Strategy is around $80 million, a proportion of which (particularly in the climate change and technology translation) is at the nexus between on-farm and post-farmgate research. CSIRO invests about $50 million in post-farmgate research. (This does not include investment to maintain pilot plant infra-structure). CSIRO’s total investment in research along the food value chain is approximately $337 million (appropriation and external revenue) annually, providing a systems approach from the farm to fork. The universities and institutes through their ARC and NHMRC grants invested about $45 million in projects that supported the Strategy’s R&D priorities. This is likely to be an underestimate of the R&D that is conducted by universities and institutes for the food industry because non grant research (e.g. research sponsored by companies) was not captured in the Audit. It was also difficult to capture all the state agencies investment in post-farm food research, and the estimate of $16m is likely to be slightly underestimated. The 2009 RD&TT audit estimated that universities and TAFE invested approximately $87m and the state agencies around $35 million in post farm food and nutrition research (Food and nutrition RD&TT capability audit 2009).

**Figure 6 Total investment of RDCs/CRCs, Universities and CSIRO against post farm research in the national food and nutrition priority areas**


The greatest investment against the strategy’s priorities (~$70 million) is in intersect between food, nutrition and health (figure 7), which includes food manufacturing and the impact of diet on health where it relates to maintenance of health and well being. Analysis of investment against the sub-priorities in this area (Figures 9-12 Appendix 6) indicated that most investment by all the key investors focused on food reformulation and food manufacturing, the substantiation of nutrition in food and promotion of healthier food and diets. Little investment is currently provided for understanding drivers of consumer demand for healthy food choices for Australia and the Asia-Pacific region and into the reasons why consumers do not always choose the healthier option (figure 12).

The audit data indicates that about $30 million investment was provided for food safety, which includes a component of biosecurity where it interfaces strongly with the food supply chain. Most of this research was supported through NHMRC grant projects. Key aspects of food safety that were supported include strategic research to respond to emerging threats and applied research to ensure the safety of food supply chains and to understand safety in relation to enabling process technologies, such as high pressure processing. There was lower investment (Figures 9-12 Appendix 6) in more strategic research to reduce the foodborne diseases that have the greatest impact on public health.

Just over $30 million in funding was distributed to climate change and resource efficiency research, which mostly focussed on improving efficiencies to utility of energy, water and raw materials during processing. It should also be noted that impact of climate change on food production is not covered in this strategy. Further analysis at sub-priority level (see Figures 9-12 Appendix 6) indicated that most of the investment was in researching the improvement and efficient use of natural resources inputs across the food processing system. Much of this research will have been driven by the food industry to reduce manufacturing costs (Lundin, et. al. 2010). A gap in research investment identified from this data was for research on reducing waste in the supply chain from post harvest to the
consumers. This has been identified as an issue across all the main commodity (grains, dairy and meat) supply chains (DIICCSRTE (2012)).

Technology translation was predominantly provided through projects invested by RDCs and CSIRO. It is likely that the state agencies also provide support to the food industry in technology translation through access to their pilot plant and analytical laboratories. A recent audit conducted by CSIRO, and Queensland DAFF indicated that about $1.5 million of near market technology translation and commercialisation projects are conducted through access to their infrastructure (internal communication). It should also be noted that the technology translation activities of the universities active in this area through their commercialisation groups has not been available.

Most investment in future markets are by the RDCs, which are the main industry peak bodies representing their primary commodity sectors and are obligated to support the sustainability and competitiveness of their industry sector. This is reflected in the almost $20 million the RDCs and CRCs invest in understanding future markets and access to them. The data at the sub-priority level (see Appendix 6) indicated that only a small amount of investment was focused on improving productivity for food manufacturing, public education and awareness of new technologies and in foresighting to identify future innovation needs for the food industry.

Training was conducted by all the public sector organisations, with the universities focusing on graduate training supported by fellowship grants and CSIRO-sponsored postdoctoral, PhD and master students. The RDCs/CRCs sponsored PhD and master students but their key focus was on workforce up-skilling and the development of career opportunities for workers in their industries.

**Figure 7 Research Investment against the national food and nutrition R&D priority areas**

The largest level of investment aligned to these strategy priorities was from the three biggest RDCs (Figure 8), which also represent the three largest food industry sectors of meat, dairy and grains. The proportion of investment by MLA for post-farmgate meat processing that supports this strategy was about $40m out of a total investment of $171 million during 2011/12, which included the expenditure of $92.4 million on marketing programs and $78.6 million on R&D programs (MLA 2012). The dairy investment totalled about $20 million for post-farmgate research across the strategy priorities. The total annual investment by Dairy Australia (DA) (2011/12) was approximately $53
million of which $33 million was invested in R&D across the dairy supply chain and nearly $20 million investment in industry services through their business groups (DA 2012). Dairy Australia subsidiary DIAL invested approximately $4.5 million in dairy processing innovation which included shelf life extension, resource efficiency, cultures and cultured products, milk quality and product formulation (DIAL 2012). The Geoffrey Gardiner Foundation (GGF) raised about $5 million in 2011/12, most of which was invested in R&D on-farm, community outreach and market outlook and information. Very little was invested post-farmgate (GGF, 2012). The Grains RDC invested about $150 million in R&D in 2011/12, most of which is focused on grain productivity through development of new plant varieties via large breeding programs (GRDC annual report 2012). The proportion of R&D focused on post-farmgate research is about 5% of the grains budget and relates mostly to the impact of climate change on the quality of the grains and the flow-on impact on milling and just off-farm processing.

**Figure 8** Specific investment of RDCS and CRCS relevant to the national food and nutrition R&D priorities and sub-priorities (2011-12)

![Bar chart showing specific investment of RDCS and CRCS relevant to the national food and nutrition R&D priorities and sub-priorities (2011-12).]

**Infrastructure**

The food industry is supported by a large and dispersed R&D infrastructure located primarily on the east coast of Australia with significant additional infrastructure to support nutrition and health in Adelaide. Table 6 (see Appendix 7) summarises the main centres or clusters of infrastructure currently servicing the food manufacturing industry and nutrition sector.
Discussion and analysis

Type of research

Australia has invested approximately $114 million (2011-12) on research to support food manufacture and nutrition, primarily through basic and strategic sciences and knowledge development conducted by CSIRO and Australian universities. This work has typically covered strategic research for food product and resource efficiency outcomes and research for consumer science, nutrition, and public good outcomes.

Nearer to market R&D for segments of the food supply chain were primarily invested by RDCs/CRCs and State agencies, and accounted for a combined investment of around $100 million. This effort was largely focussed on research for sector specific product and process outcomes, the greatest investment being in the areas of meat, dairy and grains. Sector-wide innovation and technology transfer support included teaching, training and skill development, market research and support and infrastructure.

Although there are significant limitations and gaps in the data, (e.g. it does not take into account TAFE and data from some State agencies is missing), it still provides a reasonable picture of the distribution of the total RD&TT effort that map against this Strategy’s R&D priorities. Analysis revealed that there was a strong degree of separation between strategic, applied and technology transfer research with only few organisations working across more than one area.

Overall, there is a significant public sector RD&TT effort nation-wide, but often it is without clear links to adoption by industry. The R&D organisations are also fragmented and there is only limited evidence of cooperation and collaboration at the institutional level.

Research disciplines for food and nutrition research

Much R&D in post-farmgate food manufacturing and nutrition is not carried out under the food science banner, nor indeed is the nutrition research categorised under nutrition and dietetics. Instead, research in these areas tends to fall under other core disciplines, such as chemistry, molecular biology, material science and chemical engineering. This indicates the complexity of the research challenges that food requires and the diversity of disciplines needed to address food industry challenges. This diversity also highlights the difficulty in identifying the research required to conduct food research, as well as the challenge to decide which research supports the food industry when considering the focus and boundaries of the science resources audit.

Within the university sector there has been a shift from food processing research and education to more general nutrition and public health areas, which are mostly done within medical or public health faculties. Nutrition research efforts are generally not well connected with food technology areas and linkages to the food industry are often unclear.

One effort to counteract this problem has been the 2011 appointment of the AFGC chair in food science and technology, Professor Melissa Fitzgerald, at the University of Queensland. This is a good example of the joint industry and public sector initiatives needed to drive interactions between the food industry and R&D in food research.

