



Australian Government

Department of Agriculture, Fisheries and Forestry

Resilience in the Australian food supply chain

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Acknowledgements

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1 Summary

Supply chains are the physical and information systems and processes used to deliver a product or service from one location or entity to another. The Australian food supply chain ensures that people living in Australia have access to food. It encompasses food for consumption in or out of the home.

A crucial question for the wellbeing of all Australian residents is the extent to which the food supply chain is resilient in the face of disruption—especially, how quickly it can regain its capacity to distribute food to consumers in the event of a crisis or emergency.

The key question is whether, following a natural disaster or other major disruptive event, Australians in affected regions would go hungry. The risk that this could happen is growing, especially if separate events in Australia’s eastern states were to coincide.

The Australian food industry is highly adaptable, and has been the mainstay of recovery of food supplies after natural disasters. This cannot be underestimated: in recent disasters, the rapid delivery of food to affected communities has been a tribute to the highly developed skills and extraordinary effort of both food and transport companies and many individual food producers. Nevertheless, there are potential risks associated with the food supply chain that would be outside the capacity of the industry to manage.

To date the Australian food supply chain has demonstrated a high degree of resilience, but there are factors on both the demand and supply sides of the chain that are decreasing future resilience. Some of the key elements of resilience in the Australian supply chain are not well understood, and therefore pose potential threats to the supply of food in Australia in the event of a severe emergency. Further work is needed to determine points of vulnerability and the strategies needed to address them.

Governments can help manage the growing risks to food supply through better coordination between different levels of government, encouraging greater understanding on the part of the food industry and government officials of their respective roles, and ensuring regulation does not impede the food industry’s capacity to respond.

1.1 This project

In 2010 Sapere Research Group (SRG) confirmed the validity and importance of policy work the Department of Agriculture, Fisheries and Forestry (DAFF) has undertaken on food supply chain resilience. The 2010 study was largely based on desktop research and secondary materials including departmental documents, recent relevant international studies, and other literature. During the course of that project, interviews were conducted with a small sample of key industry players in the food supply chain (covering retail, distribution and manufacture of food) and SRG documented case studies of past events that had significantly disrupted the food supply chain in Australia.

In December 2010 and January 2011 widespread flooding affected large parts of the state of Queensland. Food supply chains were severely tested. DAFF took the opportunity to commission additional work to learn from the lessons of that disaster and apply them to enhancing the resilience of the supply chain. A much larger cross section of the food industry was interviewed and surveyed about their experiences.

The second study confirmed many of the findings of the previous work, but also allowed the consultants to identify several new issues and risks to be addressed in improving the resilience of the supply chain. These included: the vital role played by communications networks; the risks associated with concurrent disaster events; and the need for greater understanding, especially among younger and/or socially vulnerable consumers, of alternative food sources and cooking methods.

1.2 Australia's food supply chain

The Australian food supply chain incorporates a diverse range of production areas, processors, manufacturers and retailers—many thousands of participants, ranging from highly sophisticated international companies to local sole traders, as well as more than 20 million consumers. For some food items, importing of fresh products, ingredients or packaging is an important aspect of whole or part of the supply chain; for others, the supply chain is wholly domestic.

Australia is a net exporter of food. This does not necessarily mean that Australia is self-sufficient in food supply. Global supply networks are increasingly important in the Australian food sector, and many types of foods or inputs to food are imported. Many ingredients, additives and packaging materials that are inputs to domestic production are only made overseas and Australia relies on imports for some important foodstuffs (such as canned fish and infant formula). While domestic manufacturing could, over time, be re-tooled to replace such imports, in a sudden crisis mechanisms need to be in place to deal with immediate shortages.

The complexity of distribution systems has grown: the information needed to manage food distribution is now sophisticated and requires complex systems and record keeping. This has increased the vulnerability of the supply chain in some respects: it has for example made the food supply chain vulnerable to cyber attack, computer viruses, industrial espionage by cyber means and other sources of system breakdown.¹

On the other hand, the industry's capacity to manage information has greatly increased and there is a much more sophisticated and widespread understanding of logistics management, especially on the part of major retailers and transport companies.

The supply chain has physically lengthened, especially in relation to fresh produce. Local suppliers that once dominated the fresh food segment, especially in perishable items such as milk, other dairy products, fruit and vegetables, are no longer the dominant source of supply to consumers. Longer supply chains expose transport routes to more points of potential vulnerability from such events as flood, fire and earthquake. Inventories are also decreasing, as major retailers apply more sophisticated supply chain management techniques.

Dependencies for the food supply chain include infrastructure, labour and imports. The degree of both interdependence and concentration in the food supply chain has steadily increased over the past three decades.

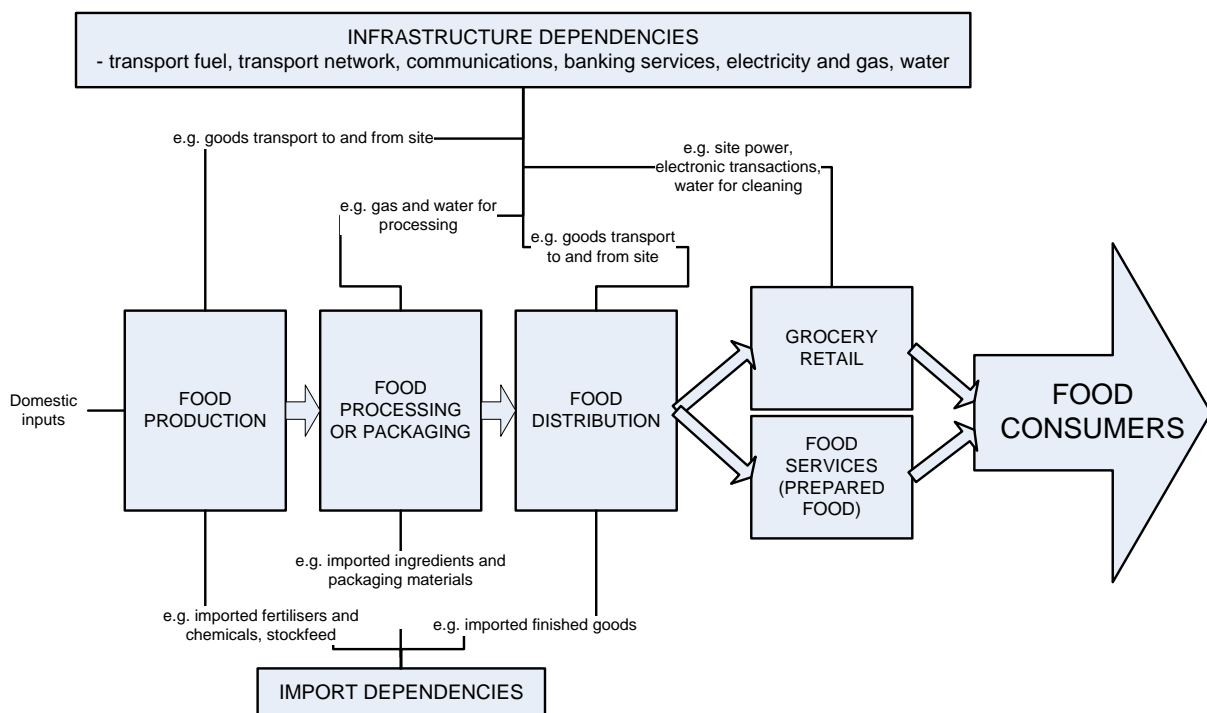
¹ Cyber attack is most likely to come in the form of denial of service (concerted bombarding of websites with electronic traffic so as to make them inoperable). This would be highly disruptive if for example it brought down the web-based links used by food companies to route food to retail outlets. Cyber espionage is different: it does not bring down a website, but extracts information from it to use to the disadvantage of the owner of the site. Espionage can also include hacking into email, twitter or other communications. Other sources of system breakdown could include physical disruption such as loss of communications towers in earthquake, fire or flood: loss of electric power supplies; or extreme solar flares disrupting electronic communications.

Like all physical supply chains, the food supply chain is dependent on a range of infrastructure for continuity of production, processing, distribution and retail—power, water, financial services, communications and transport services.

The food supply chain also relies on the employees who support it and is a relatively labour-intensive industry, particularly at the consumption interface (that is, grocery, retail and foodservices).

Figure 1 provides a schematic outline of the supply chain and its dependencies.

Figure 1: Overview of food supply chain and its dependencies



1.3 Possible threats to food supply chain resilience

Resilience refers to the capacity of organisations or systems to return to full functionality in the face of disruption. The characteristics of a resilient logistics network or supply chain are commonly identified in terms of redundancy and flexibility, to which should be added the dimension of concentration (a more concentrated network is less resilient than a dispersed one). A paradigm example of a highly dispersed network is the internet, deliberately designed from the outset to be widely spread and duplicated across numerous locations so as to withstand external threats in the event of war.

The Australian food supply chain has been demonstrably resilient in the face of localised or regional crises that have disrupted key parts of its supporting infrastructure. Where the Australian food supply chain is potentially vulnerable is in large-scale events (such as a human or animal pandemic, or a national fuel shortage), or combinations of events that affect multiple links of the food supply chain at the same time (such as widespread electricity outages combined with floods or fires).

It was clear from industry interviews that in the event of a crisis the food industry would exhibit limited willingness to contribute to broader community welfare objectives, because it does not perceive this as its role. To the extent that companies had a commercial interest in ensuring

continuity of supply they were keen to plan for and anticipate possible crises ('we want to keep our stores open' was one comment). However, planning for and responding to potential food supply problems that went beyond their immediate commercial objectives were seen as matters for government ('food companies' duties are to their shareholders' was one representative response).

From interviews with government officials it became apparent that some parts of government involved in emergency management had a limited understanding of the practical limits of the food industry's capacity to maintain supply in the event of a crisis. There was also reportedly an expectation in some quarters (mainly among lower-level officials) that in a disaster food companies would distribute food free of charge. Although food businesses frequently do donate generously, it should not be expected as a matter of course—it would affect the viability of those businesses and their ability themselves to recover.

1.4 Emerging challenges to food supply chain resilience

Factors that influence the level and nature of food supply chain resilience in response to an actual event include:

- Scale factors—whether the food supply chain can adapt to disruption up to a certain population or geographic scale, with elements breaking down beyond that point.
- Scope factors—whether the food supply chain can adapt to disruption for particular types of foods or inputs to foods up to a certain level of scope, with elements breaking down beyond that point.
- Temporal factors—whether the food supply chain can manage a resilient response to a disruption for a certain period of time, with elements breaking down beyond that point.
- Distributional factors—whether the food supply chain is less resilient for some sections of the community than others (such as low income households, tourists).
- Industry factors—whether some sections of the industry, by function or product type, are less resilient than others given their particular circumstances, and any dependencies across industries.

Key vulnerabilities that would substantially threaten food supply chain resilience as perceived by a number of interviewees included:

- concurrent loss of a number of distribution centre facilities (including power loss beyond that which can be sustained by generators)
- concurrent loss of a number of transport links to and between major cities—for example extensive east coast storm events that cut land transport links, both road and rail, between Brisbane and Sydney
- shortage of fuel (diesel) for food distribution in the case of a national fuel emergency
- ongoing workforce availability constraints beyond which affected companies can manage using standard backfilling and casual pool arrangements
- extended material disruption to Australia's access to key finished foods or inputs to foods that are only produced overseas.

1.5 Lessons from the Queensland floods

The Queensland floods during December 2010 to January 2011 were severe and widespread. The town of Rockhampton, with a population around 75 000, was cut off by road, rail and air for two weeks; the state capital, Brisbane, came within a day of running out of bread for its population; other towns and cities on the coast and inland were affected by floods, with around 100 large retail food stores and many more smaller food outlets inundated.

The experience revealed both the resilience and fragility of the food supply chain. While there were no reported instances of communities going hungry, this was only through massive effort on the part of both the food industry and authorities. This included:

- logistics providers hiring large numbers of vehicles (trailers and prime movers) from Sydney, and large amounts of voluntary overtime by employees of trucking companies
- innovation in the use of alternative transport ('pineapples were put on barges—I never thought I'd see that' said one interviewee)
- retail stores and their customers being prepared to accept whatever food arrived, abandoning automated ordering systems and their normal consumption preferences
- high levels of awareness among SES and police personnel of the importance of food supplies
- greater levels of preparedness in northern Queensland because of a history of adverse natural events.

However, a number of concerns were expressed about the risks to the food supply chain that this natural disaster revealed. One such risk was tropical cyclone Yasi on 3 February 2011. In early February, while it was still over the Pacific Ocean, fears were expressed that Yasi might hit the far north Queensland city of Cairns. Thirty-thousand Cairns residents were evacuated in preparation. In the event Yasi crossed the coast near Mission Beach, some 150 kilometres south of Cairns. It was highly destructive, but did not affect major population centres. Respondents to the survey and interviews in this study expressed considerable concern that had Yasi hit a larger city, such as Cairns or Townsville, the food supply chain—particularly perishables like fruit and vegetables, milk, meat and fish—would have been very severely affected.

Restocking the food supply chain was made possible largely through supply links to Sydney and Melbourne, and routing stock through the far west of Queensland. Had there been a disaster, such as the Victorian bushfires of 2009, at the same time as the Queensland floods, this restocking effort would not have been possible.

This reinforces the point that the food supply chain is reasonably resilient when one—even severe—natural disaster strikes but highly vulnerable to the combined effects of more than one disaster.

Concerns were also expressed about what a number of food industry participants saw as difficulties in working with the Australian Defence Force (ADF) to move food to affected areas. While respondents praised the efforts of Australian soldiers on the ground, they considered that logistically the lack of capacity and administrative hoops to be negotiated before food could be transported constitute a major risk.

A number of food industry stakeholders interviewed expressed disappointment at what they saw as lack of capability on the part of the ADF to assist with the food logistics task beyond immediate emergency food drops by helicopter. There is an apparent mismatch between industry expectations

(among some businesses) and actual capacity. The ADF is not, in today's defence planning environment, equipped to undertake large food logistics tasks, and itself relies on the private market for supply to its own messes and operational needs. It would be valuable to develop a better understanding within the industry of what ADF could realistically be expected to do in an emergency in relation to food supplies.

An unexpected finding from the second stage of the study examining the Queensland experience was that in a disaster the means of cooking food—electricity and gas—are also compromised. Many interviewees also commented on generational differences, perceiving that younger people in particular had limited capacity to prepare meals for themselves in the absence of power. Even where they had access to facilities such as barbecues, some younger Brisbane residents had no concept that a barbecue could be used for anything other than cooking meat, which itself was in short supply. These findings suggest that one addition to any list of emergency supplies might be a cheap and portable gas burner.

Broader lessons learned included a need for increased sea freight capacity; a need to improve understanding of 'best before' and 'use by' dates; and the importance of supply further down the food supply chain (such as, supplying feed to feedlots).

1.6 Areas for further investigation and possible action

The review concludes that the work DAFF has done has been vitally important in preparing government and industry for potential disruption. Given the growing vulnerability of some aspects of the food supply chain, continuation of this work should be given a high priority. More work is needed in a number of areas to complement DAFF's existing body of work. Specifically:

- Consideration of the foodservices industry (such as restaurants, clubs and caterers) and the particular issues it faces relating to supply chains. This was reinforced by the experience of the Queensland floods, where in small communities the local hotel was frequently the hub for both community gathering and for meeting immediate food needs.
- Documentation of how the ADF and AusAID supply chains operate, and how they interact with the retail food supply chain.
- Analysis of the advantages, disadvantages and options relating to food and packaging stockpiles. The Queensland experience suggests that some additional storage capacity in far north Queensland is desirable in terms of risk management for future events. This mainly related to stored goods, such as flour, rice, powdered milk, pasta and tinned fruit and vegetables. An area of risk perceived in relation to packaging supplies was long-life packaging, used for various dairy, juice and other liquids. Australia is reliant on imports for these.
- Consideration of the motivations and incentives around consumer resilience—especially testing the Pantry List concept, developed by industry to encourage consumers to increase the food stocks they hold at home. This could include encouraging test marketing of the Pantry List in a small market to determine how it affects consumer behaviour.
- Further investigation of business continuity and organisational resilience culture among manufacturers and smaller retailers in the food supply industry, and also of the flexibility of Australian food transport modes.
- Ongoing monitoring of risks associated with overseas ownership of food manufacturing enterprises located in Australia—the interviewers for this project heard reports that for such

owners the commercial response to a disaster is to close down a factory rather than assume risks associated with keeping it running during a crisis.

- Rigorous testing of models developed for pandemic planning.
- Periodic tracking and analysis of critical import dependencies and capacity for substitution in the event of reductions in supply of imported foods and inputs to food.
- Collection of data that will allow a finer analysis of differences between regions and between cities, and allow for planning to be developed in relation to the types of events that would represent a tipping point beyond which the food supply chain was seriously compromised.
- Addressing governance issues involved in food supply chain resilience planning.

1.7 Policy considerations in light of the Queensland floods

The information collected relating to the Queensland floods suggests that in addition to the further preparedness work, governments could address some immediate policy concerns to reduce risks to the food supply.

1.7.1 Confusion in roles, removing regulatory impediments

An area of concern to many participants in the food supply chain was perceived confusion in roles of different levels of government. Many respondents to survey and interviewees reported problems of inaccurate information on closures of supply routes, or lack of information about where to make contact with government agencies.

A particular concern expressed related to regulatory impediments to food distribution. These included trucking licences (resolved between federal and state ministers) and retail trading hours (where state officials intervened to override local government requirements).

Although not a problem during the Queensland disaster, other regulatory requirements that could be barriers to food supply include country-of-origin and contents labelling regulations. While these are important and normally desirable elements of the food regulatory framework they could, if applied strictly, prevent import of vital foodstuffs if a disaster seriously compromised domestic supplies (for example, disease or contamination affecting all dairy, all grains or some other vital food ingredient in Australia).

The Queensland experience suggests that there is no established protocol for cutting through regulatory barriers to food supply in the event of a disaster.

Ministers could consider agreeing on a protocol for short-term suspension of regulations that impede distribution of essential food supplies in the event of a disaster. This could be in the form of a power to the relevant minister at state and territory level—and in the event of a disaster that affected more than one jurisdiction, a federal minister—to declare an exemption from regulations for a specified period and purpose. In practice, this power should be able to be delegated to senior officials responsible for disaster management.

1.7.2 Cross border nature of food supply chains

The Queensland flood experience highlighted the fact that food today often travels long distances before it reaches consumers; this is even more the case in the event of a disaster. Many food

supplies crossed two or more state or territory borders before reaching flood-affected Queensland towns.

This suggests that ensuring food supply chain resilience in the event of disasters needs to be considered at a national level as well as at local and state levels. In much of Australia (as was shown in the Queensland example) local government has assumed responsibility for continuity of food supply in disasters. This is likely to pose increasing risks in today's nationally integrated food supply chain.

Although emergency planning at the national level has considered food supply concerns (for example, AGD 2010) evidence from this study shows that the national perspective is not well understood, including by some local officials, with consequent 'blind spots' in their ability to call on expertise and information to help in the event of disaster.

It would therefore be desirable for ministers and/or emergency management authorities to foster a greater level of communication and coordination between all levels of government on maintaining the food supply chain in disasters or other threats to continuity.

1.7.3 Unrealistic expectations

The review found some evidence of unrealistic expectations from the food industry, government officials and the community relating to disaster response. These included:

- an over-estimation of the capacity of the ADF to move large quantities of food
- an assumption on the part of some agencies that they would be able simply to obtain food from local businesses, without thought of payment
- a lack of appreciation, in communities outside disaster-affected areas, that road flooding also disrupts deliveries to unaffected areas.

Greater communication between industry and government would help manage expectations in future disasters. There are limits to communication strategies: large natural disasters have been infrequent, and communications outside the immediate disaster event may not reach intended audiences. Nevertheless, reinforcement of the need for communication and establishment of mechanisms for better dialogue between food industry and government representatives could be helpful. Some respondents noted that, in their view, liaison between industry and government in Queensland had improved over the course of disasters experienced in that state in recent years due to efforts on both sides. This learning could be applied by other governments.

An agreed policy commitment across all jurisdictions that confirmed that food business are entitled to reasonable compensation for food compulsorily acquired in an emergency would also be of value. This need not be a lengthy policy document, and could allow for local differences in the specific mechanisms applied to recompense businesses.

2 Introduction

In May 2010 the Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) engaged Sapere Research Group (then known as LECG) to undertake a food supply chain resilience study.

This study by Sapere Research Group reviews, builds on, and validates existing literature and industry information to:

- assess the level of preparedness in the food supply chain to respond to significant emergencies affecting continuity of the national food supply
- identify strengths, gaps and potential vulnerabilities affecting food supply emergency preparedness
- identify potential measures, responses and actions that could improve food supply chain preparedness.

The terms of reference for the initial study and for the subsequent study of the impact of the Queensland floods on the food supply chain are at appendix 1. Stage 1 of the project was undertaken by Stephen Bartos and Matt Balmford in mid 2010; Stage 2 by Stephen Bartos, Alistair Davey, Alex Karolis and James Swansson from March to June 2011.