Future markets and Industry competitiveness

Most of the research in future markets is conducted by the industry representatives for their sectors and by individual companies who generally focus on current market intelligence or conduct market analysis for a particular product category of interest. Often their efforts are primarily based on historic data. Much less research has been conducted into the understanding of long term market
and consumer insight, which will allow more accurate prediction of future consumer trends and possible new market opportunities.

A number of initiatives have been developed to try to address the gap in understanding consumers and markets, particularly for the Asia-Pacific region. The National Food Innovation Precinct has been given the task of pulling together food companies to determine common challenges in developing new export markets in Asia for the Australian food industry. Some large multinational companies are also beginning to drive research in consumer and market insights. Kraft, for example, was awarded ARC Industrial Transformation Research Hub funding to build a state of the art virtual centre to conduct consumer insight research.

Analysis of capability resources also indicated that there was little research conducted to improve the productivity and competitiveness of food manufacturing, or on the implementation of mechanisms to identify future innovation and consumer demand for healthy food, i.e. foresighting. In the former case the expectation has been that the food industry would assume responsibility for increasing their productivity. Because SMEs form 98% of the Australian food industry and face difficult financial operating challenges, the industry has been driven to become fast followers of innovation, relying on translating technologies for use by their businesses rather than generating new innovation themselves. The capacity for these companies to innovate, as they strip their R&D assets to cut costs and try and increase their profits, has been reduced significantly.

**The intersect between food, nutrition and health**

The ability to innovate and develop new product and process technologies in food manufacturing to increase exports has been shown, by economic analysis conducted across the complete value chain (Borrell et al, 2012), to be a very effective way to return economic benefits to all in the food supply chain. Understanding the drivers of consumer demand for healthy food choices and consumer behaviour in the Asia-Pacific region will be a critical piece of research needed to provide direction for the food industry.

Research into the so-called ‘dining boom’ in the Asia Pacific region has identified an increasing demand for healthy bio-functional, safe food with clear provenance, and that provides more dietary protein. High level surveys indicate that Asian consumers are increasingly concerned about the environmental and social hazards and risks associated with certain agricultural and manufacturing practices. However, access to robust research data to support innovation in Australian product development, packaging, labelling, messaging is severely lacking.

New research focused on developing value-added packaged food for the Asian consumer that meets their demand for dietary protein that is healthy, tastes great and is convenient is desperately needed.

**Climate change and resource efficiency - sustainability**

A key area of research focus for improving resource efficiency and sustainability will be in the area of reducing waste throughout the food supply. Analysis of the data indicates this area is well below critical mass in the public sector. Companies have focused on reducing costs in their food processing, which may support reduction in waste. However, these efforts tend to be incremental changes and no large innovation has been delivered that could reduce costs by 50-60%, which for many companies is their objective. This has also been identified as a common challenge by the sectoral strategies (see next section), and it is an area that could be addressed as a cross-sectoral research challenge through this strategy.
Food safety – integrity and traceability

Food safety is an area of research that is non-negotiable and, while food safety is well covered between most of the public organisations, the data (Figures 9-12 Appendix 6) has highlighted that much less research occurs in delivering systems to maintain Australia’s reputation and safety requirements and to conduct strategic research to respond to emerging threats. The sectoral strategies and RDCs identified specific research challenges that were common to them and that were of national importance. These included food borne pathogens, both general and specific to the industry; development and implementation of best practise; development of a whole of supply chain approach to food safety; and a need for cross institute collaboration.

While food safety has been identified as a national priority, public investment in the area has been steadily decreasing. This decrease has been attributed to the high food safety standards that Australia currently enjoys, signalling a worrying complacency. In order to address the gaps in the research and capability that emerge from the resource analysis and are identified as common concerns by the industry sectors, there is now growing momentum to elevate the need for food safety research. As part of the recommendations made by the food safety priority group, a National Food Safety Forum chaired by Anne Astin has been launched, to bring together the key research organisations in food safety and the food industry to develop research initiatives to support broad food industry needs.

Technology translation and adoption – barriers and mechanisms

A significant national gap appears to be the lack of technology transfer support services, especially for SMEs. This could potentially be addressed by mechanisms to link TAFEs to State agencies, universities and CSIRO. However, food companies are not funding public sector research to develop new innovative food products or processing and there is a danger that much of the capability in public food research and infrastructure dedicated to food processing, e.g. pilot plant facilities, could be lost in Australia if not supported.

One mechanism by which these priorities could be undertaken is through the National Food Innovation Precinct where a close interface with food companies, particularly SME’s, through national research hubs will be developed. There is already new opportunity through the Industry Innovation Fund (launched July 2013) to bring companies together where they have a shared challenge and apply enabling technologies to solve nearer market challenges. Another opportunity could be through close alignment of a future CRC for manufactured food for export and the Food Precinct, which would ensure delivery of new innovation and technologies to food companies to help improve their competitiveness. This would build on the technology translation mechanism highlighted as an area needing increased support, especially around rapid information exchange where a more coordinated focus on technology translation and access to research is important.

Skills and Training

While it is clear that there is investment by the universities and CSIRO in food research training, particularly through support of PhD, Post Doctoral researchers, and Master Degree students, new graduates are not generally considered ‘industry-ready’ and there appears to be a gap in understanding what capabilities and skills are needed from them. The RDCs have a number of training programs for their industry sector to support up-skilling farmers and extension scientists but there is little investment in the up-skilling of the food manufacturing workforce. This has traditionally been a task left to the food companies themselves.
Implementation and change plan for strategy

The recommendations from this cross sector strategy for the Australian food manufacturing industry are informed by the six main themes arising from the critical review (SWOT) and the R&D resource analysis.

Recommendations and actions

1. Establish an implementation committee reporting to the PISC RD&E subcommittee, with membership from government and industry, to deliver the objectives of this strategy.

The steering committee proposed that formation of an implementation committee should involve, where possible, existing food industry support structures such as FIAL to oversee and to put in place the agreed recommendations of the Strategy.

While FIAL may form a core part of the strategy implementation it will be important that other organisations participate as members of the committee, which should consist of key senior managers from food manufacturing industry, RDCs, CSIRO and universities.

The Committee will provide strategic oversight and direction for implementation and further development of the Strategy and it is envisaged that a number of steps will need to be taken to prioritise the recommendations and decide on which priorities to deliver first.

The implementation and change plan associated with the recommendations given will need further discussion and development through the implementation phase.

Key Features of the implementation plan must include:
   • Governance
   • A communication plan
   • A strong industry and government engagement strategy
   • Commitments to contribute to the implementation of the strategy through the major/support/link responsibility matrix (Tables 7 and 8, Appendix 8).

2. Have FIAL represented on the committee and integrate its capacity to link businesses and bring industry, researchers and governments together to solve industry problems and capture opportunities for export into Asia. This will include training and the development of relevant skills for the food and nutrition sector, and will build capability by establishing a capability and infrastructure plan.

Some of the activities and tasks associated with implementation of the recommendations could potentially be undertaken by entities such as FIAL, the AIFST forum, the National Food Safety RD&E Forum and the Food Industry Solutions Centre, all of which have goals and objectives that can potentially support a number of the recommendations given in this strategy.

Part of the implementation activities will be to define the level of investment and the level of R&D that should be conducted in each priority area, and the development of delivery mechanisms through the major, support, link responsibility matrix (Tables 7 and 8, Appendix 8).
3 Establish a national food safety forum to develop food safety systems that maintain Australia’s reputation and safety requirements, conduct strategic research to respond to emerging threats, and support market access to the Asian Region.

The focus for the National Food Safety RD&E Forum which was launched in June 2013 (Anne M Astin report, 2013) includes:

- Emerging food safety risks
- The alignment of strategic research capabilities to manage current and future needs of industry, government and consumers
- Improved integration of research capability to leverage investment by industry and government
- The sharing of data and knowledge to enhance food safety capability, policy development and risk management.

4 Build a national nutrition partnership (industry-government-academic nutrition and health platform) to facilitate a regional approach to priority setting and the delivery of outcomes for the industry, to contribute healthy dietary intakes for the Asia-Pacific region.