Data and information in this study were drawn from a range of published and unpublished documentation, validated by discussions with industry stakeholders including the Australian Food and Grocery Council, retailers, retail distributors and processors or manufacturers. Supply chain and logistics consultancy, Logistics Bureau, provided additional advice and support for Stage 1 of the project.

3 Overview of Australia's food supply chain

This chapter provides an overview of the structural, physical and commercial nature of the Australian food supply chain.

3.1 Nature of the Australian food supply chain

3.1.1 Defining the food supply chain

Supply chains are the physical and information systems and processes used to deliver a product or service from one location or entity to another—commonly, from suppliers to consumers. Mentzer and colleagues define a supply chain as ‘a set of three or more entities (organisations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer’ (Mentzer et al. 2001). Supply chains comprise a network of diverse and interdependent functions—sometimes vertically integrated, sometimes organisationally dispersed.

A useful description of supply chains is that they:

comprise flows of materials, goods and information (including money), which pass within and between organisations, linked by a range of tangible and intangible facilitators, including relationships processes, activities and integrated (information) systems. In practice, they are also linked by physical transport and distribution networks, and national/international communications and transport infrastructures (Peck 2006a:128).

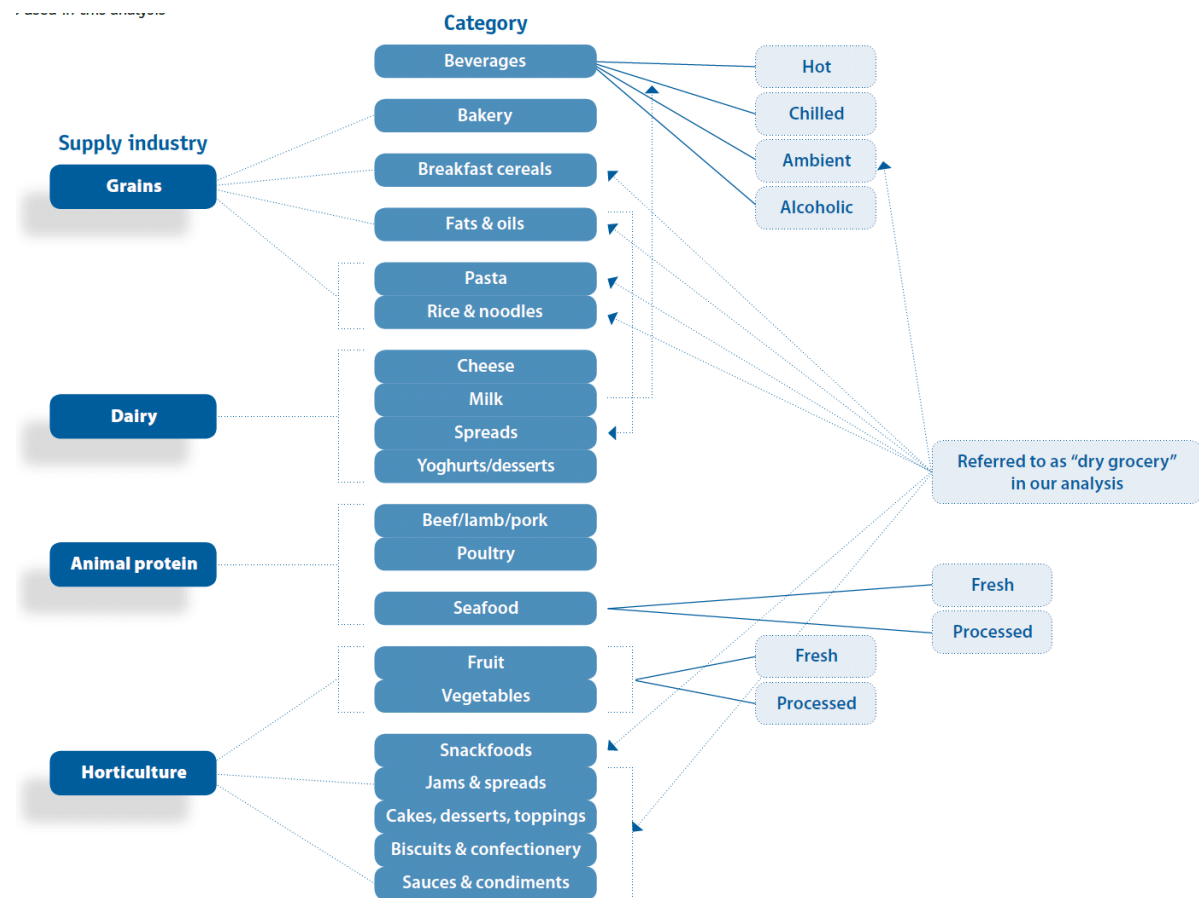
For the purposes of this study, food supply chain refers to the steps taken to meet the demand for food consumption in Australia.

Food in this study is taken to include fresh and processed products, ingredients and non-alcoholic beverages available through retail (grocery) channels, restaurants, fast food outlets and other foodservice channels. The main focus in this study is food for domestic consumption, rather than bulk commodities.

The range of groceries involved in the food supply chain, and the variety of forms in which they are available, is shown in Figure 2. In addition, food is available for domestic consumption as finished products through foodservice channels, such as takeaway and dining out—also part of the definition of food.

The Australian food supply chain incorporates a diverse range of production areas, processors, manufacturers and retailers—many thousands of participants, ranging from highly sophisticated international companies to local sole traders, as well as over 20 million consumers. For some food items, importing of fresh products, ingredients or packaging is an important aspect of whole or part of the supply chain; for others, the supply chain is wholly domestic.

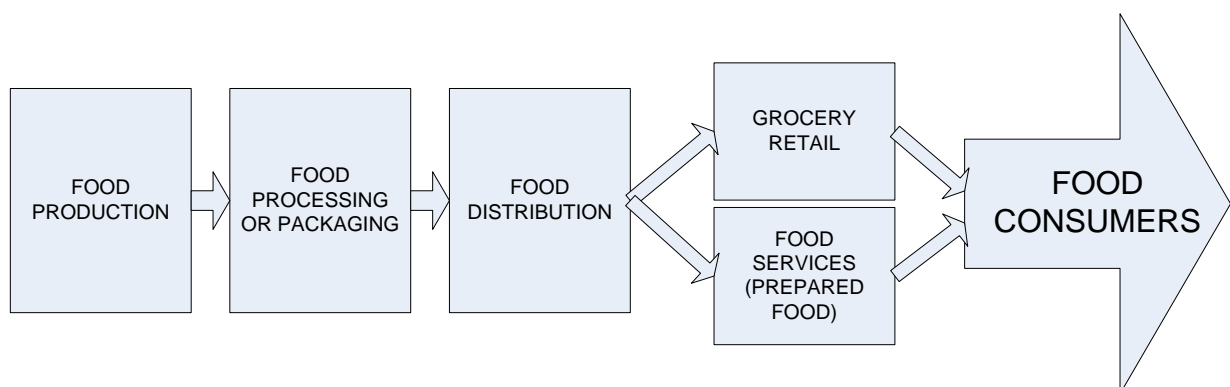
Figure 2: Food and beverage categories



Source: DAFF 2007a, *FoodMap: A comparative analysis of Australian food distribution channels*, Department of Agriculture Fisheries and Forestry, Canberra, p. 23

Although it varies by food product and delivery channel, the food supply chain 'covers a spectrum of activities from agricultural production of bulk food commodities and ingredients through fresh produce to manufacturing, distribution, sales and consumption' (Wells & Edwards 2004:17). This is broadly characterised in Figure 3 below.

Figure 3: Broad overview of the food supply chain



3.1.2 Production, processing and distribution

There are almost as many different food supply chains as there are types of food, recognising the inherent attributes of products (such as perishability, weight, value), efficient distribution models and consumer preferences. For example, fresh fruit and vegetables and fresh bread have short shelf-lives, a rapid turnover and the supply chain is short—much produce is sourced at a state level. Dry goods and frozen foods have a longer shelf-life and the supply chain is longer—most packaged groceries are produced and distributed at a national level.

The food and beverage industry manages the daily cycle of food supply to millions of consumers by specialising in sub-supply chains for dry packaged goods, chilled and frozen, and fresh daily ... and by using different delivery models to large and small outlets (I&I New South Wales and FALCONSW 2010).

Each category and channel [of food distribution] has its own peculiarities, driven by the nature of the product, the product's sources, the competitive environment within the supply chain and marketplace, and the different ownership and integration arrangements (Spencer & Kneebone 2007:1).

Many food categories have parallel supply chains categorised by dry foods and soft drinks; fresh fruit and vegetables; chilled and frozen dairy, meat, ice cream, juice; chilled milk, seafood, deli, chicken; and fresh bread (figure 4).

The nature of processing involved also affects the supply chain and the parties involved:

For fresh produce there is typically a short supply chain that mostly comprises three functional levels—produce is purchased at the farm gate by a wholesaler and is then on-sold to retailers.

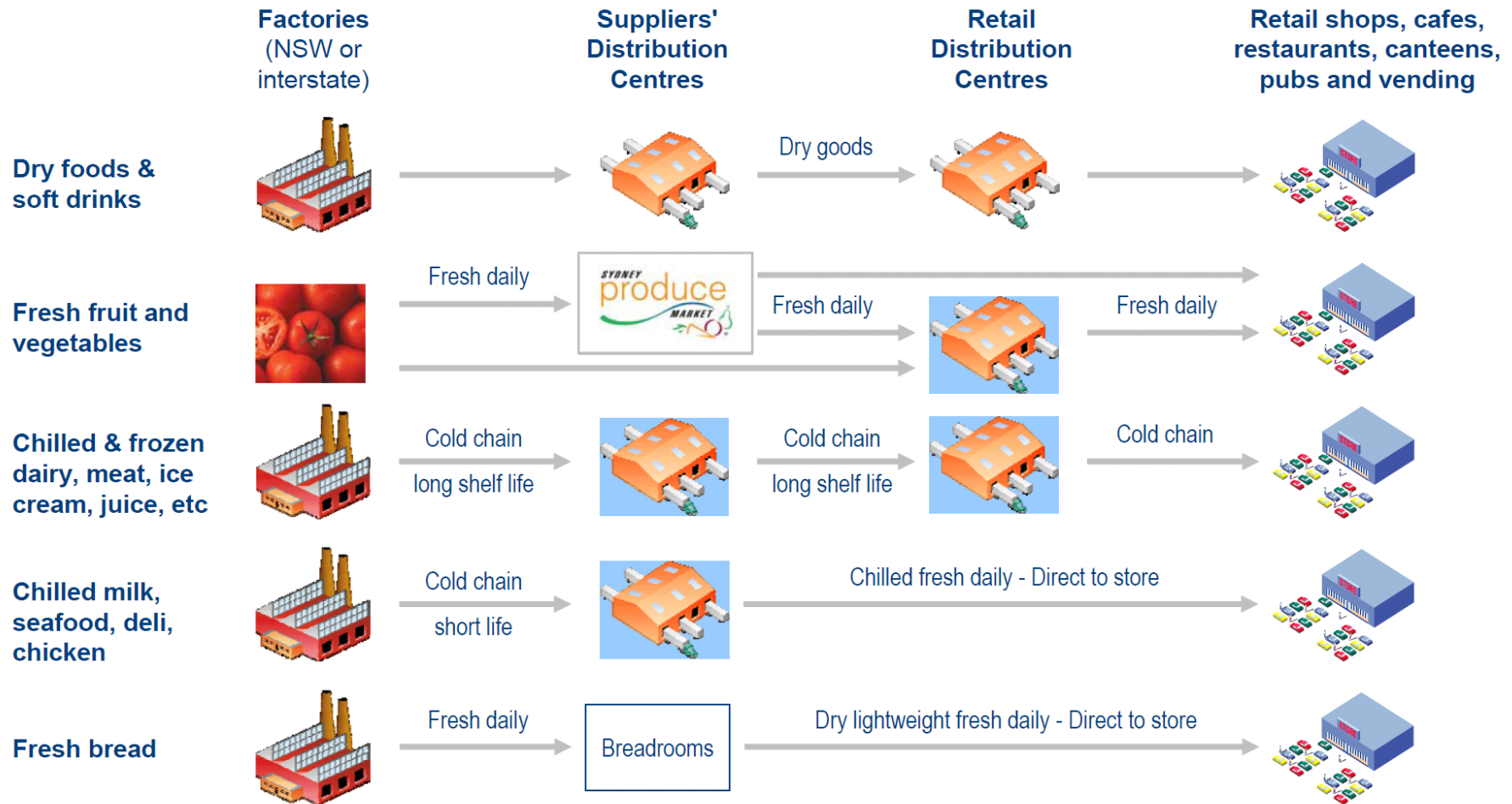
For some fresh produce, such as dairy and meat, more complex processing occurs after the farm gate and before wholesaling, resulting in a four-level supply chain (ACCC 2008:218).

While there are many producers and processors, wholesale distribution to retailers focuses down to a small number of participants of substantial and national scale. This structure represents the major influence that large integrated supermarket chains, Woolworths and Coles in particular, and other large distributors have on the supply chain.

For the MSCs [major supermarket chains Woolworths and Coles], Aldi and Franklins, the wholesale function is primarily performed in-house by the retailer

For most other grocery retailers and specialty stores, the wholesale function is performed by wholesalers and consolidators for fresh produce and by Metcash for packaged groceries (ACCC 2008:218).

Figure 4: Parallel supply chains for various food categories



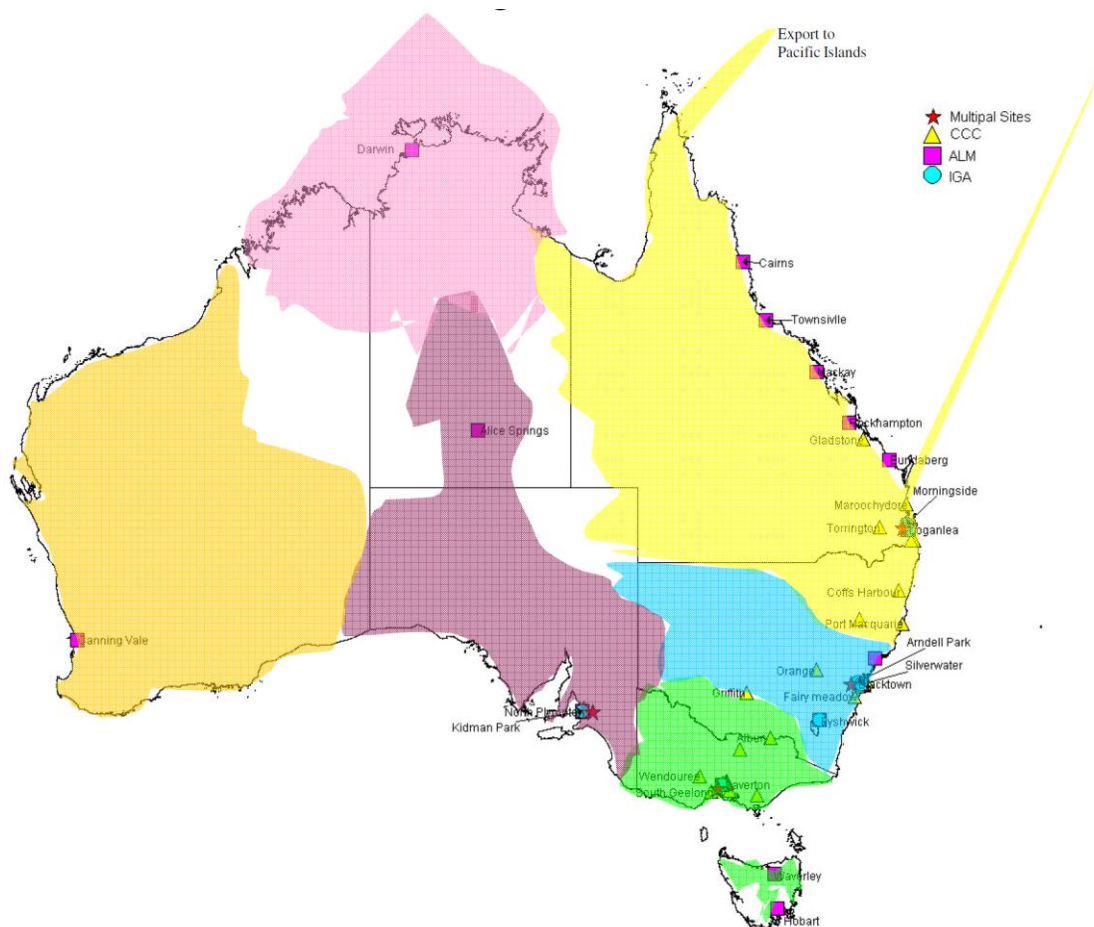
Source: I&I New South Wales & FALCONSW 2010, *Four key supply chains: opportunities for innovation*, Innovation & Investment New South Wales and Freight and Logistics Council of New South Wales, p. 72.

Note: Diagram was developed for New South Wales (e.g. Sydney Produce Market); however, the processes and modes of retail distribution are generally applicable across Australia.

Scale is an important issue. For example, the Eastern Creek region of western Sydney, at the junction of the M7 and M4 motorways, is home to a major cluster of retail distribution centres (for grocery retail channels as well as foodservice distributors and outlets). This location provides access both into and out of Sydney, and services thousands of retail outlets.

Distribution patterns are generally based on geographic distribution of population and distance rather than state borders. Figure 5 shows the geographic distribution networks of major grocery retail distributors; where distribution centres in Victoria service southern New South Wales and distribution centres in Queensland service northern New South Wales.

Figure 5: Geographic distribution networks for retail distributors

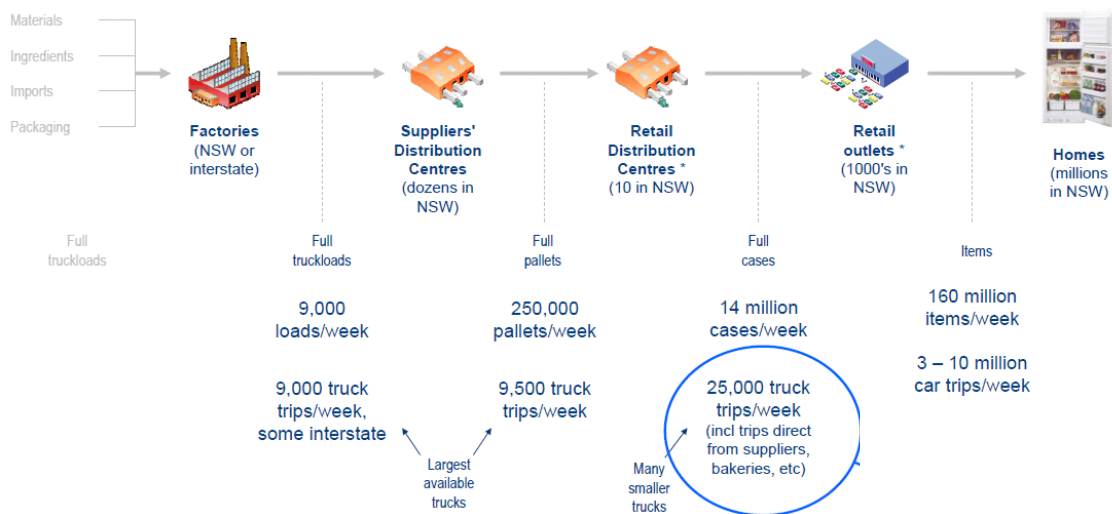


Source: 'Maintaining Continuity of the Food Supply Chain in an Influenza Pandemic', presentation by Steven Newton to the Critical Infrastructure Advisory Council, 18 October 2007; provided privately, reproduced with kind permission of Steven Newton.

Notes: ALM – Australian Liquor Marketers; CCC – Campbell's Cash and Carry; IGA – Independent Grocers of Australia.

To give a sense of the size of the production, processing and distribution task, Figure 6 shows the average weekly food and beverage volumes supplied in New South Wales. It indicates the size of the distribution task in that state: 14 million cases a week through 25 000 truck trips from retail distribution centres and direct suppliers to retail outlets. This example represents roughly one-third of the Australian food distribution task.