Involvement of the Department of Health and Ageing in the development of this partnership will support engagement for the national food and health dialogue, and the formation of close links with established health and nutrition hubs, such as the South Australian Health and Medical Research Institute (SAMHRI).

5 Convene an annual food industry forum to review and refresh the National Food and Nutrition strategy and RD&T priorities, guide research and provide future leadership, vision and planning for the Australian food and nutrition sector.

Potentially to be delivered through FIAL as the key strategic partner, the food industry forum will aim to:

- Strengthen business to business links
- Help Australian businesses to efficiently export to Asia by developing Asian consumer insights capability
- Accelerate and enhance the development capability of food businesses through training, improved networking and collaboration
- Improve connections with regional Australia.

A key aspect of the implementation phase of this strategy will be to determine how the food industry should move to increase the level of value-added products for export and not just commodity products.

The Future

The food industry in Australia will be transformed so that by 2030:

1. Australia will have regionally (local and Asia-Pacific) competitive food manufacturing
2. The industry, its composition, key statistics and key performance indicators (KPIs) will be more transparent to stakeholders providing a sound basis for the development of coherent and cogent government policy supported by science and technology
3. Consumers will make educated food choices, improve their wellbeing and reduce diet related health issues
4. More parts of the Australian processed food sector, especially SMEs, will be actively and profitably engaged in R&D
5. There will be investment in the workforce so that the relevant skills are developed to match future food industry technical needs
6. There will be sufficient investment in education (Schools, VET, universities) so that food research attracts top graduates and promotes careers in the food industry.

These goals reflect the key steps determining success for a profitable and sustainable Australian food industry. This Strategy aims to promote a more coherent approach to research and innovation in Australia to support and meet the emerging needs of the region (Asia-Pacific) and the world through:

1. Increased value-added high-protein, healthier foods available for a growingly affluent Asian population (given Australia’s strong comparative advantage, achieving export demand growth greater than 4% is a credible possibility)
2. A well-developed knowledge provenance, governance integrity, and regulatory framework
3. Food processing adapted to climate change – security of food supply
4. Exported R&D expertise from Australia to support capacity building in Australia and the Asia-Pacific region.

Concluding Remarks
Food and nutrition research and innovation in value-added products and manufacturing technologies for the Asian-Pacific region presents both opportunities and challenges for the food industry, government and the jurisdictions. The National Food and Nutrition RD&TT Strategy highlights the opportunities for public research agencies and other stakeholders to work together on common issues, share available knowledge, and build capacity among their stakeholders to make the best possible decisions.

State agencies, RDCs, CSIRO and tertiary education have different knowledge gaps and research priorities. However, there are significant opportunities for these organisations to work together to reduce research duplication and increase the coordination of research investment. There are also opportunities to share knowledge and experiences across food industry sectors on the six strategic priority areas identified in the strategy, and to build on the work that has already been done in Australia and internationally.

To ensure the resiliency of the Australian food industry, the food industry and R&D providers must take into account the interrelationships between the six areas of investment presented in the research strategy.

These areas provide a significant opportunity for collaboration between the rural RDCs, CSIRO, Commonwealth and State government agencies, universities and food companies to address issues of significant common interest, particularly in regard to research market and consumer insight research; linking innovative products to health and wellbeing for consumers; increasing sustainability in food manufacturing; and providing stakeholders with access to enabling technologies, food process infrastructure and training.

The National Food and Nutrition RD&TT Strategy development process has established new relationships and strengthened existing ones among industry stakeholders, Commonwealth and State agencies and research organisations. It has begun the process of building momentum for these various entities to work together to address food and nutrition challenges. These relationships must
be maintained and developed so that information and the lessons learned from the research strategy continues to be shared and joint research is undertaken to address knowledge gaps.

Organisations with responsibility and interest in the success of Australia’s food and nutrition industries must act on this research strategy to ensure that their stakeholders are best equipped to deal with new and increasing opportunities and challenges for food manufacturing and the potential for enormous growth in the export market over the next twenty years.
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**Further reading**

3. “National Strategic Rural Research and Development Investment Plan (Draft)”, RRDC.
5. “Rural Research and Development Corporations” (Draft), Sept 2010, Productivity Commission.
Appendices

Appendix 1: Glossary

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ABARE</td>
<td>Australian Bureau of Agricultural and Resource Economics</td>
</tr>
<tr>
<td>ABS</td>
<td>Australian Bureau of Statistics</td>
</tr>
<tr>
<td>ACDA</td>
<td>Australian Council of Deans of Agriculture</td>
</tr>
<tr>
<td>AECL</td>
<td>Australian Egg Corporation Ltd</td>
</tr>
<tr>
<td>AFGC</td>
<td>Australian Food and Grocery Council</td>
</tr>
<tr>
<td>AIFST</td>
<td>Australian Institute of Food Science and Technology</td>
</tr>
<tr>
<td>AMPC</td>
<td>Australian Meat Processor Corporation</td>
</tr>
<tr>
<td>ANSTO</td>
<td>Australian Nuclear Science and Technology Organisation</td>
</tr>
<tr>
<td>APEC</td>
<td>Asia-Pacific Economic Cooperation</td>
</tr>
<tr>
<td>ARC</td>
<td>Australian Research Council</td>
</tr>
<tr>
<td>ASQ</td>
<td>Agri-Science Queensland</td>
</tr>
<tr>
<td>BQ</td>
<td>Biosecurity Queensland</td>
</tr>
<tr>
<td>CIE</td>
<td>Centre for International Economics</td>
</tr>
<tr>
<td>CIF</td>
<td>cost-insurance-freight (calculation)</td>
</tr>
<tr>
<td>CFI</td>
<td>Centre for Food Innovation</td>
</tr>
<tr>
<td>CRCs</td>
<td>Cooperative Research Centres</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific and Industrial Research Organisation</td>
</tr>
<tr>
<td>DA</td>
<td>Dairy Australia</td>
</tr>
<tr>
<td>DAFF</td>
<td>Department of Agriculture, Forestry and Fisheries</td>
</tr>
<tr>
<td>DAFWA</td>
<td>Department of Agriculture and Food, Western Australia</td>
</tr>
<tr>
<td>DBI</td>
<td>Department of Business and Innovation (Victoria)</td>
</tr>
<tr>
<td>DEPI</td>
<td>Department of Environment and Primary Industries Victoria</td>
</tr>
<tr>
<td>DIAL</td>
<td>Dairy Innovation Australia Limited</td>
</tr>
<tr>
<td>DIICCSRTE</td>
<td>Department of Industry, Innovation, Climate Change Science, Research and Tertiary Education</td>
</tr>
<tr>
<td>DOHA</td>
<td>Department of Health and Ageing</td>
</tr>
<tr>
<td>DSTO</td>
<td>Defence Science and Technology Organisation</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation</td>
</tr>
<tr>
<td>FIAL</td>
<td>Food Innovation Australia Limited</td>
</tr>
<tr>
<td>FoR</td>
<td>Field of Research (ARC classification)</td>
</tr>
<tr>
<td>FRDC</td>
<td>Fisheries Research and Development Corporation</td>
</tr>
<tr>
<td>FSANZ</td>
<td>Food Standards Australian and New Zealand</td>
</tr>
<tr>
<td>FSC</td>
<td>Food Safety Centre</td>
</tr>
<tr>
<td>FTEs</td>
<td>Full time equivalents</td>
</tr>
<tr>
<td>GAP</td>
<td>Graduate Access Program</td>
</tr>
<tr>
<td>GGF</td>
<td>Geoffrey Gardner Foundation</td>
</tr>
<tr>
<td>GMO</td>
<td>Genetically modified organisms</td>
</tr>
<tr>
<td>GRDC</td>
<td>Grains Research and Development Corporation</td>
</tr>
<tr>
<td>HAL</td>
<td>Horticulture Australia</td>
</tr>
<tr>
<td>IFST</td>
<td>Innovative Food Solutions and Technologies</td>
</tr>
<tr>
<td>IGD</td>
<td>Institute of Grocery Distribution</td>
</tr>
<tr>
<td>ITRP</td>
<td>Industrial Transformation Research Program</td>
</tr>
<tr>
<td>KPI</td>
<td>key performance indicator</td>
</tr>
<tr>
<td>MLA</td>
<td>Meat and Livestock Australia</td>
</tr>
<tr>
<td>MTIC</td>
<td>Manufacturing Technology Innovation Centre</td>
</tr>
<tr>
<td>NFIHN</td>
<td>National Food Innovation Hub/Network</td>
</tr>
<tr>
<td>NHMRC</td>
<td>National Health and Medical Research Council</td>
</tr>
<tr>
<td>NMI</td>
<td>National Measurement Institute</td>
</tr>
<tr>
<td>NSW Industry</td>
<td>Department of Primary Industries, New South Wales</td>
</tr>
<tr>
<td>PICSE</td>
<td>Primary Industry Centre for Science Education</td>
</tr>
<tr>
<td>PIMC</td>
<td>Primary Industries Ministerial Council</td>
</tr>
</tbody>
</table>
Appendix 2: List of forum attendees

Alan Barclay (GI symbol); Alan Davey (RIRDC); Alison Saunders (RIRDC); Andrew Barber (SARDI); Andrew Pointon (SARDI); Ann Bray (DIICCSRTE); Annette Sugden (SRDC); Ingrid Appelqvist (CSIRO); Bianca Cairns (SRDC); Bob Gibson (Adelaide Uni); Brad Ridoutt (CSIRO); Bryan McGoldrick (Angliss); Callum Elder (Simplot); Catherine Barnett (FoodSA); Christine Pitt (MLA); Martin Cole (CSIRO); Craig Burns (RIRDC); Crispian Ashby (FRDC); Darren Atkinson (DIICCSRTE); Darryl D’Souza (Australian Pork); Dave Alden (RIRDC); David Moore (HAL); David Poulson (DAFF QLD); Ethne Cahill (DA); Enzo Allara (TPQ); Michael Eyles(AIFST, CSIRO); Fahri Fahri (AMPC); Geoffrey Annison (AFGC); Graeme Richardson (DTS food Labs); Heather Channon (Australian Pork) ; Holger Meinke (UTAS); Ian Alwill (NESTLE); Ian Mitchell (DA); Isabel MacNeill (DA); Jacinta McDonald (DOHA); James Kellaway (AED); Janet Quigley (DOHA); Jeremy Cook (DAFF); Jo-anne Ruscoe (FRDC); John Bartlett (UWS); John Carragher (Adelaide Uni); John Harvey(GRDC); John Wilson (FRDC); Julie Bird (RIRDC); Keith Pitts (DAFWA); Leecia Angus (GRDC); Lesley MacLeod (DIAL); Lynne Cobiac (CSIRO); Mani Iyer (DA); Margaret Darton (DEPI); Mark Tamplin (UTAS); Megan Cobcroft (Unilever); Michelle Edge (AMPC); Mike Gidley (UQ); Mohan Singh (Melbourne Uni); Neil van Buuren (DA); Nick Hazell (PepsiCo); Pam Longstaff (GI symbol); Pat Blackall (UQ); Patrick Hone (FRDC); Peter Horvat (FRDC); Phil Franks (MLA); Philippa Lorimer (HAL); Ragini Wheatcroft (DEPI); Rick Roush (Melbourne Uni); Robert Solomon (DAFF); Rod Coogan (MLA); Roger Bektash (Mars); Russell Dean (DIICCSRTE); Sam Nelson (RIRDC); Scott Seaman (NSW gov); Svetlana Rodgers; Alexandra Thompson (CSIRO); Ulrich Diekmann (NMI); Vince Logan (GRDC); Vincent Fernandes (GRDC); Yelli Kruger (AECL); Zoltan Lukacs (GRDC).
Appendix 3: Common features between the sectoral RD&E strategies

Several jurisdictions have food strategies that reach beyond primary production and processing, however, the investment objectives of these strategies and the extent of post farm value chain R&D are variable across the jurisdictions.

A qualitative analysis was conducted to identify the common themes of the national primary industries sectoral strategies and to find research areas that align and interface with the R&D priorities identified in this strategy. The main points identified across the various strategies were:

A number of priorities were common to most if not all of the industry sectors. These were:

Consumers and Global markets (wine, grains, aquatic fisheries, horticulture, beef and sheepmeat, sugarcane)
- developing new export markets
- credence values or authentication of products
- demonstrably environmentally sustainable sources
- understanding the consumer and consumer markets.

Eating and Nutritional Quality (sheepmeat, beef, pork, fisheries, grains and horticulture)
- enhancing capacity to deliver nutrients and nutritional value
- improving health and wellbeing of Australian communities
- improving eating quality and nutrition.

Supply/value chain productivity and efficiency (new emerging industries, sugar cane, wine, grains, aquatic fisheries, poultry, pork, beef and sheepmeat)
- improving supply chain integration and efficiencies
- innovative processing and manufacturing
- integration of whole supply chain e.g. production - manufacturing – strategic logistics and packaging – marketing.

Climate change and resource constraints (wine, sugarcane, grains, forestry, horticulture, aquatic fisheries, poultry, beef and sheepmeat, pork and dairy)
- green house gas emissions
- environmental impact
- competition, access to and sustainability of natural resources (water, pastures, land, fish, forests etc)
- extreme climate (flooding, drought, heatwaves and bushfires)
- adaptive capacity to cope with climate change
- productivity.

Food safety (sheepmeat, Beef, Poultry, pork and fisheries)
- food borne pathogens both general and specific to the industry
- best practise
- whole of supply chain approach
- cross institute collaboration required.

Biosecurity (poultry, fisheries, pork, horticulture, wine, sugarcane, beef and sheepmeat)
- pest organisms
- chemical and biological contaminants
- flock health and disease
- animal welfare.

**Biodiversity** (fisheries, forestry, wine, horticulture, sugarcane, grains, new emerging industries)
- diverse ecosystems
- variety development
- biotechnology – GMO, Nanotechnology policy.

**People, skills and training** (all primary industry sectors)
- succession planning
- training of people for the industry sector
- enhancing the development and retention of appropriate human resources, skills and knowledge
- access to R&D facilities and infrastructure
- leverage of international R&D through formal linkages
- collaborative research programs to provide better access to international developments
- R&D programs with critical mass rather than projects.

**Appendix 4: Food and Nutrition stakeholders SWOT consultation**

**Table 2 SWOT analysis of the current food and nutrition system**

<table>
<thead>
<tr>
<th>STRENGTHS</th>
<th>WEAKNESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong agricultural base</td>
<td>Low value add to agricultural exports</td>
</tr>
<tr>
<td>Long history of food exporting</td>
<td>Strain on non-sustainable resources</td>
</tr>
<tr>
<td>Clean green image</td>
<td>Lack of domestic scale</td>
</tr>
<tr>
<td>Quality, food safety and bio-security systems</td>
<td>Lack of Australian vision and leadership</td>
</tr>
<tr>
<td>Proximity to Asian markets</td>
<td>Poor coordination of governmental approach</td>
</tr>
<tr>
<td>Liberal trade policy</td>
<td>Slow pace of regulatory change</td>
</tr>
<tr>
<td>R&amp;D tax incentive</td>
<td>Lack of market intelligence</td>
</tr>
<tr>
<td>High level of literacy and education</td>
<td>Food courses declining, low image of food careers</td>
</tr>
<tr>
<td>Australia’s ethnic diversity</td>
<td>Low level of food R&amp;D investment including sponsoring of students by industry</td>
</tr>
<tr>
<td>Strong research capability, CSIRO, Universities etc.</td>
<td>Private sector not building skills base</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian demand for protein and processed food</td>
<td>Generic lack of focus on consumer insight and new market opportunities</td>
</tr>
<tr>
<td>Value-added healthy foods for export</td>
<td>Food imports trending upwards due to high Australian dollar</td>
</tr>
<tr>
<td>Improve industry productivity</td>
<td>Cost of raw materials, energy, water and waste management</td>
</tr>
<tr>
<td>Reinforce safety and bio-security culture</td>
<td>Supermarket duopoly power, price wars and private label reducing innovation</td>
</tr>
<tr>
<td>Food chain waste reduction and resource efficiency</td>
<td>Labour scarcity in food industry</td>
</tr>
<tr>
<td>Integrated government and state strategies for food, nutrition and investment</td>
<td>Food policy and regulations impact on innovation products in retail market</td>
</tr>
<tr>
<td>Improve efficiency and coordination of research system and government inputs</td>
<td>Aging of farmer population</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Consumer education to increase acceptance of new technologies</td>
<td>Fear of emerging technologies undermining investment in those technologies</td>
</tr>
<tr>
<td>Encourage SME innovation (Innovation network)</td>
<td></td>
</tr>
<tr>
<td>Centres of excellence-food, science and nutrition</td>
<td></td>
</tr>
<tr>
<td>Promote food science and agricultural education by engaging education stakeholders (schools, VET and Universities) to promote careers in the food industry</td>
<td></td>
</tr>
<tr>
<td>High dollar positive for capital investment</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 5: Intersect between sectoral and cross-sectoral priorities and the national food and nutrition priority areas

A number of sectoral and cross-sectoral strategies interface strongly with four of the strategic cross-cutting priorities: Food safety, integrity and traceability; People, Skills and training for the food industry; Effective technology transfer mechanisms; and Climate change, and resource constraints.