Figure 6: Average weekly food and beverage volumes supplied in New South Wales



Source: I&I NSW and FALCONSW 2010, *Four Key Supply Chains: Opportunities for Innovation*, Industry & Investment New South Wales and Freight and Logistics Council of New South Wales, April, p. 20

3.1.3 Retail and consumption

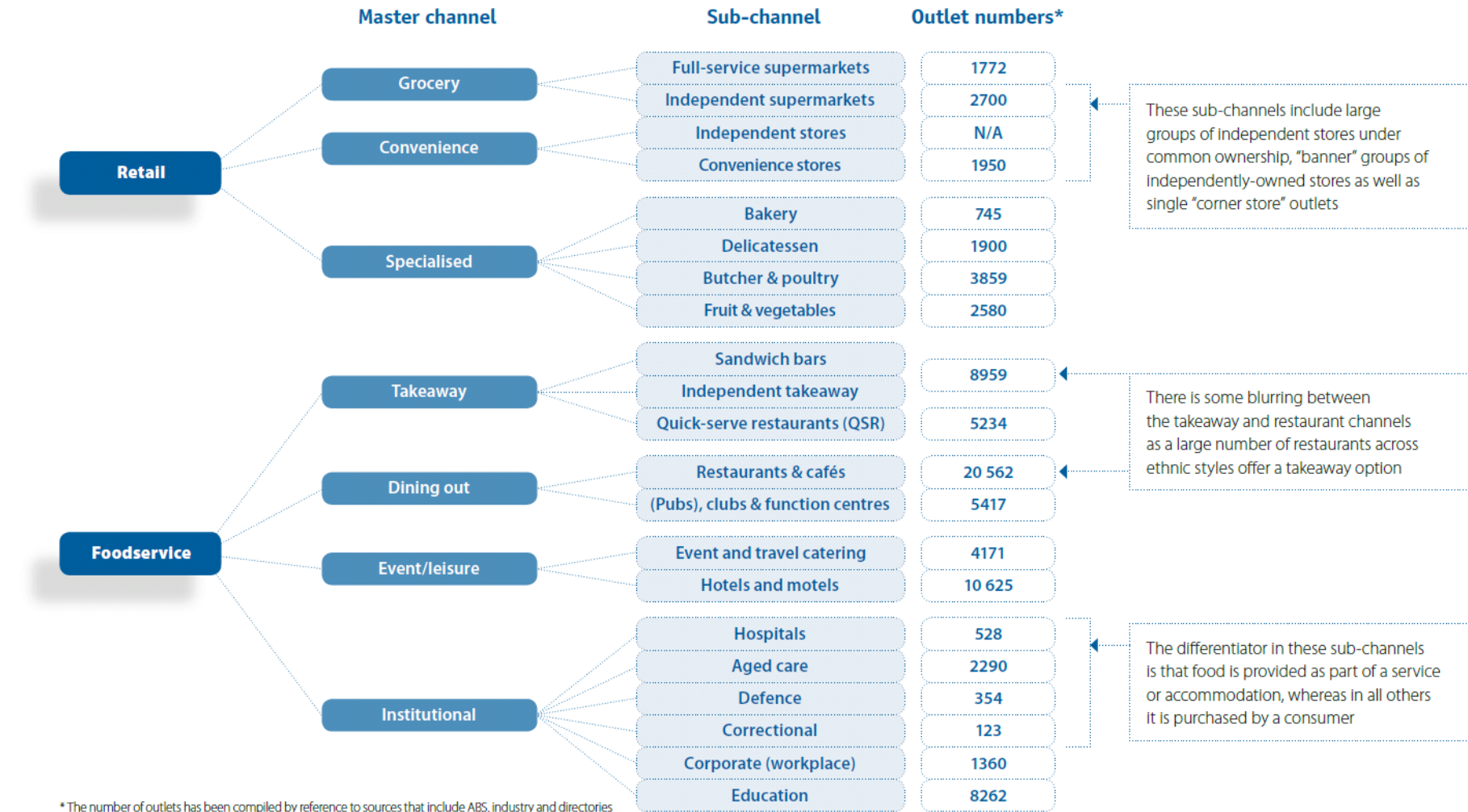
A critical aspect of the supply chain, which several interviewees suggested was undervalued in supply-driven discussion, is the point of interface with consumers.

There are two major channels for the food consumer interface, each with various sub-channels:

- Retail—incorporating grocery, convenience stores and specialised food retailers
- Foodservice—incorporating takeaway, dining out, event/leisure and institutional providers (figure 6).

The retail industry is now built around shopping centres where most family groceries are purchased at large full-service supermarkets. Supermarkets dominate sales for most types of food, and are the major conduit for food to Australian consumers.

Figure 7: Structure of food distribution channels



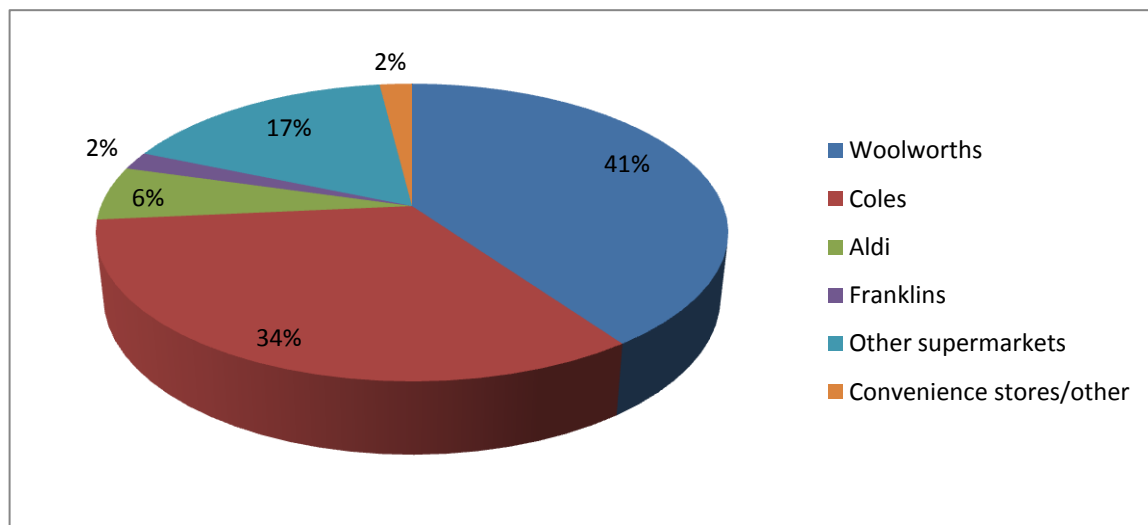
Source: DAFF 2007a, *FoodMap: A comparative analysis of Australian food distribution channels*, Department of Agriculture Fisheries and Forestry, Canberra, p. 24

An Australian Competition and Consumer Commission (ACCC) survey of grocery consumer habits found that 81 per cent of grocery shopping (by dollars spent on dry and fresh groceries) is done at supermarkets, 16 per cent at specialty stores, and 3 per cent at convenience stores or other retail outlets, although the proportion of retail sales of fresh groceries through supermarkets is generally lower than for packaged groceries (ACCC 2008:47).

There are a number of supermarket chains, although a majority of sales are through the two largest, Coles and Woolworths, which have the most stores.

The share of grocery expenditure at supermarkets, grocery and convenience stores is shown in figure 8.

Figure 8: Retail grocery expenditure at supermarkets, grocery and convenience stores



Note: These data exclude expenditure at specialist retailers, such as butchers and bakeries.

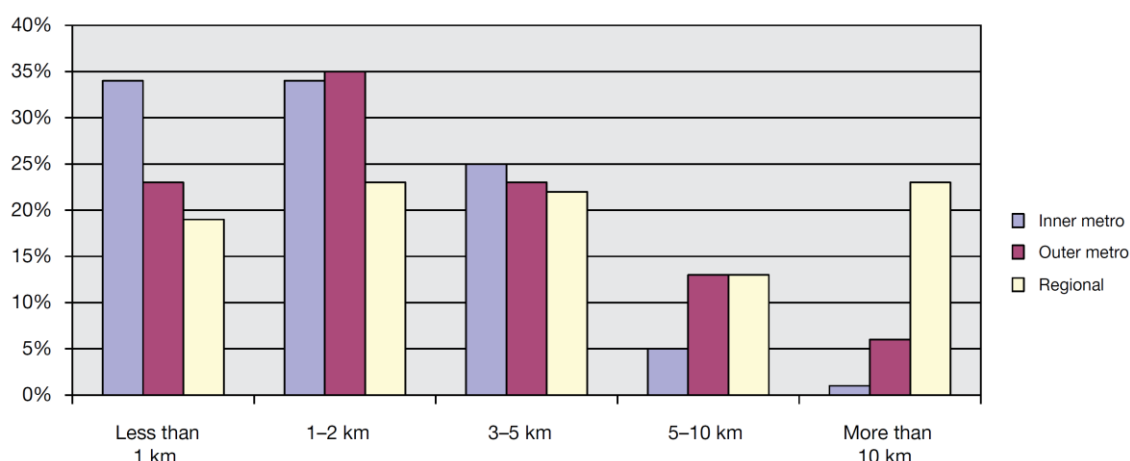
Source: Data for 2007 derived from Roy Morgan consumer survey data in ACCC 2008, *Report of the ACCC inquiry into the competitiveness of retail prices for standard groceries*, July, Australian Competition and Consumer Commission, Canberra pp. 47–48.

The foodservice sector includes tens of thousands of cafes, restaurants, sandwich shops, caterers, bars, clubs and pubs; these played a vital role in many communities affected by the 2010–11 Queensland floods (chapter 5).

Australians purchase groceries locally and generally shop more than once a week.

Almost 90 per cent of consumers living in metropolitan regions normally travel less than 5 kilometres to shop at their regular supermarket (figure 9). Consumers living in regional areas tend to travel further to do their supermarket shopping.

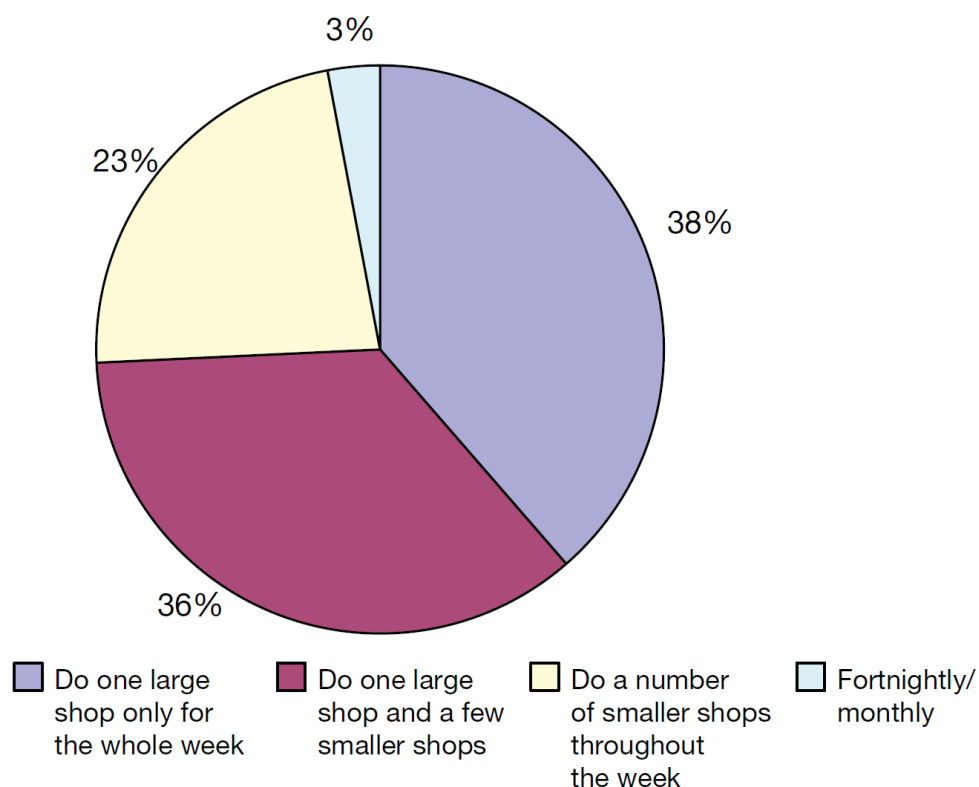
Figure 9: Distances normally travelled for regular groceries



Source: ACCC 2008, *Report of the ACCC inquiry into the competitiveness of retail prices for standard groceries*, July, Australian Competition and Consumer Commission, Canberra, p. 79.

Nearly 60 per cent of consumers shop for groceries more than once a week, although most make one large weekly shopping trip and have a few top-up shops for perishable or other items (figure 10).

Figure 10: Frequency of Australian consumer grocery behaviour



Source: ACCC 2008, *Report of the ACCC inquiry into the competitiveness of retail prices for standard groceries*, July, Australian Competition and Consumer Commission, Canberra, p. 70.

Given these shopping patterns, industry estimates suggest that 95 per cent of Australian households maintain between two and four days of pantry stock, on average (Link 2009:9).

It seems reasonable to suggest that lower-income households would have less pantry stock than the average Australian household, making them generally more vulnerable in the event of disaster. Rural residents with further to travel to purchase food would likely have more pantry stock than the average urban Australian household, especially in areas where seasonal isolation may be a reasonable expectation. For example, a resident of Windorah (in western Queensland) reflected that ‘we get flooded like this pretty much this time every year, and we get warnings so we can get stocked up before it happens’ (Agius 2010).

Anecdotal evidence from the 2010–11 Queensland floods confirms this view. For example, a senior manager said ‘rural Queenslanders are used to disasters and prepare for them’. There are, however, no disaggregated data on household pantry stocks broken down by region to prove or disprove this hypothesis statistically.

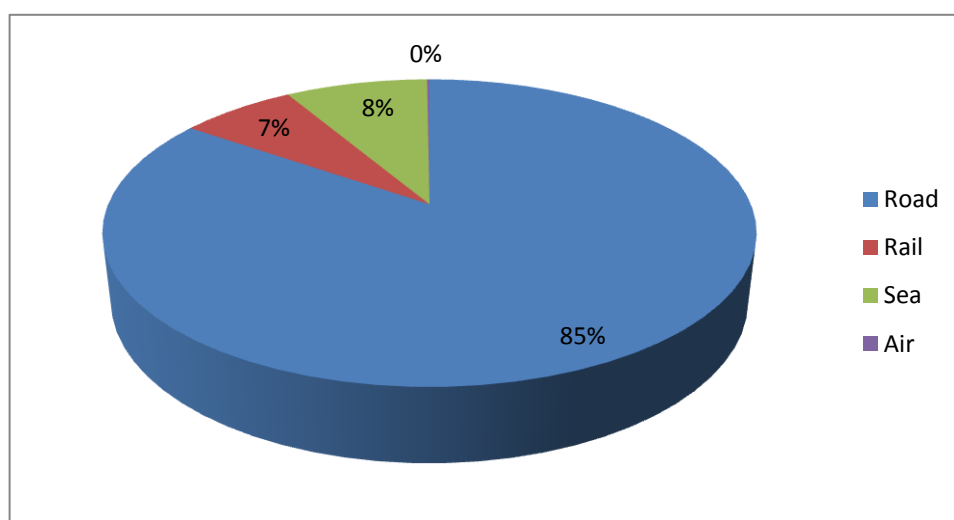
3.1.4 Food supply chain dependencies

Dependencies for the food supply chain include infrastructure, labour and imports.

Like all physical supply chains, the food supply chain depends on a range of infrastructure for continuity of production, processing, distribution and retail—power, water, financial services, communications and transport services. For example, this infrastructure enables retail stores to store chilled food, process transactions and clean; manufacturers to undertake energy-intensive processing; and distributors to relocate product from place to place.

Road transport dominates food distribution across Australia (figure 11); although other modes are also used for certain purposes (for example, rail is particularly important for food transport to Western Australia).

Figure 11: Mode share for transport of food (tonne/kilometres travelled)



Note: Food is defined as ‘food (for human and animal consumption)’ and does not include cereal grains or live animals. The data do not include road freight movements made by rigid and light commercial vehicles.

Although tonnage by air is negligible, air does account for some high-value food movements.

Source: ABS 2002, Freight Movements, cat. 9220.0, Australian Bureau of Statistics, Canberra, data for year ended March 2001 (most recent survey).

According to industry interviewees, on any given day, there could be up to two days’ food supply held at different points in the transport system (on road, rail or ship).

The food supply chain also relies on the employees who support the supply chain and is a relatively labour-intensive industry, particularly at the consumption interface (grocery, retail and foodservices).

Australia produces a wide variety of foods and inputs to foods and is overall a net exporter of food—for example, with an export surplus of \$14 billion over food imports in 2007–08 (ABARE 2009:2). This does not necessarily mean Australia is self-sufficient with regard to food, as different items are exported and imported.

Global supply arrangements are increasingly important in the Australian food sector. For cost-effective supply and/or product line diversity Australia imports many types of food or inputs to food such as:

- fertilisers, chemicals and stockfeed, for primary production
- ingredients, additives and packaging materials, for food processing
- finished goods, for distribution to consumers.

Ingredients, additives and packaging materials (inputs to finished foods) are particularly dependent on imports as there is limited Australian production of these intermediate products. Where ingredients, additives or packaging are imported into Australia for use by Australian manufacturers of finished goods, those finished goods are generally import-dependent. For example, tinplate steel used in a range of canning applications is now entirely imported (particularly from Asia) after BlueScope Steel closed the only Australian tinplate manufacturing plant in early 2007, and long-life packaging is similarly fully imported, for example Tetra Pak transitioning from local production to global sourcing since 2006. In addition, major products where a significant proportion of domestic consumption is met by imported finished goods include canned fish, infant formula and rice (as well as non-food groceries such as soap and toothpaste) (DAFF 2009).

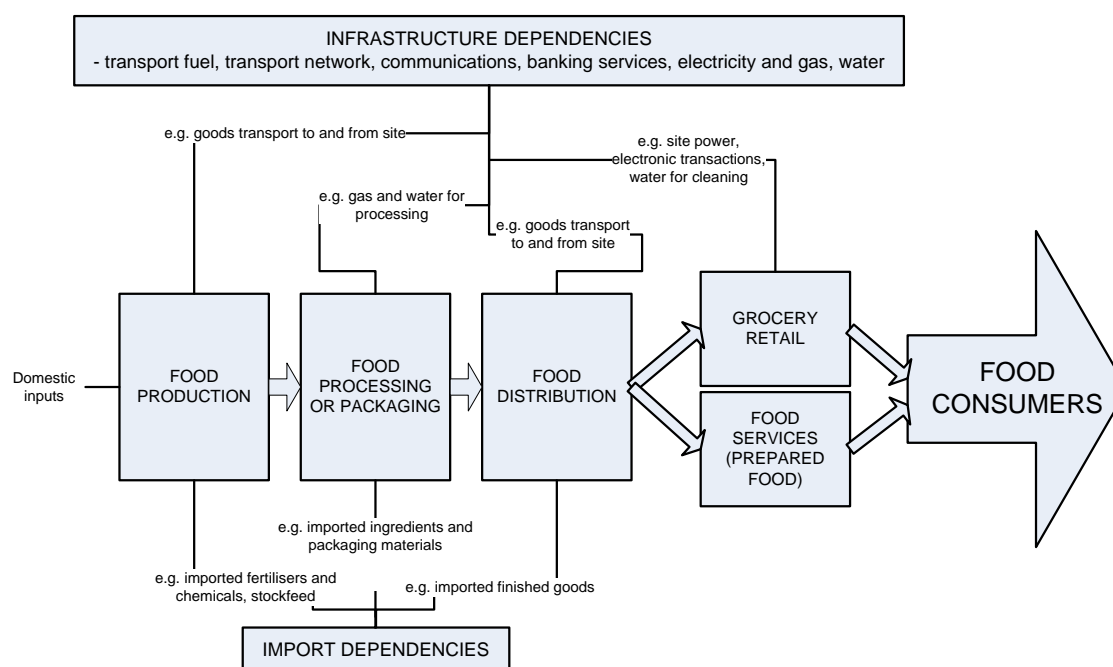
Some import dependencies are subtle, with key imported ingredients being relatively minor in terms of percentage weight or value, but nevertheless vital to final production: for example, yeast for bread products. Other foods are reliant on imported ingredients such as colouring, flavouring or other additives that are key components of approved recipes for finished products.

While limited consolidated data are available about the nature of important dependencies, recent informal analysis suggests that:

Most packaged foods contain an ingredient or a component or are packaged using imported materials for which there are no domestic alternatives ... there are significant import dependencies for the provision and/or production of the majority of foods (especially non-perishable foods) consumed by most Australians (DAFF 2009).

Figure 12 shows these dependencies.

Figure 12: Overview of food supply chain and its dependencies



3.2 Current changes in the food supply chain

3.2.1 Overview

Changes underway in the Australian food supply chain are widespread, and transforming the relationship between suppliers and consumers. Some of this change is happening dramatically over a short time period: advances in logistics and transportation technologies are enabling rapid delivery, lower inventories, and wider geographical sourcing of food—affecting not only supplier costs but also consumer variety and choice. Other aspects of change are a steady response to long-term trends: demographic trends to single-person households and families with two working parents has increased demand for prepared foods; since the 1980s a growing trend toward seasonal in-fill of fresh produce has led to increased transfer of produce between the northern and southern hemispheres; and the Australian diet has become highly diverse and varied over the last 50 years.

Consumer trends affecting the food supply chain are not homogenous, and some appear to run in contradictory directions: for example, there is both increased demand for produce out of season and a growing preference by a different segment of consumers to local sourcing and seasonal food, seen for example in the rapid growth (from a small base) of farmers markets. An Australian Farmers' Markets Association was formed in 2003 to facilitate and support such markets (personal Communication, Jane Adams, AFMA, March 2011).