These priority areas were identified as key R&D challenges by the primary industry sectors, although their focus is on how the priorities apply to on-farm production systems. The greatest potential interface between sector strategies and the National Food and Nutrition RD&TT Strategy are in the following areas:

**Food safety, integrity and traceability**
Analysis of issues and specific concerns of food safety across a number of the primary industry sectors (captured under a range of headings such as food safety, biosecurity, supply chain efficiency and biotechnology) are given below against the RD&TT priorities identified in the food safety strategic priority area:

<table>
<thead>
<tr>
<th>Table 3 Food safety, integrity and traceability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing R&amp;D to support improved access to fit for purpose food safety mitigation for the various Australian industry sectors</td>
</tr>
<tr>
<td>Enhancing knowledge of pests and diseases of commercial consequence to reduce impacts on sector businesses and the environment</td>
</tr>
<tr>
<td>Understanding attitudes and responses of industry (industry activities, goods transportation and tourism etc.) to translocation threats</td>
</tr>
<tr>
<td>A need to share food safety information across the industry sectors and adopt best practice</td>
</tr>
<tr>
<td>Compliance around registration of essential chemicals; regulatory approvals for import/export products; Identifying regulatory regimes and market barriers, and enhancing the ability of industry to meet safety standards</td>
</tr>
<tr>
<td>Developing capability, technology and processes to detect, prevent and respond to animal health pathogens and to minimise risks through translocation.</td>
</tr>
</tbody>
</table>

While food safety priorities were not always highlighted in some of the sectoral strategies, it is clear that the common issues given are probably shared by all the primary industries and that these issues are closely related to the National Food and Nutrition RD&TT Strategy's food safety priorities and provide an opportunity to build a whole of food chain approach to food safety.

**People, Skills and Training**
The lack of well trained people (e.g. capacity and succession planning) was given top priority by the primary sectors to build a competitive and resilient future. An analysis of the key complimentary points and actions identified in the sector strategies are mapped against the skills and training priorities for the National Food and Nutrition RD&TT Strategy.

<table>
<thead>
<tr>
<th>Table 4 People, Skills and Training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing opportunities in government research organisations for young agricultural science graduates</td>
</tr>
<tr>
<td>Increasing the people impetus for growth/capacity. Aggressively developing the options for education and training in industry (including scholarships and secondments) to produce ‘industry ready’ workers</td>
</tr>
<tr>
<td>Understanding and identifying opportunities to meet regional workforce needs, including attraction and retention of required technical, managerial, professional, semi-skilled and scientific capability</td>
</tr>
<tr>
<td>Developing and building leadership skills and capability across all disciplines</td>
</tr>
<tr>
<td>Increase and improve succession planning and career pathways for key people (scientists, technicians,</td>
</tr>
</tbody>
</table>

57
advisors and consultants) in the primary sectors.

Creating multi-disciplined teams to tackle specific high-priority issues for industry

Planning the education and training of future discipline and technology expertise to address the needs of the primary industries.

**Effective technology transfer (translation and adoption) mechanisms**

Technology transfer and adoption of research outcomes was a common theme in the sectoral strategies and was often incorporated as part of the skills and training needs to be developed within the industry sector. Key points made and actions identified within a number of the industry sector strategies are highlighted below and mapped against complimentary priorities in our strategy.

**Table 5 Technology Transfer**

<table>
<thead>
<tr>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enhance the critical mass of investment and resource utilisation to better deliver RD&amp;E outcomes</td>
</tr>
<tr>
<td>Strengthen the coordination and planning of RD&amp;E capacity and capability at the national level to address national sector priorities</td>
</tr>
<tr>
<td>Identify and understand factors that drive responsiveness or adoption of new practices and innovation and how these can be influenced</td>
</tr>
<tr>
<td>Enhance collaboration between all R,D&amp;E providers to deliver better outcomes to stakeholders</td>
</tr>
<tr>
<td>Ensure that RD&amp;E findings and opportunities are used effectively by developing extension programs to communicate R&amp;D findings to research users, policy makers and the broader community</td>
</tr>
<tr>
<td>Build skills and networks that support increased knowledge transfer and R&amp;D adoption</td>
</tr>
</tbody>
</table>

**Climate change and resource constraints**

The National Climate Change Research Strategy was developed to ensure that all primary industry sectors can adapt and manage climate change effectively and cope with the challenges and opportunities climate change presents. The Climate Change Strategy for Australian primary industries addresses climate change and variability; greenhouse gas emissions, mitigation, sequestration, accounting and trading; climate change adaptation; energy use and generation; and the policy, biophysical, economic and social consequences for agriculture, fisheries and forestry sectors, industries and their dependent communities. In recognition of this, the research strategy has been closely aligned to the challenges that primary production faces and does not specifically address the impact of climate change on post-farmgate food processing and manufacturing. The desired outcomes for the next five years that the strategy focuses on for the primary industry sector are:

1. Production systems based on best-available climate information
2. The lowering of greenhouse gas emissions intensity of products
3. Proactive participation in a carbon constrained economy.

Most closely aligned with our post-farmgate priorities for climate change and resource efficiency is the sub theme identified under the strategy’s Outcome 2: Managing energy use and generation along the value chain. This aligns with our priority to ‘develop technologies and ‘know-how’ to more efficiently use natural resources (water and energy) and inputs in Australia’s food processing and retail chain’, and provides a great opportunity to develop a cross-sectoral approach in adapting the post-farmgate food manufacturing industry and building on the cross-sectoral on-farm strategic priorities in lowering green house gas emissions and resource usage.
Appendix 6: Resource analysis at sub priority level

Figure 9 RDC R&D mapped against the sub-priorities for 2011-12 ($Million)

Figure 10 CSIRO R&D mapped against the sub-priorities for 2011-2012 ($million)

AAHL: Australian Animal Health Laboratory
Food portfolio: Animal, Food and Health Sciences portfolio (excluding AAHL)
SAF: Sustainable Agriculture Flagship
P Health: Preventative Health Flagship
FFF: Food Futures Flagship
Figure 11 University ARC and NHMRC projects relevant to the National Food & Nutrition RD&TT Strategy by sub-priority (2011-12)

Figure 12 Total investment of R&D mapped to the national food and nutrition R&D sub-priorities 2011-12

FM = Future markets and industry competitiveness
FN&H = The intersect between food, nutrition and health
CC&S = Climate change and resource efficiency – sustainability
FS = Food safety – integrity and traceability
TT = Technology translation and adoption – barriers and mechanisms
S&T = Skills and training
## Appendix 7: National Infrastructure