Many of these changes are also happening—or are more advanced—in other developed countries, such as the United Kingdom and the United States. For example, a 2009 UK Government study that examined food supply chains in the context of a broader study of food security noted the importance of diversity in food supply as a resilience factor—although with concomitant risks in relation to energy dependence for transportation and storage.

Changes can be considered as **supply-driven**, for example as large supermarkets seek commercial efficiencies in the distribution network; or as **consumer-driven** with demographic and societal change affecting consumer preference and behaviour.

3.2.2 Supply-driven change

The Australian food supply chain is experiencing substantial and, to a large extent, unprecedented reform in logistics and supply chain management driven by the major supermarkets.

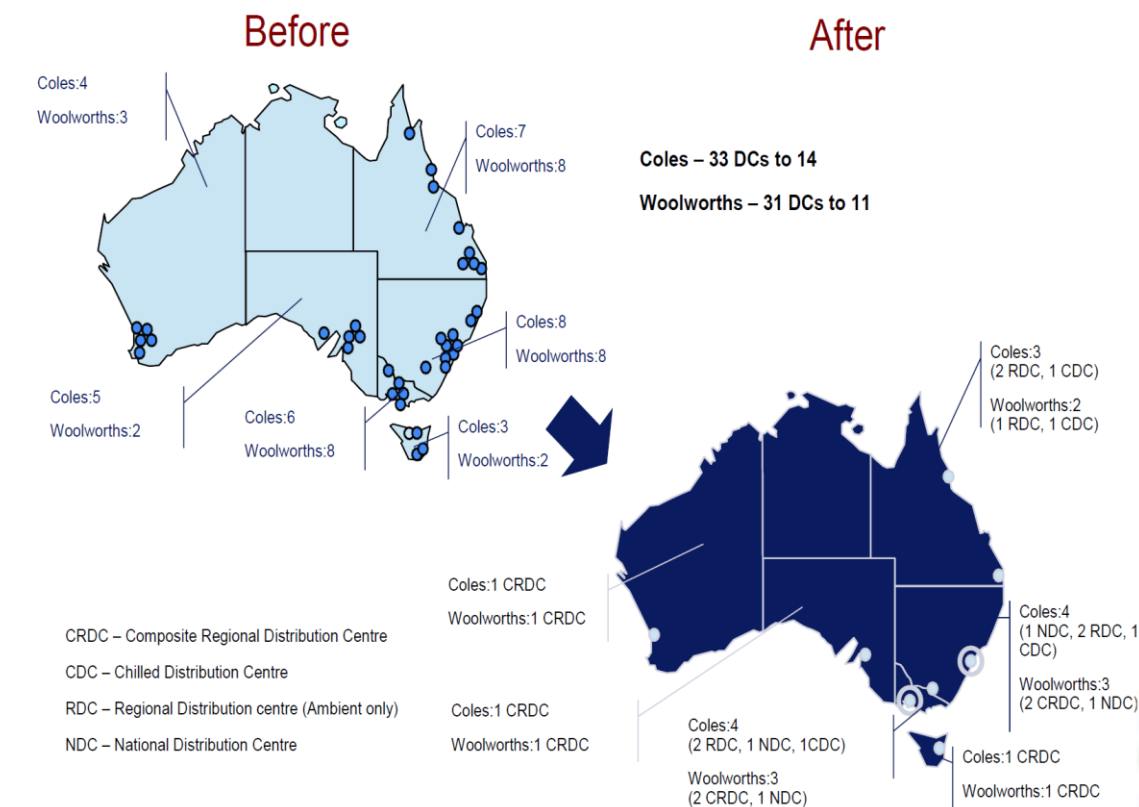
The Australian grocery supply chain has been transformed over the past five years as Woolworths and Coles, in seeking to reduce their costs and improve on-shelf availability, have adopted and tailored to the Australian market the supply chain practices of leading European and United States retailers (PwC 2008:48).

Just-in-time logistics management, through supply chain rationalisation and greater use of technology, is the focus. The commercial driver is cost savings and greater responsiveness to consumers—the impact is a more streamlined supply chain.

Much of the emphasis on [supply chain management] today is on aspects of purchasing, supplier management and the technological solutions that facilitate more efficient inventory management; the ultimate aim of the technological solutions being the substitution of information for physical inventory (DEFRA 2009:6).

One clear impact is consolidation of retail distribution centres. Figure 13 summarises the five-year consolidation of Coles' and Woolworths' distribution centres that was expected in 2006, further advancing regional (often cross-state) and in some cases national distribution.

Figure 13: Expectations of distribution centre consolidation, 2005 to 2010



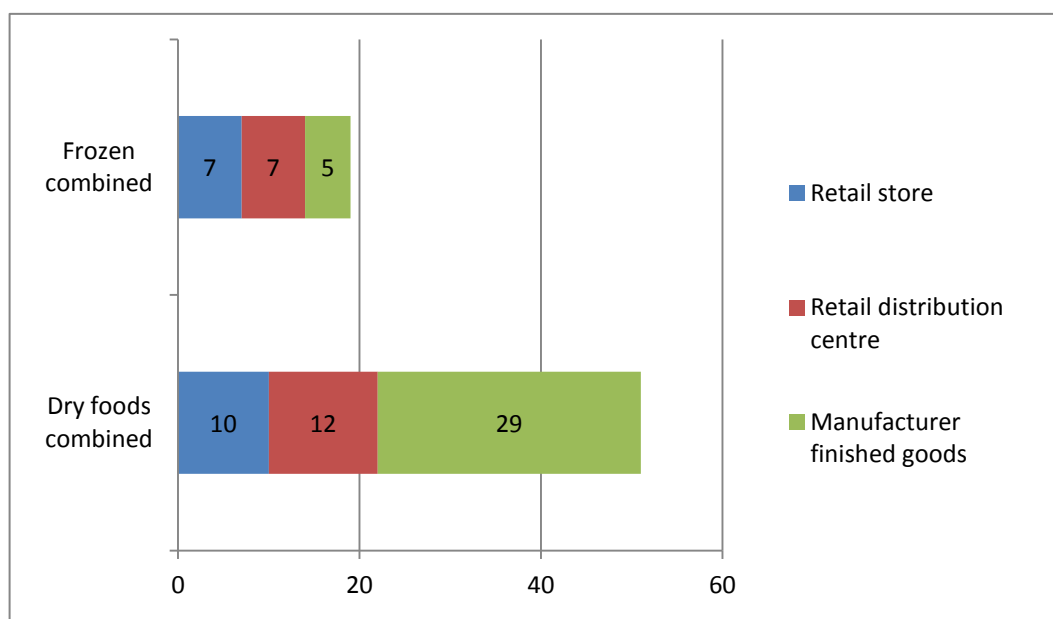
Source: PwC 2006a, *Retail & Consumer Outlook – Australia 2006: the path continues*, 2nd edn, May, PricewaterhouseCoopers, p. 68.

Supply chain efficiencies are also affecting the level of inventory in the supply chain. For example, with reference to fresh produce:

Now that retailers' fresh supply chains are largely stockless, they are focusing on the time produce spends in the supply chain and on-shelf. [A recent study] found significant opportunities to ... reduce inventory carrying time and improve freshness. ... In this particular example, inventory days were halved in some cases in the upstream supply chain (PwC 2008:54).

Overall inventories have reduced significantly in recent years. Figure 14 shows the results of a 2006 survey of three Australian retailers and wholesalers, and 11 Australian and three New Zealand manufacturers. It shows an average inventory cover of 14 days at retail stores and distribution centres for the 'frozen combined' category (chilled and frozen items), and 22 days at retail stores and distribution centres for the 'dry foods combined' category (dry foods and drinks). For dry foods combined, the manufacturer maintains a substantial inventory of finished goods for an average of 29 days.

Figure 14: Average Australasian food inventory pipeline (days, 2006)



Source: Adapted from data in ECR Australia 2006, *Australasian Grocery Industry Tracking Study 2006*, p. 23.

This is also shown numerically in table 1. Trends are considered in figure 14.

Table 1: Average Australasian food inventory pipeline, 2006

Supply chain stage	Frozen foods combined		Dry foods combined	
	Days per stage	Cumulative days per stage	Days per stage	Cumulative days per stage
Retail store	7 days	7 days	10 days	10 days
Retail distribution centre	7 days	-14 days	12 days	-22 days
Manufacturer finished goods	5 days	-19 days	29 days	-51 days
Raw materials	27 days	-46 days	29 days	-80 days

Source: Adapted from data in ECR Australia 2006, *Australasian Grocery Industry Tracking Study 2006*, p. 23

These figures are based on 'normal' demand patterns; it is likely that in any crisis the patterns of demand would change. In overseas examples the observed pattern of consumer behaviour in a crisis

has been a spike in demand for some staple products, such as rice and canned goods, and also in demand for bottled water. Although generally a manufacturer also holds substantial raw materials, barriers such as unavailability of an essential input or power or labour shortages may prevent these materials being transformed into finished goods. Some essential inputs to manufacturing may be sourced from imports or they may depend on one or two key domestic suppliers. In the event a crisis disrupted supply of a key ingredient, manufacturers may discontinue the affected food product line. Discontinuation may be temporary, for the duration of the crisis, or may become permanent if over that period a strong supply chain for an alternative source or substitute product develops.

The companies consulted during this study confirmed that the numbers shown in table 1 remain a reasonable guide to inventories, particularly if supply chain efficiencies achieved since 2006 are taken into account.

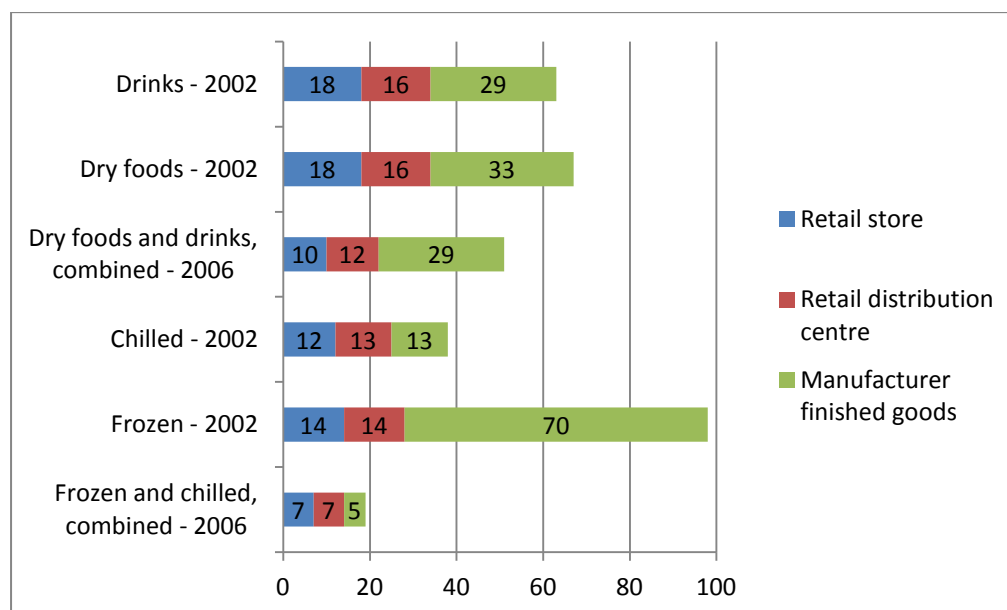
A more recent estimate for supplies available within the national supply chain indicates five days for fresh food, 14 days for chilled stock, and 30 days for dry goods (RAWG 2009:3).

In discussions for this study, one food manufacturer suggested it held 30 days of finished goods stock for ultra-high-temperature (UHT) milk and 20 days of finished goods stocks for juice. Another suggested 30 days of finished goods for various dry goods, and 25 days of (mostly import-sourced) raw materials.

There will of course be variation between different product categories; for example, in terms of raw materials much horticultural production is highly perishable and time-sensitive, whereas animals can be left on the hoof or grains in the ground or in temporary storage.

The figures above represent a reduction in inventories since the previous survey in 2002 (figure 15), particularly from a retail perspective; for example, in 2002 each of drinks and dry foods had an average of 34 days inventory at retail store and retail distribution centre totalled, compared with 22 days in the 2006 survey.

Figure 15: Average Australasian food inventory pipeline (days, 2006 and 2002)



Note: Frozen combined refers to chilled and frozen items, and dry foods combined refers to dry foods and drinks.

Source: Adapted from data in ECR Australia 2002, *Australasian Grocery Industry Tracking Study 2002*, p. 34

The Australian grocery retail supply chain still has some way to go before it operates as efficiently as global ‘best practice’ (in terms of lean supply chains and just-in-time management) (PwC 2008:48). It is therefore likely that supermarket chains and other suppliers will continue driving opportunities for supply chain efficiencies—that is, the trend to lower inventory holdings will continue for a number of years, although tapering off as the supply chain matures and grows closer to its frontiers of economic efficiency.

3.2.3 Demand-driven change

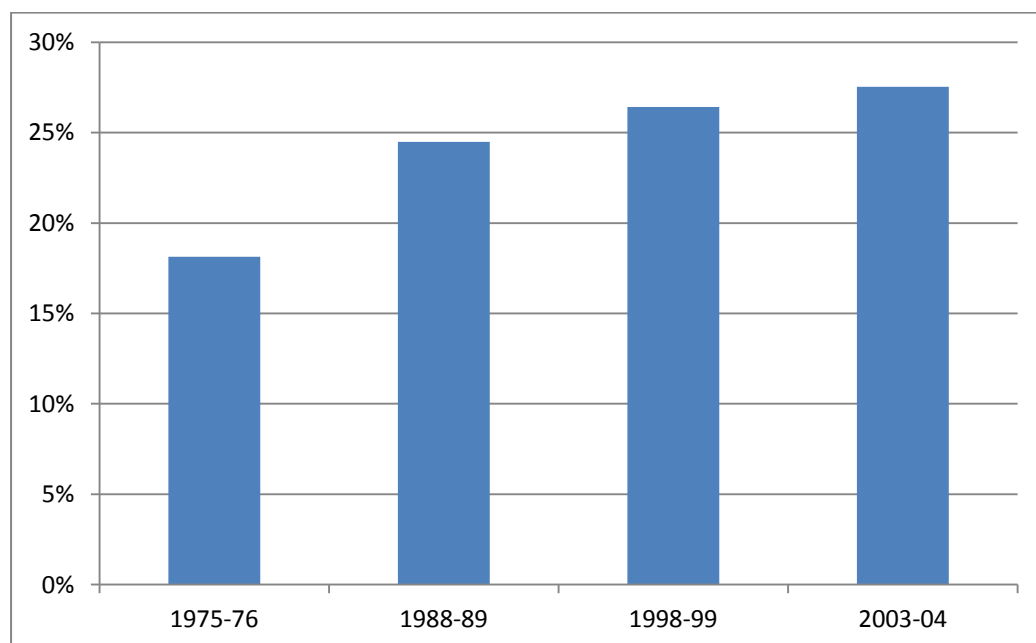
As well as changes driven by the food supply industry, consumer preferences and behaviour are also driving changes to the food supply chain.

One analysis suggests two trends leading to an increasing volume of food being distributed through non-supermarket channels: through meals consumed outside the home and through independent fresh food specialists (Spencer & Kneebone 2007:1).

While supermarkets and other grocery suppliers remain the predominant source of food for Australians, foodservices are an increasingly important part of Australia’s food supply chain.

Figure 16 shows the share of Australian households’ food and non-alcoholic drinks spending on meals out and takeaway foods. The share of meals out and takeaway foods has been increasing steadily over the last 35 years, now representing well over one-quarter of the amount Australian households spend on food. This trend is likely to continue.

Figure 16: Share of household food expenditure on meals out and takeaway foods



Note: Food is defined as food and non-alcoholic drinks.

Source: Derived from ABARE 2009, *Australian food statistics 2008*, p. 69 (based on ABS statistics, most recent data available)

Another industry statistic suggests that 40 per cent of meals are consumed outside the home (Link 2008:9); a similar analysis suggests the ABS data underestimates non-home food consumption because supermarkets and other grocery retailers supply takeaway and dining out outlets, and the

size of the institutional food market (healthcare, defence) where the food industry records this as wholesale not retail food sale (Spencer & Kneebone 2007:11).

In addition, a comment interviewees frequently made was that the composition of food purchased from supermarkets may be changing as consumers switch to pre-prepared food in preference to full preparation of meals from basic foodstuffs. One interviewee commented 'if we gave some people a bag of flour or a bag of rice they would not know what to do with it'.

If this is a widespread trend, it would contribute to reduced resilience in the face of a crisis or disaster. However, little hard data are available with which to confirm the extent of this trend. It would be possible to collect more detailed quantitative data either from industry sales data or from market survey firms (subject to appropriate protections for confidentiality—disaggregated data on consumer preferences are commercially sensitive).

4 Possible threats to food supply chain resilience

This chapter outlines current issues in supply chain resilience, with particular reference to food and the Australian context. It also discusses the possible short-to-medium term disaster scenarios the Australian food supply chain might face, and looks at case studies of recent disasters and near misses in the Australian context.

4.1 Supply chain resilience

Over recent years, ensuring continuity of Australia's food supply has been considered as part of the Australian Government's critical infrastructure protection activities. In December 2009, the government announced its intention to move from the concept of critical infrastructure 'protection' to 'embrace the broader concept of resilience', from both an organisational and a disaster management perspective (Attorney-General for Australia 2009).

Resilience refers to the capacity of organisations or systems to return to full functionality in the face of disruption. There is a rapidly expanding body of thought on resilience in a number of different contexts, reflecting recognition that not all adverse events can be avoided; effective risk management requires not only resistance but also resilience (Pettit et al. 2010).

Over the past decade the study of logistics has increasingly incorporated analysis of the factors that make a supply chain resilient as opposed to secure: that is, having an ability to bounce back from disruption rather than an ability to withstand disruptive events.

The characteristics of a resilient logistics network or supply chain are commonly identified in terms of redundancy and flexibility. Redundancy in the food supply chain refers to, for example:

- availability of additional inventory/stock of finished goods and inputs over and above that required to meet immediate needs, through multiple sources of supply and/or stocks held within the supply chain
- availability of manufacturing capacity—production lines, tools, machinery, including not only product manufacture but also bottling and canning capacity
- transport capacity—number of trucks, railway rolling stock, shipping, aircraft
- storage and handling facilities, including loading, inventory management, forklift trucks, packaging
- number of transport routes available (such as the number of alternative roads, airstrips, ports and docking facilities).

A further critical element of redundancy is staffing: the number of skilled employees available to meet unexpected events (in corporate strategy frequently referred to as 'surge capacity'). The physical elements of a network require people to operate or make use of them; a network might have a high degree of physical redundancy and still be vulnerable to shortages of key staff.

Flexibility in the food supply chain refers to the ability of participants at the various stages of the chain, from suppliers through to retailers, to adjust their behaviours and strategies in the face of changed circumstances. This includes:

- multiple strategies for packaging and handling (including, for example, the ability to move food from cans to soft packaging, or from packaged to bulk supply)

- production lines that can adjust rapidly to changes in raw materials (such as, different grades of grain in cereal manufacture, or even changes from one grain to another)
- ability to transfer from one mode of transport to another (such as, from road to rail, road to ship) should one become unavailable
- multi-skilled and adaptable workforce.

Associated with flexibility is the degree to which a network is concentrated or distributed: that is, reliant on a few key nodes in the network (for example, the aviation transport network which relies on airports and air navigation systems) or delivered through multiple overlapping channels (for example, the internet—an example of a highly resilient network with few critical dependencies). A linear network is likely to be less resilient in the face of disruption than a distributed network.

4.2 Types of threats to food supply chain resilience

Any events that affect the redundancy or flexibility inherent in the food supply chain have the potential to constrain Australian consumers' ability to obtain food, in the absence of adaptation by the food supply chain and/or consumers.

At a small, localised and company-specific level, these events happen every day; for example, late arrival of a consignment affecting the normal operational schedule for a company's distribution. The system is sufficiently redundant and flexible for this to not have any material effect on consumers (although supply chain participants sometimes incur some cost and effort to adapt).

However, sometimes events can be sufficiently large-scale and potentially across multiple links of the food supply chain to constitute a major event that may greatly test food supply chain resilience.

A recent review of UK food supply chain resilience (Peck 2006b) differentiates two types of situations that can affect resilience: 'creeping crisis' and 'sudden onset' emergencies.

A creeping crisis is an emergency that tends to:

build slowly at first (often almost unnoticed at a national level), then escalate quickly, causing enormous economic damage and social disquiet ... [and which represent] systemic supply chain disruptions (Peck 2006b:3).

In the Australian context, one potential creeping crisis that has generated wide discussion and, to some extent, planning is an influenza pandemic. Other examples might include a biosecurity concern (such as foot and mouth disease) and drought for certain food products.

A sudden onset emergency is one that generally has a direct impact on links in the food supply chain, such as industrial action, a natural disaster or severe weather event, a terrorist attack, or food or water contamination.

There are also hybrids of these situations where food and beverage supplies are disrupted as a creeping crisis as a consequence of a sudden onset emergency, such as where the food supply chain is indirectly affected by a direct impact on an infrastructure dependency, such as power, water or communications outage.

Possible effects as a result of these events might include, in whole or part:

- constrained ability to locally produce or import certain food products
- logistics failures across the supply chain

- panic buying by consumers
- increased general demand on supermarkets (due to reduced capacity of foodservice outlets and/or reduced supply of fresh produce)
- regional quarantine measures or national border control measures.

The type of event will often vary in how it directly affects the food supply chain; whether the major disruption is at the food production, processing, distribution or retail stage, or more than one of these stages, but all will likely have downstream effects on consumers.

Sometimes these affects will be localised (but often require supply chain adaptation at a national level); sometimes they will only relate to certain product categories.

For example, a biosecurity threat to animal health (such as foot and mouth disease affecting cattle) would have a direct impact on the (domestic) production link of the supply chain and have a downstream impact on the availability of beef for consumption. A natural disaster (such as a flood affecting distribution of foodstuffs in Queensland) would have a downstream impact on the availability of fresh fruit and vegetables across Australia, as well as localised direct impacts in Queensland.

Table 2 provides examples of major events that have affected or could affect the Australian food supply chain.

Table 2: Examples of major events that may test food supply chain resilience

Event type	Example
Pandemic	Possible influenza pandemic
Electricity or gas supply outage	2009 Victorian Black Saturday bushfires 2008 Western Australian gas crisis—Veranus Island 1998 Victorian gas crisis—Longford explosion
Industrial action	2008 national road transport driver shutdown 1998 waterfront strike 1987 storemen and packers strike
Food or water contamination	1998 Sydney water contamination incident
Severe weather event (flood, cyclone, drought)	2011 tropical cyclone Yasi 2010/11 Queensland floods 2010 tropical cyclone Ului—Queensland (Airlie Beach) 2010 central Queensland flooding 2007 Sydney supercell storm 2007 Hunter Valley floods 2006 tropical cyclone Larry—Queensland
Other possible events	Coordinated demonstrations Land contamination (chemical) in production areas Major animal or plant disease biosecurity emergency

4.3 Case studies of recent disasters and near misses

Appendix 2 provides a number of case studies of events that tested Australia's food supply chain resilience over the past decade. They cover the Veranus Island gas crisis in Western Australia, tropical cyclone Larry in Queensland, and the Longford gas crisis in Victoria.

The key lessons from the case studies is that the food supply chain proved resilient in the face of immediate threat, and suppliers adjusted rapidly to the changes in circumstances. During consultations with industry undertaken for this project, other examples (including bushfires and floods) were also cited, and industry representatives were generally pleased with their capacity to respond rapidly and adaptively to immediate threats. Some noted this as an Australian national trait.

The case studies also indicate that one of the key elements of dealing with threats to the food supply is that, where disaster events have been localised, other states or regions have been able to make up shortfalls in the affected areas. Rail and road transport played key roles, as did sea transport and barges in Queensland (also mentioned in relation to flooding in 2010–11; see next chapter). This suggests that if adverse events coincided (for example, both a natural disaster and a disruption to communications and transport links at the same time in adjoining states) or a nation-wide disaster occurred (for example, a pandemic or a severe animal disease outbreak) the consequences for the food supply chain would be severe and the risk of disruption real.

The lessons from the past were consolidated by the recent experience of Queensland in the face of one of the largest flood events in that state's recent history, in December 2010–January 2011. The floods were closely followed by tropical cyclone Yasi that at one stage threatened the northern Queensland cities of Cairns and Townsville.

5 Lessons from the 2010–11 floods in Queensland

This chapter presents a case study examining the effects of the 2010–11 floods in Queensland and the lessons learned.

5.1 Background

In December 2010 and January 2011 one of the worst flood events in Australia's recent history affected large parts of Queensland. The extent of rainfall that contributed to the floods resulted from a coming together of a number of adverse weather events. The La Niña pattern during 2010 brought wetter conditions across Queensland's river catchments, which in some parts of the state resulted in isolated flooding early in December 2010. Wide-scale flooding followed in late December 2010 when the short-lived but devastating tropical cyclone Tasha and a subsequent low pressure system brought torrential rain across north, west, central and south-east Queensland. This exacerbated existing flood situations and brought severe flooding to a much wider geographic area.

Over two weeks, flooding spread south across the state from Rockhampton to Brisbane including the Fitzroy River basin, the Burnett River basin, the Condamine–Balonne River basin, the Mary River basin, the Lockyer Valley–Toowoomba, and the Brisbane River catchment, as well as other locations in Queensland. The intensity of the flood events and their impact on human settlement grew steadily worse over the month of December and into January.²

By early January 2011, three-quarters of Queensland—Brisbane, Bundaberg, Dalby, Gladstone, Gold Coast, Gympie, Ipswich, Logan, Maryborough, Rockhampton, Roma, Sunshine Coast, Toowoomba, Warwick and Redcliffe—was declared a disaster zone (Bligh 2011).

Food supplies were affected by direct inundation of growers and producers, food retail outlets and distribution centres, including flooding of the major fresh produce market for the city of Brisbane, the Rocklea markets.³ The food supply chain was severely disrupted across all transport modes: road, rail, sea and air.

The flooding resulted in evacuation of residents and closure of transport links in many communities. At its peak, 155 roads were severed by flooding and damage, including 14 highways. Affected highways included the Bruce, Burnett, Capricorn Centenary, D'Aguilar, Dawson, New England, and the Warrego, as well as the Ipswich Motorway; all major freight routes (Wallace 2011).

Rail was also severely affected. Parts of the North Coast Line between Brisbane and Cairns, used to move freight into central and north Queensland, were closed for almost a month from mid-December 2010 after an initial derailment near Mackay, and subsequent flooding in Bundaberg and elsewhere (Nolan 2100). Comments from a number of industry sources were that in a natural disaster rail is immediately and severely affected, and is considered a risky option for food distribution because of the time it takes to return to functionality. The industry is also cautious that following a disaster there can be a greater likelihood of later disruption in the rail network due to

² A map of Queensland showing developments as they unfolded is available at www.thecourier.com.au/specialfeature.aspx?id=4353 (viewed 20 May 2011).

³ Temporary markets were established and limited functions restored within three days of inundation; a very rapid turnaround, given the scale of flooding experienced.

weakened infrastructure; they are wary that subsidence or other damage to the track could increase the chance of derailment, which would further delay food shipments.

Road is also favoured over sea during an emergency due to its relative speed. However, sea transport is an important alternative source of supply when roads are entirely closed (see 'Food storage, transport and distribution—problems and risks' below).

The flood event cut off numerous cities and towns from food and other supplies. As well as major regional centres, such as Rockhampton, scores of small rural towns and communities were isolated by flooding for lengthy periods. Emergency food drops by helicopter were required for some communities to meet immediate needs before food supply chains could be restored. At centres such as Rockhampton both road and rail were disrupted.

Following soon after the flooding, a major tropical cyclone threatened far north Queensland. Yasi began as a tropical low north-west of Fiji on 29 January, and by the time it neared Australia had intensified to a category 5 cyclone. According to the Australian Bureau of Meteorology, it was 'one of the most powerful cyclones to have affected Queensland since records commenced' (BoM 2011). It crossed the coast near Mission Beach in the early morning of 3 February 2011. According to most industry observers, this was a stroke of good fortune. Although it had a devastating impact where it made landfall, had it struck another 150 kilometres either north (near Cairns) or south (near Townsville) the effect on the population and on the food supply chain would have been much greater than it was.

The destructive winds would have been compounded by a massive tidal surge that would have cut road and rail links along the coast, further isolating communities and adding pressure to food stocks already depleted by the flooding.

Another element of infrastructure particularly at risk in coastal communities, had they been hit by cyclone and tidal surge, was the emergency cold stores (typically, shipping containers fitted with diesel powered refrigeration units) delivered following the floods. The cold store units were in limited supply, and vulnerable to tidal surges due to their temporary locations: had they been destroyed, replacing them would have been difficult, and many communities would have lost the capacity to access perishable foods, such as vegetables, meat, fish and dairy.

Despite extensive disruption caused by the flooding and subsequent cyclone, the response from the food industry and government appeared to effectively ensure continuity of food supply to affected areas. While no media reported Queenslanders going hungry as a result of the floods, some interviewees claimed that in some of the flood-affected Brisbane suburbs in areas of low socioeconomic status anecdotal reports circulated of greater food hardship than reported publicly; some interviewees also speculated that lack of coverage in the media could have been due to the media's desire to encourage recovery and boost morale. These instances were not in the suburbs worst affected by flooding—waterfront properties were more severely affected, but wealthier owners and tenants had greater resources to ensure continuity of food supply. Some interviewees suggested that media reporting may have understated the impact among disadvantaged communities because the effect of food shortages arising from the floods was likely to have been masked by ongoing problems of poor nutrition in any case.

Stocks may have been limited, and the normal range of choice for consumers restricted, but all communities maintained food supply. The factors underlying this resilience, and the risks faced in dealing with the disruption, are the subject of this chapter.

The key message is that although food was effectively distributed to flood affected communities this was only because of both extraordinary effort from industry and good fortune. If more risks had eventuated, many people in Queensland may have been left without sufficient food to maintain good health, and may have been forced to rely on limited and inadequate supplies.

5.2 Flooding and the food supply chain—immediate impacts and responses

The extent and severity of the floods affected the supply chain in a number of ways:

- transport routes were cut, preventing restocking of supermarket shelves and causing temporary shortages of some essential items
- major warehouse facilities were lost, in particular the Brisbane markets in the low-lying suburb of Rocklea
- manufacturing was disrupted, with an immediate effect on food staples, such as bread and milk
- food production was disrupted, including meat production at feedlots.

The flooding had short and long-term ramifications; in the short-term the food industry and the government had to put in place emergency measures, and in the longer-term both had to make adjustments.

5.2.1 Transport of food and groceries

Closure of major transport corridors, including large sections of the Bruce Highway, was the problem of most immediate concern for the food industry as road is the predominant mode of food transport in Australia. The Bruce Highway is Queensland's most heavily trafficked long distance road transport route, carrying freight along the coast from Brisbane to Cairns. One industry interviewee noted that 40 per cent of trucks on the road would, under normal circumstances, be carrying food.

Isolation of towns along the Queensland coastline and closure of major roads was therefore a major challenge for the food industry. The level of resilience demonstrated was however high. In the event, food was delivered quickly and successfully. A number of factors contributed to this resilience:

- Business continuity planning by the large food retailer chains and distributors (Coles, Woolworths and Metcash) was effective. This meant contingency plans were already in place that enabled these organisations to respond quickly.
- Capacity to source additional road fleet from New South Wales: mostly trailers, which allowed packing from warehouses in anticipation of future deliveries. Numerous prime movers were also available, both from New South Wales and, in the case of far north Queensland, from other industries that had been disrupted (drivers reasoned that if they were not using their prime mover for business as usual they might as well help move food). There were though some accompanying problems with this (see 'Food storage, transport and distribution—problems and risks' below).
- Well developed communications networks. The large food retailers and their transport providers often had more timely and more accurate information on the state of the road network and particular routes into and out of affected towns than did the police or other

authorities. This was due to drivers telephoning in information on mobile phones, with constant updates on road conditions, especially closures, and impending threat of closure.

- Innovative routing:
 - for long hauls, this included use of inland routes through far western Queensland and even South Australia, and making return journeys from far north Queensland back to Sydney rather than Brisbane as the flooding moved southward
 - for immediate delivery, use of alternatives to roads, including in some instances driving heavy vehicles through paddocks (with the landholders' permission) when roads into towns were inundated.
- Use of sea transport—many operators used barges to transport food, in both north and south directions, and for produce that did not normally travel by barge (one interviewee said they never expected to see pineapples on a barge, but they did in this crisis). Some food was loaded onto a ship from Melbourne to far north Queensland, and fortuitously was able to be routed to Cairns to meet demand arising from tropical cyclone Yasi.
- Use of air transport—in addition to use of local helicopters to deliver food, charter aircraft and RAAF C17 and C130 aircraft were used to fly essential food and goods into isolated regions.
- Effective communications between transport companies and the Queensland Disaster Coordination Centre.
- Rapid assessment and reopening of supply routes. A key Australian Defence Force expertise is the engineering ability to assess and repair roads, bridges and waterways for transportation. Army engineers opened roads and bridges to access outlying towns in the western area beyond Toowoomba, Royal Australian Navy divers cleared bridges for safe crossing along 45 kilometres of the Brisbane River, and mine hunters and hydrographic surveyors cleared debris posing a navigational hazard to shipping in Moreton Bay and the Brisbane River.
- A huge additional effort by retailers, transport companies and other logistics providers, with very long hours (up to 18 hour days) worked during peak times. We asked businesses if they had experienced industrial relations problems relating to hours or conditions and were told that the reverse had occurred—during the flood staff were more willing to work and many businesses experienced a reduction in sick leave taken.
- Some key differences to normal supply chain operations, which relied on changed consumer behaviour, were evident during the floods. The trigger for deliveries became availability of stock rather than orders from retailers: stock was distributed to retail outlets based on what was in warehouses and could be distributed. Important learnings were that in a crisis:
 - auto-stocker software, which updates orders based on information from cash registers, was not a reliable guide to needs
 - affected consumers, especially those in remote towns, were happy to adapt their eating preferences to whatever was available, rather than insist on preconceived menus.

5.2.2 Food storage, transport and distribution—problems and risks

Fuel

The most important risk was availability of fuel. Diesel fuel was vital for road transport and for powering refrigeration units (diesel is used for cooling, both as the backup source of power at many retail sites and for temporary cool storage in refrigerated containers). The industry was fortunate in this case that adequate diesel fuel supplies were available, but several food industry interviewees were concerned that the risk was not sufficiently identified and managed.

In Queensland, the *Liquid Fuel Supply Act 1984* outlines arrangements for essential or high priority users of liquid fuel and other constraints on liquid fuel use in emergency or related situations. The Minister has discretion to identify specific types of essential or high priority users, and legislation provides for the Minister to issue guidelines for relevant parties in relation to this power.⁴ Some industry interviewees were strongly of the view that in terms of risk management for future events, guidelines ought to be promulgated specifically identifying food transport as an essential use in cases where fuel supplies might be rationed.

According to informal advice from the Queensland Department of Employment, Economic Development and Innovation, in practice Queensland would follow whatever has been defined as essential users in the national context—that is, through the *Liquid Fuel Emergency Act 1984* (Cwlth), Liquid Fuel Emergencies Guidelines 2008 and the Liquid Fuel Emergency (Activities - Essential Users) Determination 2008. These state (in summary) that the responsible federal minister may identify essential users:

in a particular state or territory if, and only if, the activities carried on by that person or organisation in that state or territory are or include:

- (a) activities related to the defence of Australia; or
- (b) activities related to the provision of that [fuel] product as fuel for ships and aircraft engaged in trade or commerce: (i) between Australia and places outside Australia; or (ii) among the states; or (iii) between a state and a territory or between territories; or
- (c) activities related to the export of that product from Australia; or
- (d) activities carried out by the following: (i) an ambulance service; (ii) a corrective service; (iii) a fire or rescue service; (iv) a police service; (v) a public transport service; (vi) a State Emergency Service or an equivalent organisation; (vii) a taxi service.

There is no doubt that if food supplies were threatened the guidelines would be broadened to include food transport. Protocols are also established for rationing of emergency fuels in an emergency. However, food industry interviewees were of the view that food should be automatically included rather than having to be added after the need emerged (at which time some communities would already be at crisis point).

According to government stakeholders consulted, there are practical difficulties in defining what food and groceries are essential. Emergency authorities would be reluctant to include a broad

⁴ Similar provisions apply in other states. For example, in New South Wales, the *Energy and Utilities Administration Act 1987* gives the relevant Minister discretion to give directions for fuel uses and users, in respect of a state of emergency. Similar provisions exist in the Victorian *Fuel Emergency Act 1977* with the relevant Minister having discretion to give directions for fuel uses and users during an emergency. No specific legislative provisions include or exclude specific uses or users.

definition because of the pressures business operators (large and small) would put on them to have their goods moved so the businesses concerned could continue operating and make sales for as long as possible. Some government interviewees expressed concern that they would receive numerous requests for fuel supplies to be allocated to move non-essential items, and this could put pressure on fuel needed to meet more urgent needs. If a narrow definition can be developed that provides a workable solution to this problem, there would be merit in considering amending the guidelines. Industry stakeholders were of the view that clear and simple delineation of essential food and hygiene goods required in a disaster or emergency response could be achieved.

Electricity and gas

Second to fuel as a risk to food supplies is availability of power; loss of power has a huge impact on the food industry. If cash registers are not powered, not only are retailers unable to sell food, but also communications between cash registers and suppliers (auto-ordering systems) are lost. Cash sales are often not an option—consumers rely on EFTPOS or credit cards for food purchases, and do not carry cash to make purchases, and retailers are unable to record cash purchases. According to industry sources, between 50 and 80 per cent of sales of food and groceries are on EFTPOS.

Loss of or reduced power can also lead to closures of retail outlets due to other concerns; no lighting can mean occupational health and safety and public safety concerns in many retail stores, forcing them to close even if they have stocks of dry goods on the shelves. It can also affect warehouses—although most large distribution centres do have diesel backup for power outages. More often, it is smaller operators with limited storage and no backup generators that suffer the greatest losses due to power failures.

Power outages also have an immediate impact on stock losses, particularly of chilled and frozen food. During the Queensland flood crisis, many retailers donated those goods to community organisations before they perished.

Sea freight capacity

Although some food was transported by barge, finding space on the limited number of barges available was not easy. Most interviewees who commented on this question were of the view that not enough sea freight capacity was available, and that resilience would be greater if there were more sea options. One interviewee said bluntly that barges were ‘not available’ and that the Queensland Government had to dispatch reconnaissance teams to assess transport and docking options during the crisis.

Where seagoing capacity was available, delays were still reported due to the paperwork needed to divert and reschedule barges or container vessels. This was a particular frustration for businesses trying to resupply coastal towns cut off by road, rail and air.

The Australian Defence Force also had limited capacity to assist with sea freight. The comments of the Defence Minister, Stephen Smith, in February 2011 relating to the risks of unavailability of amphibious vessels had tropical cyclone Yasi hit a major population centre were widely publicised. This element of capability is being addressed internally within the Department of Defence.

Airfreight

Another factor that inhibited efficient distribution of essential food and goods using RAAF aircraft was the different commercial (road/rail/air) and Defence packing requirements that meant re-

palleting goods on the tarmac before take-off and after landing. Commercial pallet sizes are not compatible with Defence palletising systems.

The media reported volunteers were recruited to help re-pallet goods, and from these reports it appeared that as a result uploading the supplies onto aircraft was accomplished in reasonable timeframes. It would have been far more difficult to achieve had it relied solely on RAAF personnel.

Most of the airfreight of food in this disaster was to meet immediate emergency needs rather than for restocking. Some supplies from overseas arrived by air; for example, dairy company Fonterra organised a large air shipment of UHT milk from New Zealand to Queensland. For the most part though, limited use was made of airfreight due to costs involved and the rapid response of road transport (see 'Transport of food and groceries' above). In addition, some Queensland airports were flood affected so airfreight was not an option. In particular, Rockhampton Airport was closed for three weeks, and its runways suffered flood damage that limited their use even when they reopened. Road and sea were thus very important to supplying food to Rockhampton.

Cyclones and associated storm surges in Queensland can cause extended airport closures due to the location of many airports close to the shore. In this case, although tropical cyclone Yasi caused temporary closure of Cairns and Townsville airports it did not cause lasting damage.

Refrigerated transport

Although road carriers were able to source a large number of additional prime movers and trailers from New South Wales, some risks relating to refrigerated transport had to be managed. The loss of rail capacity (where refrigerated containers are used to move fresh produce) meant a greater demand on refrigerated pantechnicons (large enclosed vehicles) sourced from a variety of operators. In normal circumstances, major food distributors control their own fleet and apply careful controls in relation to fresh produce, such as sanitising after previous loads and knowing what those loads were so as to minimise possible contamination. This is more difficult in an emergency where information about the vehicles may not be available. While no health incidents, such as outbreaks of food poisoning or other disease, were reported it is a risk when fresh produce is involved.

Communications

The importance of the communications network to the response in this emergency cannot be overstated. If there had been a breakdown of telephone and/or internet facilities, there is no doubt in the minds of those involved in transporting food that the effort would have been less effective. As one interviewee commented, 'without mobile phones the disaster would have been much worse'. One of the main Australian Defence Force capabilities in emergencies is to quickly and efficiently provide a communications network over a wide area, based on Defence communications equipment. In this instance the capability was not required as the civilian mobile phone system still functioned. No empirical testing was therefore possible in this emergency of the effectiveness of Defence communications in ensuring the food supply. Defence sources indicated that, had the need arisen, Defence capacity would have been available to coordinate food delivery by private truckers.

Although communications between industry and authorities were mostly effective, some instances of logistics problems were identified. In some cases researchers were told 'police were too vigorous in enforcing road closures'—although such comments were not common, the industry perceived a lack of recognition, in some instances, that food was an essential service. On the other hand, there was a rationale for caution on the part of authorities in relation to road closures, especially in cases

where critical infrastructure, such as bridges or culverts, was suspect: opening a road before engineering inspection ran the risk that a truck could overturn or be trapped, closing the road for other deliveries.