<table>
<thead>
<tr>
<th>Table 6 Distinctive Infrastructure</th>
<th>Organisation</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilot plants and processing laboratories</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extensive pilot plants (molecule - kg)</td>
<td>CSIRO</td>
<td>Brisbane, Melbourne</td>
</tr>
<tr>
<td>Small pilot scale processing equipment</td>
<td>University of Queensland</td>
<td>Brisbane</td>
</tr>
<tr>
<td>Extensive pilot plant</td>
<td>DAFFQ</td>
<td>Brisbane</td>
</tr>
<tr>
<td>Fermentation lab (micro to pilot scale)</td>
<td>Provisor</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Brewing plant</td>
<td>SARDI</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Distilling plant</td>
<td>SARDI</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Malting pilot plant</td>
<td>Edith Cowan University (ECU)</td>
<td>Perth</td>
</tr>
<tr>
<td>Cheesemaking facility</td>
<td>SARDI</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Ultra High Temperature processing units</td>
<td>University of Newcastle, University of Western Sydney</td>
<td>Newcastle, Sydney</td>
</tr>
<tr>
<td>Food Technology laboratory</td>
<td>DAFFQ</td>
<td>Brisbane</td>
</tr>
<tr>
<td>Live seafood laboratory</td>
<td>DAFFQ</td>
<td>Brisbane</td>
</tr>
<tr>
<td>Pilot facilities for training and product development, bakery, confectionary</td>
<td>William Angliss TAFE</td>
<td>Melbourne</td>
</tr>
<tr>
<td>Horsham Grains Innovation Park (Small scale grain quality testing instrumentation and laboratory; FACE- Free Air Carbon dioxide Enrichment (FACE) array - for assessing quality under higher carbon dioxide field conditions),</td>
<td>DEPI Vic</td>
<td>Horsham</td>
</tr>
<tr>
<td>Agribio – Bundoora (molecular technologies for crop protection, soil health, quality, pre-breeding and structure function analysis at molecular scale)</td>
<td>DEPI Vic</td>
<td>Bundoora</td>
</tr>
<tr>
<td>Hamilton and Attwood (Red meat innovation centre - quality testing lab. facilities to support on farm trials)</td>
<td>DEPI Vic</td>
<td>Hamilton, Attwood</td>
</tr>
<tr>
<td>Ellinbank (Laboratory and paddock and field facilities to support GHG abatement and mitigation)</td>
<td>DEPI Vic</td>
<td>Ellinbank</td>
</tr>
<tr>
<td>Ration packs, freeze-drying production line</td>
<td>DSTO</td>
<td>Scottsdale, Tasmania</td>
</tr>
<tr>
<td>Food and grain drying equipment</td>
<td>University of NSW</td>
<td>Sydney</td>
</tr>
<tr>
<td>ISO 9001 accredited Whole grain assessment, micromalting, milling, test baking, yellow alkaline noodle evaluation facilities</td>
<td>DAFFQ</td>
<td>Toowoomba</td>
</tr>
<tr>
<td>NATA Accredited Microbiological Food Safety Lab</td>
<td>DAFFQ</td>
<td>Cairns</td>
</tr>
<tr>
<td>Non-invasive pre-processing and in-line assessment technologies facility</td>
<td>DAFFQ/James Cook University</td>
<td>Cairns</td>
</tr>
<tr>
<td><strong>Human and animal studies facilities</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consumer/Sensory Laboratory and Focus Group</td>
<td>DAFFQ</td>
<td>Brisbane</td>
</tr>
<tr>
<td><strong>Units</strong></td>
<td><strong>University</strong></td>
<td><strong>City</strong></td>
</tr>
<tr>
<td>------------------------------------------------------------------------------</td>
<td>----------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Sensory evaluation laboratory and booths</td>
<td>University of NSW, CSIRO, Uni SA, TAFE SA, SARDI</td>
<td>Sydney, Adelaide</td>
</tr>
<tr>
<td>Product development kitchen</td>
<td>SARDI, TAFE SA</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Food-based clinical labs for human trials</td>
<td>University of Wollongong</td>
<td>Wollongong</td>
</tr>
<tr>
<td>Human Clinic</td>
<td>CSIRO</td>
<td>Adelaide Flinders</td>
</tr>
<tr>
<td>Large scale clinical lab for human trials</td>
<td>Adelaide University</td>
<td>Adelaide</td>
</tr>
<tr>
<td>Animal house</td>
<td>Flinders University, CSIRO</td>
<td>Adelaide, Sydney</td>
</tr>
</tbody>
</table>

**Nutrition and Health facilities**

The world class research facility will house up to 675 researchers and will be developing innovation and improvements in health services.

Nutrition substantiation, glycaemic measurement equipment and nutrigenomics laboratories: CSIRO, Adelaide

**Analytical Facilities**

National centre for durum wheat and pasta lab: NSW Trade and Investment, Tamworth

Synchrotron, accelerator and neutron scattering Facility: Australian Synchrotron, Melbourne

Rheology and polymer testing lab: RMIT University, Melbourne

Flavour analysis lab: University of NSW, Sydney

Lipid analysis lab: Adelaide University, Adelaide

Packaging stability lab: University of NSW, Sydney

Sustainable packaging systems lab: Victoria University, Melbourne

Neutron scattering instrumentation facility: ANSTO, Sydney

Chemical, nutritional, microbiological instrumentation laboratories: NMI, Sydney, Melbourne

Food safety microbiology and genomics research lab: University of Tasmania, Tasmania

Pilot flour milling and baking facilities: Grain Growers, Sydney

Australian Export Grains Innovation Centre (AEGIC), with capability for grain quality, grain economic analysis, market intelligence, grain quality genetics, processing and product functionality, and storage and product integrity: DAFWA, GRDC, Perth, WA

Food testing laboratory: DTS Food laboratories, Kensington, Vic

National Association of Testing Authorities labs: Food Laboratories Australia, Abbotsford, Vic

Spectroscopic rapid analytical laboratory: The Australian wine research institute, South Australia

Fully equipped training kitchens and bakeries, Coffee Academy, Wine sensory evaluation centre, meat processing rooms, Confectionery training centre: William Angliss Institute of TAFE, Melbourne

Bakery test kitchens: Box Hill Institute of TAFE, Box Hill, Vic

Dairy processing facilities (UHT, dryers, sterilisers): Shepparton TAFE, Shepparton, Vic
Appendix 8: Major –support and link responsibility framework

As part of the implementation phase of this strategy under the PISC RD&E major –support and link framework, analysis of current research projects being funded in Universities and CSIRO, RDCs/CRCs and funding agencies, ARC and NHMRC have been captured and been mapped to the priorities.

The analysis for the Universities were based on the ARC and NHMRC databases of individual current projects (i.e. mined at project description level), assessed to be within the scope of the strategy (that is post-farmgate food and nutrition research) and relevant to the six RD&TT priorities.

The R&D pertinent to the National Food and Nutrition RD&TT Strategy was selected using both the field of research (FoR) and the socio-economic objective (SEO) cited for the University projects that were within scope of the strategy. The university projects were mapped to the strategy sub-priorities and their codes aligned to each priority to indicate the science disciplines that were most relevant to supporting the strategy RD&TT priorities. These formed the basis of the major, support and link responsibility matrix that is under development (See below).

Through the PISC National RD&E Framework, broad definitions were developed to describe the roles of individual governments (including States, Territories, and Commonwealth) in the development and implementation of sector strategies:

1 Major: Take a lead role by providing significant R&D effort through maintenance of capability and leadership to deliver national R&D outcomes.

2 Support: Contribute R&D in partnership but major effort will fall within another State or agency.

3 Link: Undertake little or no R&D, but access information and resources from other States or agencies.

To help clarify the interpretation of Major, Support and Link roles, the following criteria have been developed:

Major

An organisation with a Major role will be committed to maintaining a critical mass of skills, expertise and infrastructure required to deliver R&D to address national priorities subject to the maintenance of agreed co-investment arrangements with GRDC and/or other industry partners.

The organisations with a major role will commit to resourcing the flow of research information to Support and Link organisations and technology adoption providers for their use in promoting adoption of research outputs.

Major organisations will collaborate in national RD&E initiatives and be prepared to devote resources to leading and coordinating these initiatives across state boundaries and organisations.

Support

An organisation with a Support role will be committed to maintaining the necessary skills, expertise and infrastructure required for R&D in their area of specialisation.

Support organisations will be prepared to collaborate in national RD&E initiatives but will not be required to lead or coordinate such initiatives, unless otherwise agreed.

Link

An organisation with a Link role will maintain core skills and capacity to lead or collaborate in development and technology translation activities delivering technology through their organisation’s technology adoption and commercialisation models.
Link organisations will commit resources to access and disseminate information from international, national and regional sources.

### Table 7 Future R&D priority focus and responsibility to overall implementation of strategy

<table>
<thead>
<tr>
<th>R&amp;D and TT Priorities</th>
<th>Major</th>
<th>Support</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Future markets and industry competitiveness</strong></td>
<td>DEPI</td>
<td>SARDI UQ</td>
<td>CSIRO NSW DAFF</td>
</tr>
<tr>
<td>Focus on needs and wants of regional (local and Asia-Pacific) markets and consumers and improve the flow of market intelligence information through the whole supply chain.</td>
<td>FIAL</td>
<td>UQ; DAFFQ</td>
<td>UTAS/CFI AIFST DAFF</td>
</tr>
<tr>
<td>Improve the productivity and competitiveness of food manufacturing</td>
<td>DAFFQ FIAL</td>
<td>SARDI UTAS/CFI CSIRO UQ</td>
<td>DAFF AIFST</td>
</tr>
<tr>
<td>Produce scientific information to inform, influence and input to global food regulation policy design and food standards for market access.</td>
<td></td>
<td>UTAS/FSC UQ</td>
<td>AIFST DAFFQ FIAL</td>
</tr>
<tr>
<td>Collate information and develop strategies for public education of new production (e.g. GMO) and processing technologies</td>
<td>SARDI (seafood) DAFFQ FIAL</td>
<td>UTAS/FSC</td>
<td>UTAS/FSC DAFF</td>
</tr>
<tr>
<td>Implement mechanism to identify future innovation needs, wants and challenges - e.g. foresighting</td>
<td>FIAL</td>
<td></td>
<td>UTAS/CFI DAFF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R&amp;D and TT Priorities</th>
<th>Major</th>
<th>Support</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. The intersect between food, nutrition and health</strong></td>
<td>CSIRO</td>
<td>SARDI UQ</td>
<td>DEPI NSW</td>
</tr>
<tr>
<td>Understand drivers of consumer demand for healthy food choices for Asia-Pacific region</td>
<td>Uni SA FIAL</td>
<td>CSIRO UQ; DAFFQ</td>
<td>UTAS/CFI</td>
</tr>
<tr>
<td>Capability to produce and manufacture foods that positively impact on health and well being</td>
<td>CSIRO DAFFQ/ASQ FIAL</td>
<td>SARDI; Uni Adelaide (food plus) UTAS/CFI &amp; FSC; UQ</td>
<td></td>
</tr>
<tr>
<td>Investigation and substantiation of nutrition &amp; health effects of foods and diets</td>
<td>CSIRO UQ</td>
<td>Uni Adelaide (Food Plus) DAFFQ UTAS/CFI</td>
<td></td>
</tr>
<tr>
<td>Promote informed food choices and dietary patterns that contribute to overall population health</td>
<td></td>
<td></td>
<td>AIFST FIAL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>R&amp;D and TT Priorities</th>
<th>Major</th>
<th>Support</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3. Climate change and resource efficiency- sustainability</strong></td>
<td>CSIRO DEPI SARDI</td>
<td></td>
<td>NSW DAFF</td>
</tr>
<tr>
<td>Efficient use of natural resources inputs into food processing system</td>
<td>DAFFQ CSIRO</td>
<td></td>
<td>UTAS/CFI FIAL</td>
</tr>
<tr>
<td>Develop tools and technologies to measure environmental impact</td>
<td>CSIRO</td>
<td>DAFFQ FIAL</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>Reduce waste throughout the food supply chain</td>
<td>DAFFQ CSIRO; UQ SARDI UTAS/CFI &amp; FIAL</td>
<td>DAFF AIFST FIAL</td>
<td></td>
</tr>
<tr>
<td>Limit impact of climate change on nutritional quality and consumer acceptance of food</td>
<td>CSIRO UQ; DAFFQ</td>
<td>DAFF</td>
<td></td>
</tr>
</tbody>
</table>

**4. Food safety – integrity and traceability**

<table>
<thead>
<tr>
<th>System that maintains Australia’s reputation and safety requirements for safe products</th>
<th>SARDI UTAS/FSC</th>
<th>CSIRO DAFFQ</th>
<th>DAFF FIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic research capacity to respond to emerging threats (viruses, hazards, pathogens)</td>
<td>CSIRO</td>
<td>UTAS/FSC DAFFQ</td>
<td>DAFF</td>
</tr>
<tr>
<td>Reduce foodborne diseases; focus on those with greatest impact on public health</td>
<td>CSIRO UTAS/FSC</td>
<td>DAFFQ</td>
<td></td>
</tr>
<tr>
<td>Support and ensure safety for food supply chain and processing innovation</td>
<td>SARDI UTAS/FSC CSIRO</td>
<td>DAFFQ</td>
<td>UTAS/CFI FIAL</td>
</tr>
<tr>
<td>Support bio-security risk management where it links to food safety for Australia</td>
<td>SARDI CSIRO</td>
<td>UTAS/FSC DAFFQ</td>
<td>DAFF</td>
</tr>
</tbody>
</table>

**5. Technology translation and adoption – barriers and mechanisms**

<table>
<thead>
<tr>
<th>Technology push matched to market pull – Promote SME access to and participation in the innovation system</th>
<th>DAFFQ QMI FIAL</th>
<th>SARDI CSIRO UQ AIFST</th>
<th>DAFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid information exchange – Coordinate and focus TT: Training, conferences, workshops, access to research</td>
<td>QMI FIAL</td>
<td>UTAS/FSC CSIRO AIFST DAFFQ</td>
<td></td>
</tr>
<tr>
<td>Responsive management of information</td>
<td>DAFFQ</td>
<td>UTAS/FSC</td>
<td></td>
</tr>
<tr>
<td>Equitable risk and reward sharing</td>
<td>Uni Adelaide</td>
<td>UTAS/FSC</td>
<td></td>
</tr>
</tbody>
</table>

**6. Skills and Training**

<table>
<thead>
<tr>
<th>National policy for skills and career paths in the food and nutrition RD and TT system</th>
<th>FIAL</th>
<th>SARDI Uni Adelaide (PICSE: GAP) UTAS/FSC DAFFQ AIFST UQ</th>
<th>CSIRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry/government capability gaps and needs assessment, implementation strategy and review</td>
<td>UQ FIAL</td>
<td>AIFST</td>
<td></td>
</tr>
</tbody>
</table>
Appendix 9: Endorsement forms
### Endorsement Form

<table>
<thead>
<tr>
<th>National Primary Industries Research, Development &amp; Extension Framework</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agency</strong></td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
</tr>
</tbody>
</table>

**Does this Agency have an interest in the Strategy?**
(Please circle)
- [x] Yes
- [ ] No

**Agency Position**
(please circle, and provide comments with options 2 and 3)
- [x] 1. Endorsed
- [ ] 2. Endorsed with comments
- [ ] 3. Not endorsed

**Signature block**

<table>
<thead>
<tr>
<th>Name: Geoffrey Annison</th>
<th>[Signature]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position: Deputy Chief Executive</td>
<td>25 September 2013</td>
</tr>
</tbody>
</table>

**Signature**
# Endorsement Form

**National Primary Industries Research, Development & Extension Framework**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Australian Institute of Food Science and Technology Incorporated.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>National Food and Nutrition Research, Development &amp; Technology Transfer Strategy</td>
</tr>
</tbody>
</table>

Does this Agency have an interest in the Strategy?  
(Please circle)

- [ ] Yes  
- [x] No

**Agency Position**  
(please circle, and provide comments with options 2 and 3)

1. **Endorsed**

2. **Endorsed with comments**

3. **Not endorsed**

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Dr Anne M Astin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>President, AIFST Inc.</td>
</tr>
<tr>
<td>Signature</td>
<td>[Signature]</td>
</tr>
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</table>
## Endorsement Form

### National Primary Industries Research, Development & Extension Framework

<table>
<thead>
<tr>
<th>Agency</th>
<th>AMPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>Food + Nutrition</td>
</tr>
</tbody>
</table>

Does this Agency have an interest in the Strategy?  
(Please circle)