Emergency planning

Other food industry interviewees reported difficulties linked to what they reported as a lack of emergency planning between retailers and government. Some difficulties included:

- A view from some in the industry was that at least initially, emergency and Defence services appreciated neither the priority of food resupply to the emergency response nor the expertise and capacity of the large retailers to respond to an emergency of the scale of the Queensland floods. The food retailers recognised the need for a large-scale food and goods resupply response and took their concerns to the Queensland Premier, who responded rapidly and effectively to integrate retailers into emergency response mechanisms. At ground level, this lack of recognition was seen as manifest in poor information on available routes, denial of truck access to closed roads to isolated communities, and local government distrust of ‘big business’.
- The need for exceptions to the trading-hours rules to facilitate sale of goods received at unusual hours was recognised at state but not necessarily local government level. Retailers were repeatedly required to seek state override of local powers over trading hours to open stores to serve communities delivered food and goods.
- The need to recall staff to supermarkets closed by emergency services preparing for the cyclone or floods, to provide emergency food and goods to evacuees in centres established in public centres close to supermarkets, such as shopping malls. In some instances, national retailers were reluctant to do so in unstable situations that might have posed a risk to staff that was unacceptable to the retailers’ occupational health and safety and risk policies.
- The complicated interaction between local, state and federal agencies was identified as a particular problem.

Unwanted donations

The Australian public responded immediately to the emergency; many offers of food assistance were received. While donors were well intentioned and keen to help, some companies experienced problems with unwanted donations or offers of assistance that could not be processed. Interviewees from these firms suggested that greater official guidance (such as, a dedicated website to direct and channel such offers) would have helped ensure the community’s desire to help could have been harnessed appropriately (see ‘Online assistance in matching offers to need’ box).

Online assistance in matching offers to needs—an international example

The Aidmatrix Foundation (www.aidmatrix.org) is a not-for-profit organisation headquartered in the United States and with offices in Germany and India. It aims to match supply and demand for assistance not only in disasters but also in other situations where aid is needed, applying sophisticated online supply chain management tools ‘to get the right aid to people when and where they need it most’.

It has partnered with the US Federal Emergency Management Agency to create the National Donations Management Network. This portal is described as:

designed to make it as easy as possible to donate financial support, product donations or to volunteer your skills and time to the non-profit organizations that most need it ... Please keep in mind that leading relief organizations typically seek sizable, bulk donations only when they meet the service delivery needs of a particular relief operation. Product donation offers that meet the following criteria are most likely to be considered for acceptance for a national relief operation... (<http://www.aidmatrixnetwork.org/fema/> viewed 12 August 2011)

Donations of both goods and money could be channelled through the portal; the site for goods identified categories of goods that at the time were required to meet needs in a number of locations in the United States. At the time of viewing (12 August 2011) the section of the site allowing people to volunteer was not operating.

Impacts outside the immediately affected areas

Panic buying was a factor in some locations—particularly in northern Queensland in advance of tropical cyclone Yasi—but not to the extent that it caused major concern to emergency management officials; ‘at least they had some food’ was one comment. By contrast, there were also reports of panic buying in areas that were unaffected—for example, the Gold Coast—which put unnecessary pressure on food supplies in locations that had far greater need.

A factor determining whether a community was prone to panic buying was consumers’ familiarity with disasters: some commented that newer Queensland residents were more prone to panic buying than longer-term residents. The impact of panic buying would have been worse, causing considerable hardship, had major retailers not already anticipated the possibility and built it into their business continuity planning.

The foodservices industry was also affected as it experienced considerable disruption to supplies. Consumers in flood affected zones appreciated the efforts of food outlets to supply what they had available. However, many staff in takeaway outlets in other parts of Queensland reported receiving customer criticism when the range and quantity of food was compromised. Many consumers in these situations had little awareness of the effect of a disaster on food distribution across a very wide area, not just the immediately affected zones. This reflects a more pervasive problem of a lack of ‘food literacy’ (see ‘Food literacy’ box).

Animal feed

Some interviewees were concerned about distribution of feed to feedlots, piggeries and other locations (including on-farm) where animals relied on feed to be trucked in. The flooding entailed considerable risk to animal welfare (animals dying of starvation) and to supplies of meat to the domestic food supply chain.

Cattle feedlots and piggeries tend to be located off main supply routes and out of major population centres, so are prone to be cut off by disasters such as flood, fire or similar events. This issue received little attention in media coverage, and has a low profile by comparison with immediate retail needs, but is an important component of the food supply chain. An increasing proportion of Australian fresh meat is derived from fewer suppliers, with finishing of live animals at feedlots becoming a prevalent step in the supply chain (as compared with practice in past decades of local meat producers delivering directly to their local abattoir). This suggests that ensuring continuity of feed during a disaster would need to be incorporated into emergency planning to a greater extent than is currently the case.

5.3 Storage

Many retail food outlets were inundated by floodwater. For these, restocking became the immediate priority. In other cases, panic buying depleted supermarket shelves. Overall, the perception among not only state authorities but also, in retrospect, major food retailers was that the northern parts of Queensland had insufficient warehouse capacity to meet demand.

This issue will need to be addressed as part of the state's reconstruction efforts or by industry itself. Some difficult questions will need to be answered. Resilience in the face of disaster is aided by redundancy in storage facilities, but this imposes additional costs: who should bear those costs, distributors, retailers, consumers or governments?

Some major national retailers are considering the need for additional storage capacity in far north Queensland. Their normal risk management and business continuity planning will help reduce the risk associated with reduced storage capacity in disaster-prone areas. While this will primarily be to meet retailers' commercial business needs, rather than immediate recovery, greater preparedness is likely to reduce demand for emergency relief in towns where those retailers operate. However, it was apparent from consultations and the business survey that smaller businesses do not have well developed risk management plans and in many cases no food storage backup capacity. Although the major retailers dominate food supply, residual problems exist in smaller outlying communities that have limited food outlets. These problems include lack of backup or contingency planning, low stocks of some essential food and grocery items, and lack of established relationships with suppliers who can include these stores in their own contingency planning.

5.4 Lack of food knowledge

5.4.1 Best before and use by dates

Many consumers, influenced by conservative 'best before' dates on food labels threw away a very large amount of edible food. Many products including cheeses, refrigerated smallgoods and some other dairy products can be consumed well after their best before dates.

'Use by' dates are an important guide to the suitability and safety of food for consumption on health grounds rather than simply palatability (for example, chicken, fish, offal meats that have a short shelf life). The Australia New Zealand Food Standards Code, section 1.2.5 'Date marking of food' states that a **best before** date 'specifies the end of the period during which the intact package of food ... will remain fully marketable and will retain any specific qualities for which express or implied claims have been made' and that a **use by** date means the date '... after which the food should not be consumed because of health and safety reasons'.

The Queensland evidence from both food suppliers and some government officials was that many in the community had little understanding of the difference between ‘use by’ and ‘best before’ dates, leading to loss of food that could have been safely consumed.

Food literacy

An interviewee familiar with the flood response commented on a lack of ‘food literacy’ in the community. This means many consumers are unable to make informed choices about whether to apply or disregard ‘best before’ dates on food packaging. They lacked the skills to be able to make choices about food based on colour, appearance, smell or other indicators of freshness and/or palatability.

Similarly, many consumers lacked the ability to prepare meals in an emergency from basic dry or tinned goods, or understand how different cooking methods can affect foodstuffs.

Increased food literacy would improve community resilience in the face of natural disasters or shortages caused by human factors.

5.4.2 Inability to cook food among some segments of the community

Some interviewees in Brisbane reported that the flooding had a disproportionate effect on younger people, for various reasons, including:

- Many lived in apartments where there was limited storage space for food, meaning they had no reserves upon which to draw in an emergency.
- Many did not regularly cook food, kept little stock of dried or tinned food, and did not know how to cook anything other than pre-prepared meals (which became unavailable during the flooding).
- Many were not able to cook once they lost power, even if they had access to facilities such as a barbecue. Anecdotal evidence was that some younger people had no concept that a barbecue could be used for anything other than cooking meat.

From a health perspective, in a disaster not only the quantity but also the quality of food available to those affected is important. Good nutrition helps those affected by a disaster to respond in other ways—in this instance, to help with cleanup or relocation—and to maintain morale. Research by the Queensland Department of Health indicates that much of the population does not carry sufficient stock of food to cope with adverse events, does not know how to eat nutritiously out of stored foodstuffs, and how long food can be kept out of refrigeration if power is unavailable.

Some interviewees suggested that State Emergency Service (SES) volunteers may also have limited knowledge of food preparation in a disaster. This hypothesis could be tested through further research on SES volunteers, and if confirmed, there would be merit in training them in food preparation, to enable them to help affected populations in the event of future disasters.

5.4.3 Supply of food to people in care

The other segment of the community whose food needs were severely affected by the flooding was those in supported accommodation, including hospitals, nursing homes, boarding houses and refuges. Emergency services recognised the priority of the food supply to such facilities but reports emerged that some came close to running out of food.

Emergency management interviewees consulted for this study were concerned about a lack of awareness of food supply and logistics among many such institutions, together with inadequate risk management (the general perception being that they depended on their regular food suppliers and ‘assumed that food suppliers or the SES would look after them’).

The food supply chain would be more resilient if there were greater recognition of the vulnerabilities and risks of large end-users of food supplies, such as hospitals and nursing homes. If such institutions had continuity plans in place that explicitly dealt with food needs, including specifying minimum levels of emergency stocks, risks would be reduced.

Food distribution through charitable organisations was hampered by limited access to official information about where the areas of greatest need were located. For example, it was reported that Bundaberg was well serviced while Rockhampton and Gympie had a lower level of charitable food supply (this was in relative terms as all towns were under stress). According to an interview with a large distributor of food for charities, lack of a coordination mechanism ‘led to overstocks or over servicing in some places and a distinct lack in others’.

5.4.4 Inappropriate food purchases

In the lead up to flooding in the southern parts of the state—where residents received prior warning of the impending flood events—many consumers made panic purchases of fresh and frozen produce, not considering that these foods would not survive a power outage.

Some interviewees cited this as a further example of the lack of food knowledge among many consumers. In a disaster, many such food items have to be discarded. Many retailers took the initiative to distribute frozen food, meat and similar perishables free to their local communities to encourage immediate consumption, rather than allowing the goods to perish and waste.

5.5 Medium-term impacts

5.5.1 Food production

The wide-scale flooding experienced in Queensland increased uncertainty in the food production cycle. Production damage is difficult to assess, as farmers must first wait for waters to recede, and then assess soil condition to gauge how long it might take to re-crop and what the soil conditions mean for the likely quality of produce. This creates opportunities for replacement of supplies with imported product to meet consumer demand. While medium-term crop quantity may be restored, almost certainly crop quality will remain diminished. This creates an unfortunate impact on domestic producers striving to restore their market while consumers have become accustomed to unblemished imported fresh produce, often at lower prices.

According to the Produce Marketing Association of Australia, the floods led to loss of \$225 million of fruit and vegetables and \$125 million of private infrastructure. The impact of tropical cyclone Yasi was greater in financial terms, leading to destruction of 75 per cent of the banana crop, losses of \$250 million to the banana industry, \$25 million in other tropical fruit, and \$200 million of private infrastructure.

The immediate impact of the Queensland flooding on food production was most noticed by consumers of bananas, where prices rose sharply—the price spike was even higher than that seen in the aftermath of tropical cyclone Larry (see appendix 2). Queensland produces more than 90 per cent of Australia’s bananas, and the industry is concentrated around the towns of Innisfail and Tully.

The 2010–11 flooding and tropical cyclone Yasi affected production of many other food items from Queensland. However, as substitutes were readily available from other parts of the country (for example mangoes and avocados from the Northern Territory) consumers experienced more moderate price hikes for these products. At the same time, delivery of Queensland fresh produce to southern markets was often delayed or disrupted, which restricted availability of these goods in those markets. Queensland's food producers with fresh stock struggled in the immediate aftermath of the floods, with stocks often rotting at the farm or on the roadside.

Thousands of Queensland fruit and vegetable growers will continue to experience negative effects over the longer term due to changes in consumer behaviour as a result of high prices (such as, switching to frozen products); loss of established trees, equipment, sheds and other infrastructure; and costs of rebuilding.

5.5.2 Road conditions

The floods not only cut routes in the short-term but also had a massive effect on the medium and long-term condition of roads. Queensland now faces substantial road rebuilding and maintenance that is more than patching potholes. The stability of waterlogged road beds is greatly reduced, requiring systematic reinforcement (stabilisation pylons up to tens of metres deep). In some cases key roads will have to be entirely re-routed. Until and while such maintenance is undertaken, delivery times will be lengthened as trucks negotiate deteriorating road surfaces and/or road works.

5.5.3 Household food restocking

Some instances were reported of flood-affected households that had not restocked to their normal level of food supplies some four months after the event, and were continuing to rely on emergency or charitable donations. The charitable organisations that identified these households attributed the slow recovery to the stress of a natural disaster and the mental toll it took on more vulnerable members of the community: a broader problem that had affected other elements of their lives, not only their food supplies.

This observation suggests that agencies dealing with people already in disadvantage should be aware of a heightened risk of starvation among such populations in cases where a subsequent disaster hits a community within months of an initial disaster.

5.6 Problems identified

5.6.1 Queensland Floods Commission of Inquiry

The Queensland Premier established an independent commission of inquiry to examine the flood disaster, with terms of reference that provide for examination of the chain of events leading to the floods, all aspects of the response and the aftermath. At the time of writing, the commission was underway and while food supply is not its main concern, some mention of food supply issues have been made in hearings.

The commission's examination observes the on-the-ground disruption of the final link of the food supply chain to consumers; the need to feed emergency workers and volunteers; power generation to safeguard existing food stores; high demand for helicopter food drops to isolated properties and communities; and sourcing food from communities, schools, pubs etc., for evacuees in both formal and informal evacuation centres. The commission rarely focuses on production or distribution links,

with brief mention of Emergency Management Queensland's Transport Resupply Taskforce coordinating distribution logistics across the state.

One theme that developed through the commission's hearings was the confusion about the authority for food resupply in an emergency, and coordination between local and state governments. Obtaining food resupply and organising transport for remote delivery is a local government responsibility, with Emergency Management Queensland providing guidance and assistance when demand exceeds the local authority's capability. Some local authorities were more capable, better prepared and understood their role more clearly than others.

5.6.2 Procurement policy and authority

The Queensland Floods Commission of Inquiry has heard a number of statements about the authority for food procurement in an emergency and the frustration with the 'three quotes policy' in organising air delivery of food supplies and food drops in particular.

At root appears to be confusion over the extent of devolution of authority in the new Queensland emergency management system, in which local disaster management groups (LDMGs) are convened around local government.

Under the new arrangement it's up to the LDMG first to try and resource locally, and if it can't resource locally then it has to pass that on to the DDC (Manager of Operations, Somerset Regional Council - transcript of proceeding 10052011, at www.floodcommission.qld.gov.au viewed 12 October 2011).

Coordinating mechanisms established by Emergency Management Queensland provide guidance and coordination between local groups, particularly when they are struggling with demands beyond their own capability. Procurement of transport for emergency supplies is a local government expense and hence a local government (LDMG) decision. Ipswich City Council created its own local capability to deal directly with Coles and/or Woolworths State Distribution Centres because local stores were unable to supply.

In other instances this was obscured by a perceived state requirement to obtain three quotes for charter services—a complaint being that three service providers may not operate in a given area. Emergency Management Queensland has a role to verify that procurement policy is observed; that purchases are for essential items and transport options are considered to the extent they are available. Clearly there is an emergency planning issue at the local level in securing the food supply chain:

We would certainly encourage people, if there is any ... potential requirement, through your risk profile, to have a need for resupply, to make those arrangements before the event. Go to the market, get your three quotes, have a standing offer arrangement in for both fixed wing and rotary wing assets, or whatever it is you may need. You may not need them, but if you do you have already been through the due diligence process (Assistant Director-General, Emergency Management Queensland).

5.7 Coordination and communication—successes and lessons learned

Coordination of the various parties working to restore essential services—including food—is a key element of resilience. The lessons learned from the Queensland floods were that the communication and coordination mechanisms were for the most part effective, but that some elements could be improved for future disruptions to food supply chains.

5.7.1 State emergency management

According to both industry and government sources, it took a few days to gather a group with expertise in food supply that included all key food industry players. When it did, it worked very effectively.

- The Australian National Retailers Association coordinated twice daily logistics conferences with Coles and/or Woolworths and the Queensland Government.
- The logistics provider, Toll, played a key role in distributing food and worked closely with the state disaster authorities.
- The supply chain solution provider, Linfox, worked closely with authorities and maintained regular and effective lines of communication.

A lesson for the future, in the words of one interviewee, is that authorities and industry together need to 'have a team already organised and ready to "go in to bat" in the event of a widespread disaster'. Although the response was rapid when it happened, it could have been more effective had a group of key participants already been available and primed to work on food supply issues.

Comments from some food industry people outside Queensland who were trying to restock Queensland supply chains were that it was difficult to find out who or where the key contact points were.

5.7.2 Australian Defence Force

The Australian Defence Force does not take over from capable civilian organisations in emergency situations, but seeks to provide support in a specialist role; for example, clearance and engineering support to some communities. Liaison officers were supplied at local, state and national levels. Local commanding officers have a degree of autonomy to respond to local problems and 'pull' requests on ADF resources. This liaison arrangement followed the normal chain of command—local commanders and liaison officers provided daily situation reports to the Joint Task Force 637 headquarters, which was able to deploy specialist equipment and personnel to areas as needed. This was most clearly demonstrated in the use of Navy assets to clear Moreton Bay.

Retailers encountered a number of communication and coordination difficulties working with the RAAF to distribute goods. While a single ADF point of contact was established and ADF had a member in the Transport Resupply Task Force, varying degrees of cooperation between multiple contacts across the country remained, especially at airbases. The task force faced repeated demands to exhaust every conceivable commercial option before deploying a defence airlift, despite involvement in logistics planning. As well, competing demands on transport aircraft for overseas deployment meant that while retailers were able to process food orders within six hours, rescheduled flights meant mismatched loads to aircraft capacity.

5.7.3 Local level responses to food supply needs

Local government in Queensland has significant responsibility for emergency preparedness, with varying degrees of understanding and capability. Some were capable of engaging directly with the national retailers and/or contracting transportation to meet their requirements. Inherent in this is an understanding of the food industry and supply chain, including understanding those elements for which a local government is responsible (such as availability of fixed or rotary wing assets, store

opening hours) and their interface with the next link in the chain (such as local store and/or state distribution centres). Not all local governments had this knowledge or understanding.

In the crisis areas some people had mixed experiences with awareness of food shortages. Some authorities perceived actions like promotion of the 'pantry list' as potentially promoting panic buying. On the other hand a supermarket with stocked shelves may locally be judged 'not empty' when in reality some essential stock needed in the emergency (such as long-life milk, baby food, toilet paper) may be depleted. Devolution of emergency management to local areas in Queensland highlighted the divergent states of awareness among local councils of these questions.

5.8 Broader lessons for the future

The impact of concurrent disasters is a key lesson from the floods. In the words of many people consulted, Queensland 'dodged a bullet' because tropical cyclone Yasi did not have as severe an effect as feared. But if there had been a severe bushfire in southern states—such as the Victorian bushfires in 2009—the chance of resupply from Melbourne and/or Sydney would have been diminished. As noted, inland supply routes and sea routes from both ports were vital components of the flood response.

While the immediate focus of emergency planning is on resupply, the obstacle of infrastructure damage is equally critical to food production and hence to ongoing economic stability and disaster recovery. Rebuilding infrastructure is of long-term benefit not only to the economy of the state but also to the resilience of the food supply chain.

Foodservices were important responders during the floods. In some communities the local hotel became a key centre for food information and supply. In small towns the pub (or bowling or RSL club) became a place where food and drink were supplied as well as a source of information about availability of domestic food supplies. An example from the Queensland Commission of Inquiry evidence showed that, with the school inundated, the Murphy's Creek Tavern effectively became an evacuation centre. It accommodated more than 300 people (from a community of about 450 people) and provided food, shelter and cheer, and became a centre for information and government agencies (such as Centrelink) to interact with the community. This suggests that such outlets should be considered an important avenue through which officials disseminate information about food supply in an emergency.

6 Emerging challenges to food supply chain resilience

This chapter identifies and summarises strengths, gaps and potential vulnerabilities in Australia's food supply chain, and consumer engagement with it. It also summarises the food supply chain's ability to respond to significant emergencies affecting national food supply continuity, including through preparedness activities. These conclusions were drawn from both stages of this project, and thus are grounded in past practices as well as actual recent experience with a significant disruption to the food supply chain in Queensland.

6.1 Strengths, gaps and potential vulnerabilities

6.1.1 Resilience against food supply continuity threats

The structure and competitive nature of the food supply chain drives its resilience (through redundancy and flexibility) to creeping crises or sudden onset threats to continuity.

Threats to food supply chain continuity often form a continuum—as one industry participant said, 'something goes wrong [in the supply chain] somewhere every week'.

Factors that influence the level and nature of food supply chain resilience, in response to an actual event, include:

- **Scale factors**—whether the food supply chain can adapt to disruption up to a certain population or geographic scale, with elements breaking down beyond that point.
- **Scope factors**—whether the food supply chain can adapt to disruption for particular types of foods or inputs to foods up to a certain level, with elements breaking down beyond that point.
- **Temporal factors**—whether the food supply chain can manage a resilient response to a disruption for a certain period, with elements breaking down beyond that point.
- **Distributional factors**—whether the food supply chain is less resilient for some sections of the community than for others (such as low income households, tourists).
- **Industry factors**—whether some sections of the industry, by function or product type, are less resilient than others given their particular circumstances, and any dependencies across industries.

Food supply chains are well distributed networks with multiple suppliers and multiple retailers interacting in various ways, suggesting relatively strong resilience to most threats to food supply continuity that are generally localised and short-term.

Historical evidence suggests the Australian food supply chain is sufficiently resilient to most threats to continuity (such as listed in table 2) and more recently in relation to the Queensland floods.

Examples of resilience through redundancy include:

- Flooding and cyclone activity in Australia's far north can isolate remote towns and properties for extended periods. As such disruptions are relatively common consumers in these locations tend to ensure they have sufficient home stocks to manage expected periods of isolation.
- Coles, Woolworths and Metcash, have used alternative transport routes, such as sea barges and freight planes, to distribute food.

- Most food categories are produced or processed in a number of locations across Australia or internationally, which for many food categories ensures a reasonable level of flexibility in sourcing alternatives should an event disrupt crop production or food processing in one location. This element of redundancy is however steadily eroding, as more food production is concentrated in fewer locations, and so the risk to production is growing.
- In most locations, consumers can access food through a diverse range of channels including up to five large retail supermarket chains to a wide variety of independent or networked foodservice enterprises.

Examples of resilience through flexibility include:

- During the Western Australian gas crisis, some food processors used alternative (diesel) power supplies to maintain production over the short-term.
- Consumers were able to gain access to product substitutes, such as, long-life UHT milk and frozen or canned vegetables. However, natural limits and barriers to product substitution—given certain inventory of finished (non-perishable) goods and limited surge capacity in domestic production—constrain medium-term flexibility in the absence of complementary imports.

Many resilience examples eventuated because individual participants in the food supply chain acknowledged the real risks to supply chain disruption, such as natural disasters, and explicitly planned and prepared (see ‘Business continuity planning by food supply chain participants’ below).

Resilience also incorporates ‘bounce-back’ from disruptions—industry data suggest ‘it took six to eight weeks to recover from ... the South Australian bushfires and the New South Wales floods’ (Link 2008:9). Wider-scale disasters can take longer; it took up to four months for some food supply chain elements to recover fully from the Queensland flooding. Major facilities, such as the Brisbane markets at Rocklea, were completely inundated and required considerable effort to re-establish; however, temporary markets at an alternative location were put in place within a matter of weeks.

Most supply chain participants interviewed for this study generally agreed that Australia is reasonably well placed to manage localised, short to medium-term disruptions.

However, in large-scale or extended events, the regular (commercial) food supply chain has not always been able to meet consumer needs, and special emergency intervention from the SES or ADF has been needed to maintain human welfare. For example, when people are displaced and/or local services are interrupted by fire or flood, such events are generally localised, relatively short-run, and well understood and planned for in Australia.

This is not to say that the Australian food supply chain has a high level of resilience in all circumstances.

Most supply chain participants consulted generally agreed that a sustained disruption at a number of locations across Australia would cause difficulties, and Australia’s food supply chain, under normal commercial arrangements would arguably not be particularly resilient to national (or international) extended crises, such as pandemics.

Import dependencies are generally not affected by local emergencies (for example, other entry points would be available if a key port were inaccessible) and it is rare for a localised incident overseas to affect the only source of a critical food or input to food. However, critical import

dependencies could be problematic in a global pandemic or other distributed event that affects a range of international locations, where a constraint on imports to Australia results.

There are commercial and regulatory constraints to changing the composition of processed foods, should an ingredient, packaging or other input become increasingly unavailable. Examples of commercial constraints might include additional costs associated with changed production processes, or an unwillingness to compromise the product brand with changed foodstuff quality. A more likely scenario in response to input unavailability would be the processor choosing to cease production for the short-term. So it is quite likely that in a widespread disaster some manufacturers would choose to close their operations rather than attempt to meet demand, given the potential for financial losses and the possibility of legal exposure relating to product standards or consumer information.

A number of interviewees perceived the key vulnerabilities that would substantially threaten food supply chain resilience to be:

- concurrent loss of a number of distribution centre facilities (including power loss beyond that which could be sustained by generators)
- concurrent loss of a number of transport links to and between major cities; for example, extensive east coast storm events that cut the Sydney–Brisbane land transport links
- shortage of fuel (diesel) for food distribution, in the case of a national fuel emergency
- ongoing workforce availability constraints beyond which affected companies could manage using standard backfilling and casual pool arrangements
- an extended, material disruption to Australia’s access to key finished foods or inputs to foods exclusively produced overseas.

Food supply chain participants and other parties can and, increasingly, are taking action to minimise barriers to resilience—although the food industry is generally viewing this as a work-in-progress with various complexities and external influences.

At the level of implementation, planned actions to support resilience have not always run smoothly, limiting their effectiveness. For example, anecdotally, major distributors’ trucks carrying food supplies had trouble accessing controlled roads during tropical cyclone Larry, potentially in part because the commercial food sector did not have a substantial presence or influence in state government emergency planning.

6.1.2 Emerging issues in food supply chain resilience

Australia, like many advanced economies, is experiencing an evolution in food sourcing, distribution and consumption. This evolution has accelerated over the past five to 10 years given supply chain efficiencies and just-in-time approaches to inventory management, and ongoing shifts in consumption patterns toward more regular purchase of fresh-prepared foods.

The extent of food supply chain resilience to natural disasters, pandemics, terrorism and other threats to food supply chain continuity, and possible responses, are gaining increased attention in other countries, particularly the United Kingdom. The UK Department for Environment, Food and Rural Affairs has, for example, commissioned a number of reports on aspects of UK food supply resilience, and the Scottish Government has commissioned a report on resilience of the food supply chain in that country.

Table 3 shows the major trends this research identified as strengthening or weakening resilience in the Australian food supply chain.

Table 3: Major trends strengthening and weakening food supply chain resilience

Strengthening resilience	Weakening resilience
<p>Supply chain participants learning from experience and evolving internal planning and external relationships to facilitate effective incident response</p> <p>Supply chain participants engaging in cross-sector coordination and planning (e.g. processes for industry cooperation in the early stages of a pandemic)</p> <p>Sub-national/national supply chain distribution and just-in-time supply chain reforms increasing sophistication of logistics operations (e.g. increased information about location of products in supply chain)</p> <p>National electricity market allows for more flexibility to maintain supply in case of generation facility disruption</p> <p>More flexible industrial relations environment (e.g. greater ability to manage surge activity or absence)</p> <p>Increased international links allowing for greater alternative sources in the event of loss of particular products or suppliers</p>	<p>Consumer trends leading to low pantry stock, including pre-prepared or ready-to-assemble meals, preferences for fresh foods, eating meals outside the home</p> <p>Reducing inventory at retail, distributor and manufacturer level, as a result of just-in-time supply chain reforms</p> <p>Increasing import dependency for certain foods and inputs to foods (e.g. packaging) as part of global supply chains</p> <p>More centralised, less distributed local production and processing for certain food products (e.g. dairy)</p> <p>Consolidation of manufacturing plants and distribution centres, leading to reduced flexibility in the event of disruption</p> <p>Evolving regulatory requirements such as country-of-origin labelling, quarantine, reducing flexibility for short-term substitution with imports or modifications to product to maintain supply</p> <p>Increasing dependency on external infrastructure outside control of the food supply chain (e.g. electronic financial systems and communications networks)</p>

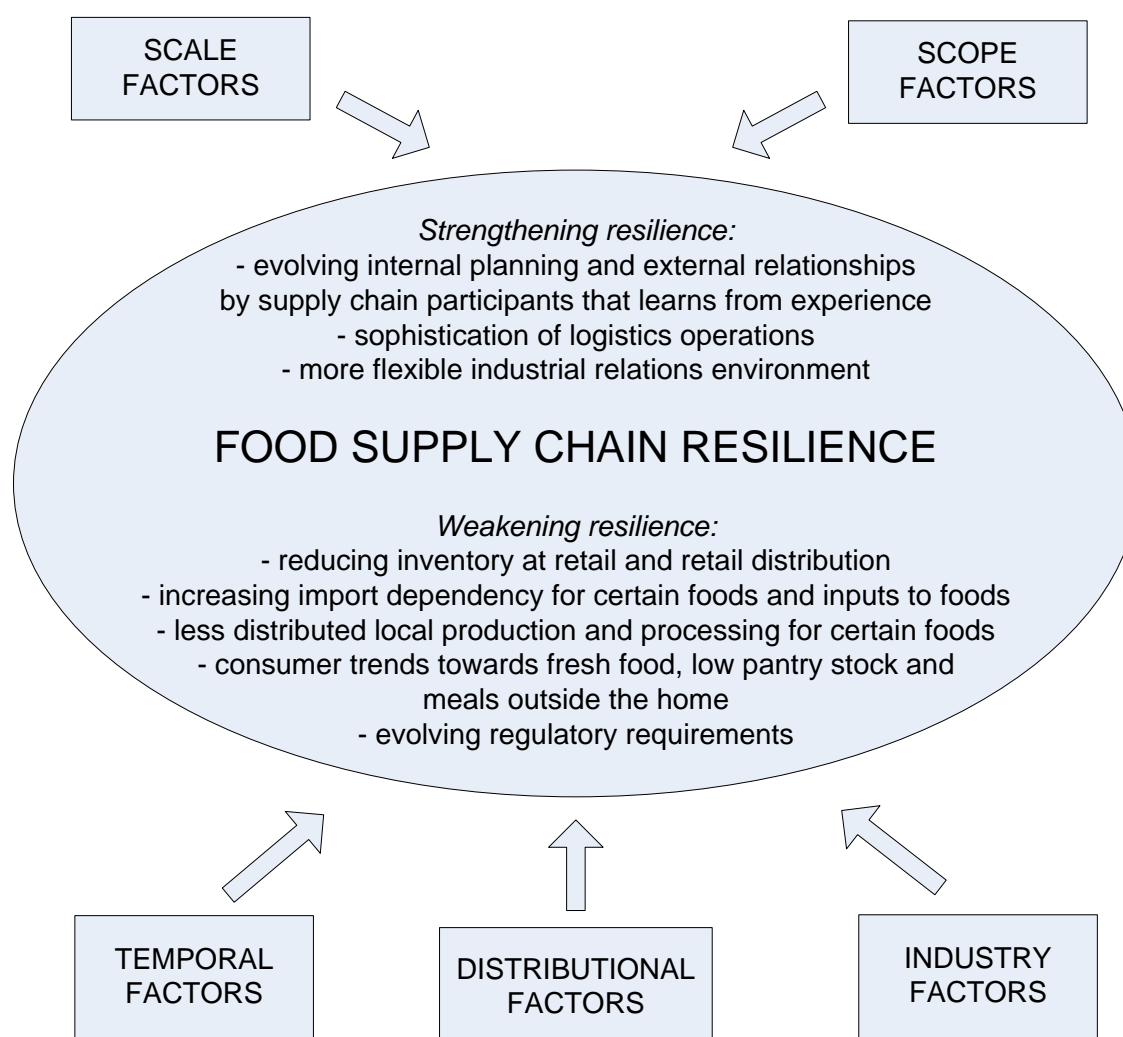
Source: Drawn from LECG analysis and targeted consultation with a small number of major industry stakeholders.

Each trend is not necessarily equal in importance, and opinions among interviewees varied as to whether the Australian food supply chain is more or less resilient than in the past, depending on how the various trends are weighted. Many of those consulted considered that reducing inventory at retail and retail distributor level was the most significant factor among those identified, and that its effect in reducing resilience outweighs other elements.

On balance and in the absence of adaptation across the food supply chain, the evidence suggests these trends are putting pressure on aspects of Australia's inherent resilience to food supply chain disruption. The work the Australian Government Department of Agriculture, Fisheries and Forestry is doing to address resilience, from both a policy and an operational perspective, is therefore valid and a highly desirable response to the changing circumstances facing the Australian food industry and consumers.

Figure 17 suggest a conceptual approach for considering the nature of particular threats to continuity of the food supply chain, and the factors increasingly strengthening or weakening the supply chain's resilience.

Figure 17: Threats and trends affecting food supply chain resilience



6.2 Current actions toward preparedness

6.2.1 Overview

Continuity of critical elements of the food supply in the face of risks and threats requires effective planning and preparedness, across the whole food supply chain.

One indicator of resilience might incorporate effective planning for and delivery of preparedness, response and recovery in the face of an incident adversely affecting the food supply chain.

Participants in the Australian food supply chain are undertaking a number of actions to improve preparedness and resilience; some are on an individual firm basis and some are on a supply-chain wide basis.

Attributes of a food supply chain focused on resilience through preparedness for likely impacts might include:

- established business continuity management within organisations in the supply chain—such as, arrangements for alternative sourcing

- established continuity management across organisations in the supply chain—such as established processes for industry cooperation on a commercial or other basis where merited in the event of an incident
- complementary consumer-led resilience—such as, home pantry stockpiles
- established processes for rationing and meeting the needs of people with special needs and those not able to fend for themselves.

The following sections discuss business continuity planning by food supply chain participants, critical infrastructure planning and industry collaboration, pandemic planning by government and industry, and consumer preparedness and resilience.

6.2.2 Business continuity planning by food supply chain participants

Industry participants consulted expressed a common view that business continuity planning across the industry varied considerably. One perspective was that large, multinational firms allocate resources to manage this issue, but small-to-medium enterprises have less sophisticated arrangements. In general, business continuity was seen as a work-in-progress for the industry as a whole, with some well advanced and a majority characterised as still developing their approaches to the issue.

It became clear when examining the experience of the Queensland floods that major food retailers and distributors had well developed business continuity plans, and exhibited strong resilience and adaptability. The remainder of the food industry was less well prepared, in many cases had little or no business continuity planning, and was consequentially less able to withstand the disruption. Foodservice businesses were also markedly weaker in their business continuity planning.

Recent experience—both in practical situations and given the threat of a major influenza pandemic—has allowed supply chain participants to refine their internal planning and processes.

For example, the experience of the 2006 Sydney superstorm, which damaged Metcash's Blacktown distribution centre, allowed the company to understand the positives and negatives of its response, and build on that for improved short-term and long-term business continuity planning (Newton 2010).

Another retailer reflected on its culture of strong customer focus and its ability to react quickly by using alternative distribution routes or methods. The company has well-developed disaster recovery planning (such as diesel generators at distribution centres), but recognises that workforce availability at its point-of-sale and distribution centres requires more planning. The retailer is also learning from experience; for example, it is now building up stocks of relevant goods in far north Queensland in advance of the wet season.

One large processor/manufacturer discussed well-developed preparedness through good internal planning and disciplines for handling disruptions. These included:

- detailed consideration of the core products the company would be expected to have available during a crisis (and for the company to maintain financial stability)
- supplier alternatives reviewed and flexibility in manufacturing capacity evaluated, including alternatives in case of disruption to the company's gas supplier

- strong internal requirement to develop and test implementation plans for disruption, for example through training workshops, workforce planning and internal drills.

Of the large processors/manufacturers consulted, this would be a typical situation; however, one large manufacturer acknowledged its preparedness was less developed, in part due to the nature of the products it supplies. Those consulted also expressed general recognition that smaller processors' preparedness actions would be less well developed.

Supply chain participants indicated they would incur additional costs to maintain continuity only up to a certain point—one said the role of food companies is to look after their shareholders and employees. A range of factors may affect business decisions, depending on the company's context. For example, food supply chain participants with a less direct relationship with consumers, such as manufacturers, may be more willing to suspend operations than those that depend on a strong public image.

6.2.3 Critical infrastructure planning and industry collaboration

The Australian Government's approach to threats affecting the food supply chain has recently been one part of the government's broader approach to critical infrastructure security and/or resilience. A major arm of the government approach to critical infrastructure is the Trusted Information Sharing Network (TISN), a forum in which the Australian Government and business community work together. The TISN food supply chain component was until recently the Food Chain Assurance Advisory Group, formed in 2003.

DAFF currently convenes the Food and Grocery Sector Group, chaired by the Australian Food and Grocery Council, as part of the government's broader approach to critical infrastructure resilience/security. It is a unique forum for raising resilience and preparedness issues within and between government and various elements of the food supply chain. Existence of such a group provides a foundation for discussion and information dissemination that might not otherwise occur.

At October 2011, membership of the Food and Grocery Sector Group consists of:

- industry groups— Australian Food and Grocery Council, Food & Beverage Importers Association, Packaging Council of Australia, Refrigerated Warehouse and Transport Association
- supermarket retailers and distributors—Aldi Supermarkets, Coles Group, Franklins Supermarkets, Metcash Trading, Woolworths
- major food and beverage processors/manufacturers—Coca Cola Amatil, George Weston Foods, Kimberley Clark, Lion Group, Nestle, Simplot, Unilever
- major foodservice providers—McDonalds
- representatives of primary producers and their suppliers—Australian Chicken Meat Federation, Australian Pork Limited, Australian Meat Industry Council, Croplife Australia, Dairy Australia, Grain Trade Australia, Horticulture Australia Limited, Meat and Livestock Australia, Produce Marketing Association
- biosecurity and food safety bodies—Animal Health Alliance, Australian Food Safety Centre of Excellence

- Australian Government agencies—Attorney General’s Department; Department of Agriculture, Fisheries and Forestry; Department of Health and Ageing; Food Standards Australia New Zealand
- state government agencies and the Australian Local Government Association.

Previous actions of the Food and Grocery Sector Group (in its previous form as a Food Chain Assurance Advisory Group of TISN) included publication of the 2006 *National strategy for enhancing the safety and security of our food supply*. This strategy provides a strategic context and identified actions for enhancing preparedness for responding to the potential for acts of deliberate intervention or contamination.

6.2.4 Pandemic planning by government and industry

As a national sustained and ‘creeping crisis’ threat to food supply chain continuity, preparedness for pandemics is a special and most extreme case of preparedness that both government and industry are refining.

Government

Whole-of-government planning in support of influenza pandemic prevention and preparedness has incorporated planning for food supply chain continuity.

The Australian Government Department of Agriculture, Fisheries and Forestry (DAFF) has developed the *AUSFOODPLAN—Pandemic* as a working draft.

AUSFOODPLAN—Pandemic focuses on continuity of food supply in the context of a human influenza pandemic with sustained high absentee rates in the food industry and in supporting services—importantly, the plan states that it is not a business continuity plan for businesses or sectors in the food supply chain.

AUSFOODPLAN—Pandemic proposes using existing supply and distribution systems as the only viable option for food supply continuity to most of the population, with specific plans for prevention and preparedness, response and recovery. With a focus on government and industry cooperation, national implementation would be managed through a National (Food Chain) Coordination Centre administered by DAFF (DAFF 2009).

Various interviewees commented that a number of government policies and procedures might influence the food supply chain’s ability to meet consumer demand in the case of a pandemic, and which require more clarity or, in their view, reconsideration of existing rules. These are across a range of portfolios and include:

- Energy policy—will food supply receive sufficient priority for allocation of fuel in the event of an emergency that requires rationing of diesel fuel?
- Competition policy—will the Australian Competition and Consumer Commission relax its rulings to allow cooperation between retailers in order to ensure orderly distribution of food?
- Import policy—would customs and quarantine staff prioritise food supplies in the event that imports were required to address domestic shortages, or would all imports be processed in order of arrival date?
- Labelling policy—will country of origin, ingredients and sourcing rules be relaxed to allow substitutions in the event of an emergency?

Industry participants were confident that DAFF had addressed these questions in relation to pandemic planning. However, interviewees (independently in separate interviews) suggested that in other emergencies there might not be the same degree of willingness to amend regulatory constraints to food distribution.

Industry

As part of the food industry's pandemic preparedness activities, the Food and Grocery Sector Group is developing a 'Food Industry Contingency Plan—Pandemic'.

This plan will complement national pandemic planning through *AUSFOODPLAN—Pandemic* and specifically describe:

how the food and grocery industry intends to manage the capacity and capability of the existing food and grocery industry supply and distribution chain to maintain fair and orderly distribution of available foods and groceries to the [Australian] community during a pandemic (RAWG 2009).