- Yes
- No

**Agency Position**  
(please circle, and provide comments with options 2 and 3)

1. **Endorsed**
2. **Endorsed with comments**
3. **Not endorsed**

**Signature block**

- **Name**: Michelle Edge
- **Position**: CEO
- **Signature**: Michelle Edge
<table>
<thead>
<tr>
<th>Agency</th>
<th>CSIRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>National Food and Nutrition RD&amp;TT Strategy</td>
</tr>
</tbody>
</table>

Does this Agency have an interest in the Strategy?  
(Please circle)

- **Yes**
- **No**

<table>
<thead>
<tr>
<th>Agency Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>(please circle, and provide comments with options 2 and 3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1. <strong>Endorsed</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Endorsed with comments</td>
</tr>
<tr>
<td>3. Not endorsed</td>
</tr>
</tbody>
</table>

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Prof Martin Cole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Acting Group Executive</td>
</tr>
</tbody>
</table>

Signature
## Endorsement Form

| National Primary Industries Research, Development & Extension Framework |
|---|---|
| **Agency** | Dairy Australia |
| **Strategy** | National Food and Nutrition Research and Development and Technology Transfer Strategy |
| **Does this Agency have an interest in the Strategy?** | Yes |
| **Agency Position** | (please circle, and provide comments with options 2 and 3) |
| 1. Endorsed | |
| 2. Endorsed with comments | |
| 3. Not endorsed | |
| **Name** | Isabel MacNeill |
| **Position** | Group Manager |
| **Signature** | [Signature] |
**Endorsement Form**

National Primary Industries Research, Development & Extension Framework

<table>
<thead>
<tr>
<th>Agency</th>
<th>Department of Agriculture, Fisheries and Forestry (DAFFQ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>Food &amp; Nutrition</td>
</tr>
</tbody>
</table>

Does this Agency have an interest in the Strategy?
(Please circle)

- Yes ✓
- No

Agency Position
(please circle, and provide comments with options 2 and 3)

1. Endorsed

2. Endorsed with comments ✓ See below

3. Not endorsed

Signature block

<table>
<thead>
<tr>
<th>Name</th>
<th>John Chapman</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Managing Director (Agri-Science Queensland)</td>
</tr>
</tbody>
</table>

Endorsement Comments: Table 8 as it is published currently is difficult to comprehend and does not correctly state our intentions. DAFFQ wishes to be listed as “Support” along side UQ in the sub-sections titled Focus on needs and wants…… of Section 1 and Understand drivers…… of Section 2. All other responsibilities for DAFFQ are correct. Additionally, we would be agreeable to being listed as a “Major” for all of Section 3 if the title was changed from including the words Climate Change – DAFFQ is committed to RD&E in resource efficiency and sustainability in the food and nutrition context but cannot agree in this context to being listed as “Major” when climate change is included.
## Endorsement Form

### National Primary Industries Research, Development & Extension Framework

<table>
<thead>
<tr>
<th>Agency</th>
<th>Department of Agriculture and Food Western Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>National Food and Nutrition Research, Development and Technology Transfer Strategy</td>
</tr>
</tbody>
</table>

**Does this Agency have an interest in the Strategy?**
(Please circle)
- Yes [ ]
- No [ ]

**Agency Position**
(please circle, and provide comments with options 2 and 3)

1. Endorsed

2. Endorsed with comments
   - DAFWA ‘link’ role endorsed.
   - (See below)

3. Not endorsed

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Rob Delane</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Director General</td>
</tr>
<tr>
<td>Signature</td>
<td>[Signature] 26/8/13</td>
</tr>
</tbody>
</table>

---

Concern about NPNRDTE being a comprehensive audit of current activity, a significant amount of which is outside PISC/SCoPÉ scope and influence, but limited in terms of strategy. Documentation coming to PISC will need to be clear on what is proposed to be different/better as a result of PISC/SCoPÉ endorsement.
**Endorsement Form**

**National Primary Industries Research, Development & Extension Framework**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Department of Environment and Primary Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>National Food &amp; Nutrition Strategy</td>
</tr>
</tbody>
</table>

**Does this Agency have an interest in the Strategy?**

(Please circle)

Yes

No

**Agency Position**

(please circle, and provide comments with options 2 and 3)

1. **Endorsed**

2. Endorsed with comments

3. Not endorsed

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>James Flintoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Deputy Secretary, Agriculture Productivity Group</td>
</tr>
<tr>
<td>Signature</td>
<td></td>
</tr>
</tbody>
</table>
## Endorsement Form

### National Primary Industries Research, Development & Extension Framework

<table>
<thead>
<tr>
<th>Agency</th>
<th>Department of Primary Industries, Parks, Water and Environment (DPIPWE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td>National Food and Nutrition Strategy</td>
</tr>
</tbody>
</table>

**Does this Agency have an interest in the Strategy?**

(Please circle)

- [ ] Yes – [LINK](#)
  - Through our Joint Venture Agreement with Tasmanian Institute of Agriculture (UTAS)

### Agency Position

1. **Endorsed**
2. **Endorsed with comments**
   - Funding for the formation of the sub-committee will need to be quantified.
3. **Not endorsed**

### Signature block

<table>
<thead>
<tr>
<th>Name</th>
<th>Kim Evans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Secretary</td>
</tr>
</tbody>
</table>

**Signature**
**Endorsement Form**

**National Primary Industries Research, Development & Extension Framework**

<table>
<thead>
<tr>
<th>Agency</th>
<th>Horticulture Australia Limited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategy</td>
<td></td>
</tr>
<tr>
<td>Does this Agency have an interest in the Strategy?</td>
<td>Yes</td>
</tr>
<tr>
<td>(Please circle)</td>
<td>No</td>
</tr>
<tr>
<td><strong>Agency Position</strong></td>
<td></td>
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<tr>
<td>(please circle, and provide comments with options 2 and 3)</td>
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</tbody>
</table>

1. **Endorsed**

2. Endorsed with comments

3. Not endorsed

**Signature block**

Name: David N Moore

Position: General Manager R&D

Signature: [Signature]

### Endorsement Form

**National Primary Industries Research, Development & Extension Framework**

<table>
<thead>
<tr>
<th>Agency/RDC</th>
<th>Meat &amp; Livestock Australia</th>
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<tbody>
<tr>
<td>Strategy</td>
<td>Food and Nutrition RD&amp;TT</td>
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Does this Agency have an interest in the Strategy?  
(Please circle)  
- [ ] Yes  
- [X] No

**Agency Position**
(please circle, and provide comments with options 2 and 3)

1. [ ] Endorsed  
2. [ ] Endorsed with comments  
3. [ ] Not endorsed  

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Scott Hansen</th>
</tr>
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<tbody>
<tr>
<td>Position</td>
<td>Managing Director</td>
</tr>
<tr>
<td>Signature</td>
<td>[Signature]</td>
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<th>Agency</th>
<th>NSW Department of Primary Industries</th>
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<tr>
<td>Strategy</td>
<td>National Food and Nutrition Strategy</td>
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</table>

**Does this Agency have an interest in the Strategy?**
(Please circle)

- [ ] Yes
- [x] No

**Agency Position**
(please circle, and provide comments with options 2 and 3)

1. **Endorsed**
2. Endorsed with comments
3. Not endorsed

**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Philip Wrayhead</th>
</tr>
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<tbody>
<tr>
<td>Position</td>
<td>Chief Scientific Officer</td>
</tr>
<tr>
<td>Signature</td>
<td>Philip Wrayhead</td>
</tr>
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# Endorsement Form

**National Primary Industries Research, Development & Extension Framework**

<table>
<thead>
<tr>
<th>Agency</th>
<th>The South Australian Research And Development Institute</th>
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<tr>
<td>Strategy</td>
<td>Food and Nutrition</td>
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Does this Agency have an interest in the Strategy?  
(Please circle)  
Yes

**Agency Position**  
(please circle, and provide comments with options 2 and 3)

<table>
<thead>
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<th>1. Endorsed</th>
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**Signature block**

<table>
<thead>
<tr>
<th>Name</th>
<th>Prof Pauline Mooney</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>Executive Director</td>
</tr>
<tr>
<td>Signature</td>
<td>[Signature]</td>
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