This has incorporated food and grocery supply chain modelling bringing together national demographic and retail industry data to be used for operational coordination and management of essential food and grocery items during a pandemic:

focused primarily on ... non-perishable products supplied by processors and manufacturers to the three national supply chains. Manufacturers and processors will forecast their production in 14-week cycles. Where supply of a product is expected to meet demand, there will be no intervention. Where supply is expected to fall below demand, directive control will be exercised over those products to ensure fair and orderly distribution to the whole community (*AUSFOODPLAN—Pandemic* section 3.4).

The members of the Food and Grocery Sector Group interviewed held the general view that major strategic issues have been resolved, but not necessarily implemented. For example, retailers have developed prototypes and tested operational arrangements for health and hygiene stations, sufficient stations for a large-scale event have not been acquired.

Potential cooperation between large national retailers/distributors likely has significant trade practices implications; discussions are underway with the Australian Competition and Consumer Commission about the approach and its implementation.

However, this planning does demonstrate the major food retailers' willingness to cooperate in a severe emergency, which is itself a major contributor to food supply chain resilience. (Although, it should be noted that retailers only intend this approach for a full-scale pandemic, with normal commercial arrangements for other supply chain continuity threats).

6.2.5 Consumer preparedness and resilience

Consumer behaviour trends toward a shorter stock cycle, more fresh and convenience items, and meals eaten outside the home, are likely to continue.

Opportunities to counter the negative aspects of these general trends exist at the margin, especially with certain types of consumers, for example older consumers or consumers in geographic regions prone to natural disaster.

As a major action to support consumer resilience, the Food and Grocery Sector Group developed and maintains a web-based pantry list ('Emergency Pantry List—ensuring the supply of critical foods and essential items for Australian conditions', at www.pantrylist.com.au) to encourage households

that are willing and able to stockpile food for emergencies, such as a pandemic, infrastructure failure or natural disaster.

The suggested pantry list is grouped into the types of food and other essential items that may be needed during an extended (up to 14-day) stay at home or self-imposed quarantine as a result of a prolonged emergency. Items include dried and long life food, ready to eat canned/bottled food, drinks and snack food, baby supplies, emergency backup power supply (such as batteries), pet food, health supplies and other items (such as, prescription medications).

The pantry list focuses on raising community awareness and self-reliance, in order to reduce demand on food channels during prolonged emergencies and therefore strengthen food supply chain resilience.

The concept has been adopted in other jurisdictions; Canada, New Zealand and California have used versions of the list.

This review was frequently told that the pantry list does not affect consumer behaviour—attributed by retailers to the relatively small amount of publicity the list received.

In addition, there is no evidence to indicate pantry stocking would have the effect of reducing panic buying in the event of a crisis. It is possible that households with a well stocked pantry would still panic buy additional stocks in an emergency, putting the same amount of pressure on supplies as purchases by households with poorly stocked pantries.

Some stakeholders interviewed about the Queensland flooding were of the view that media promotion of the pantry list had encouraged panic buying. Others took the opposite view: that the pantry list had encouraged appropriate stocking up (this was a view expressed particularly in relation to preparation for tropical cyclone Yasi, where the Weather Channel had promoted the list).

The policy conclusion arising from this divergence of opinions is that the pantry list is a useful tool if used to prepare for a disaster, but not if used to respond after a disaster. This suggests any promotion efforts need to be associated with longer-term preparedness initiatives.

7 Key areas for further investigation and possible action

With renewed critical infrastructure focus on resilience, continued examination of threats and risks, and new developments in the food industry (such as supply chain and logistics transformations of major food distributors), there is scope to re-examine and further explore Australia's food supply chain continuity and resilience arrangements.

This chapter identifies further steps that may be needed to strengthen food supply chain resilience, or areas that need additional investigation to provide a more reliable indication of areas of threat or vulnerability. Areas identified as needing further investigation are:

- foodservice resilience
- parallel supply chains
- advantages and disadvantages of stockpiling food
- consumer resilience
- business continuity and organisational resilience culture
- testing pandemic planning
- periodic tracking and analysis of critical import dependencies and capacity for substitution
- data and analysis to understand weaknesses and tipping points
- governance in food supply chain resilience planning.

7.1 Foodservice resilience

The leading international jurisdiction on food supply chain resilience from a public sector perspective—the United Kingdom—followed up initial work on business continuity in the supermarket and grocery sector with detailed analysis of business continuity in the foodservice sector.

While foodservice may play less of a role during a pandemic, where public congregation is discouraged, it can still be a major channel for food distribution before and during recovery from other types of emergencies.

The UK analysis found that country's large and small foodservice organisations were:

managing operational risk or intuitively taking steps to safeguard mission critical assets and activities ... However, the complex structure of the industry meant the largest companies were sometimes protecting head offices and activities such as contract management, marketing and finance, rather than food preparation and consumer-facing service outlets (Peck 2009)

Investigation of whether this situation is applicable in the Australian context, and possible responses, could be worth exploring.

It was clear in the response to the Queensland flooding that foodservices (particularly hotels and clubs) were an important part of the food supply chain, especially in smaller communities. In larger cities, increased consumer reliance on takeaway and pre-prepared foods presented difficulties.

The present planning and consultative mechanisms have had a higher level of participation from retailers and manufacturers than from foodservices companies. Information on the level of food service industry preparedness for threats to supply chain continuity is not easily accessible.

This gap could be addressed through a desktop analysis of the extent to which the foodservices sector is vulnerable to threats to the food supply chain and which areas are of most concern, followed by additional consultation based on the outcomes of that analysis.

7.2 Parallel supply chains

Australia has parallel food supply chains that are potentially significant sources of resilience—or may be facing the same trends that are leading to reduced resilience in the retail sector. These are the Australian Defence Force logistics employed to supply food products to defence personnel in Australia, and the supply chain AusAID uses to distribute food after natural disasters in the Asia Pacific region.

These and standard retail food supply chains overlap considerably, but some important differences exist due to the need for both Defence and AusAID to maintain sufficient supplies to enable fast response to emergencies. The extent to which these processes might be used to support domestic food requirements in the case of certain threats to food supply continuity—and if so how that might best be implemented—was outside the scope of this project, but warrants investigation and documentation.

One area that could be investigated immediately is the possibility of standardising food industry and defence pallet and packing specifications, to avoid having to pack and unpack goods on the tarmac before they can be airlifted in an emergency.

7.3 Advantages and disadvantages of stockpiling food and packaging

Physically stockpiling food supplies is a risky option; food can pass its best before or use by date, labelling could be superseded by new scanning or recording systems, and consumers might not be willing to accept stockpiled food that does not meet their current preferences (food preferences can change significantly over time in response to new products, advertising and social trends). No interviewee favoured separate stockpiles of food as a mechanism for increasing resilience.

There are, however, more sophisticated ways to achieve increased stocks in the supply chain over and above that which would otherwise be available. One interviewee suggested it could be reasonable for Australia to maintain a stockpile in the food supply chain of critical import-dependent stock (principally packaging materials) above what is reasonable from a commercial efficiency point-of-view. The proposed mechanism was to subsidise distributors or retailers to maintain a rolling surplus of identified stock units in excess of that required for normal use.

Another stakeholder drew an analogy with operational medical supplies: ‘safety stock’ in the United States, where the US Department of Defense carries the risk and cost of the material and its storage. Australia used an equivalent approach to maintain high stocks of a proprietary antiviral drug against the threat of an influenza pandemic.

Analysis of where stockpiling may be a useful risk mitigation strategy, the advantages and disadvantages of different types of stockpiling mechanisms, potential unintended consequences, and associated funding issues, may further inform discussions between industry and government about the merits of stockpiling and ‘safety stock’. From a policy perspective, careful design of any

approach to ensure it was not subsidising business-as-usual in the food industry would be needed; the analogy with pharmaceuticals may be weaker in light of the considerably greater quantities and diversity involved in stockpiling in the food supply chain.

As an intermediate step, ongoing monitoring of the level of industry inventory for highly critical food products and inputs to food might be merited. ECR Australasia's *Australian Grocery Industry Tracking Study* is a useful time series, although it is at four-year intervals and is at a reasonably high level of aggregation. The Food and Grocery Sector Group could be a forum to facilitate a more focused monitoring of inventory issues of key concern.

7.4 Consumer resilience

The main initiative to support consumer resilience is the pantry list, which has not yet been evaluated. It does have support from the food industry, but the motivation for that support is not clear. Some members of the industry consider that awareness of the pantry list could be wider and communicated in different ways or through a broader range of channels. Options suggested included emergency services to refer to the pantry list in preparedness warnings, and direct distribution of its contents to areas of Australia particularly prone to natural disasters.

Another approach might be to analyse existing market research, or to undertake new market research to improve understanding of consumer types. Such research could investigate consumer practices and attitudes to pantry stocks and self-dependency particularly when facing disruption to normal food channels. It could also examine the timing and ways in which consumers would best receive and adopt information about pantry stocks. This may offer insight into the most appropriate ways to target future pantry list information, and how to monitor its effectiveness.

The pervasive messages in mainstream advertising from takeaway food chains (total spend in 2009, according to IBIS research, of \$3.4 billion) and from supermarkets promoting 'fresh food', tend to bias consumers against storing food in pantries. The weight of this countervailing message may mean take-up of the pantry list will inevitably be low.

The rationale (that well-stocked pantries will increase resilience by reducing the need for households to purchase foods in the event of an emergency) has, in any case, not been proven. It is possible that households that have absorbed the pantry list message will, in the event of an emergency, seek to further add to their stocks, thereby reducing the availability of food to people with less pantry stock. Another unintended consequence of the pantry list could be that, if the list is widely circulated and awareness is high but household behaviour is unchanged (they know the list exists but have not bought any of the goods listed), in the event of a real emergency those consumers would panic-buy the items on the list, creating shortages of those items.

On the other hand, if the pantry list encouraged consumers to make prudent provision against possible disruption in the food supply chain, it would make a strong positive contribution to enhancing resilience in the face of disaster. One way to investigate whether the pantry list changes consumer behaviour would be to market test it in a specified location, measure the days of stock held in pantries of a selected group of consumers before advertising the list, and the days of stock held by a comparable group after advertising.

7.5 Business continuity and organisational resilience

A food supply chain is likely to be resilient when participants are as well prepared as possible for a range of potential risks. Provision of information about best practice through industry programs and conferences, for example, could target and better inform industry participants.

The food supply chain has a special role as critical infrastructure so it is important to identify points of weakness or stress. Industry representative bodies and/or governments might, therefore, establish a more systematised approach to monitor the quality and effectiveness of business continuity planning in companies with a material impact on food supply continuity. The Food and Grocery Sector Group may be the mechanism through which to pursue such initiatives.

7.6 Testing pandemic planning

A critical dependency of effective industry coordination during a pandemic would be the effectiveness of the Food and Grocery Sector Group's modelling.

Food supply chain resilience would be enhanced by ensuring the model's robustness to support industry action.

For example, it will be important that accurate, up-to-date data can be provided to feed the model; that the variables used in the model are valid; that testing against possible scenarios has proved realistic; and that the outcomes are a clear and practical basis for real-world, real-time decision-making. This is likely a progressive activity, given that the model is still in development.

Also, alone the Food and Grocery Sector Group model would probably not achieve effective food industry pandemic planning. The model focuses on retailers re-routing current stocks or orders, not on manufacturers re-routing use of short supplied raw materials to enable more stock to be in the supply chain. This is not a fault of the modelling, but does highlight additional work that might be considered in the pandemic context about prioritisation of manufacturing, particularly in an environment where some manufacturers may choose to suspend operations given workforce constraints.

7.7 Periodic tracking and analysis of critical import dependencies and capacity for substitution

The level of import dependency on critical food products is a key aspect of resilience.

The current understanding of Australia's level of dependence on imports of food and inputs to food is limited and tentative. Based on discussions with various industry participants, DAFF has developed some informal analysis of the imported content of some products; such as, canned fish, baked beans, rice and infant formula, as well as tinplate, long-life and cardboard packaging, and plastic bottles.

However, the food industry is dynamic. Any contemporary understanding can quickly become redundant as commercial arrangements change. Given this context, a sensible activity, as part of an overall risk management approach, might be periodic examination of changes in the nature of import dependency for critical foods and inputs to foods. Regular examination—perhaps biennially—of a small range of non-perishable food items and their inputs considered crucial for community wellbeing would also help track trends and identify potential implications for industry or government.

Key issues to examine, for given products, might include:

- the extent of international sourcing of finished goods
- the extent of international sourcing of inputs to food, for goods produced domestically
- the extent of concentration or distribution—in terms of companies and localities—of the production of import-dependent food or inputs to food
- the ease with which consumers and/or producers can substitute for import-dependent foods, and the likely availability of sufficient substitutes
- the level and nature of safety stock Australian processors and manufacturers hold
- commercial trends likely to affect the nature of domestic production and importation.

Much of this information may be commercially sensitive and therefore not easily accessible. It may be useful to work with the Australian Food and Grocery Council and individual industry associations to develop the analysis.

7.8 Data and analysis to understand weaknesses and tipping points

Anecdotal evidence suggests that people in rural Australia are better prepared to withstand disruptions to the food supply chain than are people in cities. Rural consumers are used to difficulties caused by climatic or other disruptive events, they maintain greater stocks at the household level, and can make better use of the stocks they hold (that is, they know how to cook from base ingredients and are not as reliant on pre-prepared meals as are their city cousins). No hard evidence confirms this hypothesis. Further investigation is warranted to ensure food continuity planning is not based on comfortable, but inaccurate, assumptions about the resilience of rural Australia.

There is little data disaggregation covering the threats to food supply chain resilience that different cities have faced. Communities in northern Queensland have experienced a high number of severe disruptive events, but it is not clear whether these communities are less resilient (due to the prospect of cyclones, floods and other adverse climate conditions) or more resilient (due to experience in coping with such events). Certainly the experience of the Queensland disasters in 2010–11 suggests that familiarity with disasters contributes positively to resilience. It should be possible to prepare an analysis of food supply chain resilience, based on data major retailers and distributors hold, in order to guide future planning.

Finally, a better understanding of the kinds of events that pose the greatest threat to the food supply chain, and where such events would have the greatest impact, would be highly useful. Although much of the planning to date has concentrated on the risk of a major human pandemic, other events could pose equally severe threats to the food supply chain. Some combinations of different and unrelated risks could severely disrupt the food supply chain. For example, a national fuel shortage that involved limited distribution of diesel fuel would itself be a disruption to the food supply chain, but if it were to coincide with a prolonged breakdown in the electricity grid the consequences could be catastrophic as not all retailers have emergency generation capacity and those that do rely on diesel fuel.

Scenario planning against such events would be one option to aid preparedness and policy development. Arising out of this work, a better documented understanding of the tipping points and vulnerabilities in the system would be a useful complement to the work DAFF has already done.

7.9 Governance in food supply chain resilience planning

7.9.1 Institutional mechanisms for industry–government interaction

Australia's food supply chains are not based on state or territory borders. Supply chains have been growing longer (crossing more borders) and this trend will continue. However, under Australia's Constitution, emergency management is a state responsibility and most of the powers needed to manage a crisis are exercised at the state level.

This results in a potential mismatch between crisis-imposed need and responsibility/accountability of government agencies for meeting that need. Some possible major disaster scenarios could see severe disruption to food supply chains in one state that could only be alleviated by the resources of another. A mechanism would have to be found to deal with that situation.

One interviewee, asked about coordination among authorities (in the context of a discussion about food transport) said 'I assume that there is a high level group that looks after this'. This is not a well-founded assumption. Outside the work done on pandemic planning, mechanisms for dealing with possible barriers to coordinating an emergency response on food supply do not seem to have been subject to agreement between different jurisdictions. This could be addressed through further work to determine if there is a potential problem and suggest options for dealing with it.

A lesson learned from the Queensland floods is that the food industry should be included in disaster preparedness at an early stage, and that there is considerable advantage in the kind of information sharing demonstrated in that event. The close cooperation between authorities and key retail chains and logistics providers was crucial to ensuring speedy food deliveries. Comments from industry stakeholders suggest these arrangements were better coordinated in Queensland—perhaps due to that state's greater experience with disasters—than in most other jurisdictions.

7.9.2 Capacity to cut through regulatory barriers

The Queensland experience showed that when regulatory problems were escalated to ministers for decision they were resolved quickly, but there ought to have been no need to divert time and attention to such matters during a crisis. A number of interviewees suggested it would be better for governments to agree and legislate that in a declared emergency a responsible minister would be empowered to suspend regulations that impeded supply of essential food. The types of regulation that might be included are opening and working hours, food labelling and compulsory additives to processed food.

In practice, many Queensland businesses and employees simply did what was needed to maintain food production and adopted a commonsense approach to regulatory restrictions. In doing so, however, they exposed themselves to possible litigation, even though their actions benefitted the community.

No interviewees suggested emergency suspension of regulations essential for personal health or for protection of Australia from introduced pests and diseases (biosecurity). However, it seems undesirable to specify, in advance, what regulation should be encompassed by such a power, given that the circumstances of disasters vary widely. Exercise of such power should be open and transparent, and rely on good judgement.

Such a power could in practice be delegated to officials, to enable quick response in an emergency. Given the increasingly national nature of the food supply chain, it would be logical for such powers

to rest with a federal minister; or appropriate state ministers could be delegated the authority in relation to matters clearly confined to their own state, with cross-border issues able to be quickly escalated to a federal minister.

Any such arrangement would need to be supported by well documented delegations to officials who could take speedy action as needed in a crisis. Information on ministers and officials responsible under these arrangements, including their contact details, would need to be circulated to emergency management units in each Australian jurisdiction.

7.9.3 Compulsory acquisition of food

Section 51(xxxi) of the Australian Constitution gives the Commonwealth power to acquire property 'on just terms'. The situation in relation to state and local governments is not always as clear.

In the case of the Queensland floods, anecdotal evidence indicates food was requisitioned as a matter of course, with the expectation that the food business from whom it was acquired would bear the cost. No independent verification of the reports could be found, and one person who made this comment indicated he was not referring to senior officials in the state.

Of concern is any perception that in an emergency food will simply be commandeered. Governments could usefully deal with this concern by confirming that when food is compulsorily acquired the affected business will, in due course, receive reasonable compensation. A policy statement to this effect need not be lengthy or prescriptive, and could leave the details of implementation to local authorities.

Appendix 1 Terms of reference

Initial study

Consistent with Schedule 1 of the consultancy agreement, LECG will provide the following services:

- an assessment about the level of preparedness in the food supply chain to respond to significant emergencies affecting continuity of the national food supply
- identification of strengths, gaps and potential vulnerabilities affecting food supply emergency preparedness; and
- identification of potential measures, responses and actions that could improve food chain preparedness.

This will be based on LECG's professional knowledge and expertise of the food logistics supply system and the information collected by the department.

The (initial) study will:

- Incorporate all sectors of the food supply chain including agricultural production, food manufacturing and processing, distribution and retailing.
- Consider short to medium-term disaster scenarios, including creeping crises (pandemic, animal and plant diseases) and sudden onset emergencies (natural disasters). Longer-term food security issues that allow sufficient lead time for business to adapt are outside the scope of this study.
- Include a review of relevant literature.
- Examine risks and vulnerabilities in the food supply chain, including concrete more tangible (infrastructure) risks, and less tangible (business culture) risks.
- Utilise information and data already available and collected by the department. Validate and build on this information.
- Review recent natural disasters/near misses and identify broader preparedness lessons of relevance to the food industry, for example (but not limited to) power failures—Victorian bushfires, Basslink Cable, Veranus Island, Longford gas.
- Assess the scope, extent and limitations of the food supply chain's preparedness and ability to respond to significant emergencies.
- Identify potential actions industry and/or government could take to improve preparedness in the food supply chain.

Expected deliverables/outcomes

A report detailing the findings of the study, including risks and vulnerabilities in the food supply chain; the scope, the extent and limitations of the food supply chain's preparedness, and its ability to respond to significant emergencies affecting continuity of the national food supply; and potential actions industry and/or government could take to improve preparedness.

Additional report on lessons from the Queensland floods

The Queensland floods of December and January 2010/11 provide an opportunity to undertake further work in understanding the resilience of the food and grocery supply chain in a severe emergency, including threats and points of vulnerability, through a case study on the impacts of the Queensland floods on the food supply. (The food and grocery supply chain is referred to as 'the food supply chain' throughout this document).

The case study should include the following:

- assess the immediate impact and challenges in maintaining food supplies to affected areas
- assess the immediate and longer-term impact on the national food supply chain
- assess the immediate and longer-term issues for the food supply chain as a consequence of the impacts on agriculture and horticulture businesses
- assess the impact on local food retail businesses, for example, staff not being available to attend work due to extenuating circumstances
- assess the extent to which business capacity may have been diminished due to employers' concerns in relation to occupational health and safety
- assess the impact of flooding on the ability of food manufacturers in Queensland to maintain continuity in the food supply chain
- investigate reported panic buying leading to destocking of supermarket shelves, and if this had lasting consequences for the food supply chain
- investigate price increases post-flood and assess whether they could be characterised as profiteering
- analyse the financial costs to the major food suppliers of maintaining food supplies to affected areas
- compare and analyse the experiences of a major national retailer with the independent retailers, for example Coles versus IGA (Metcash)
- identify strengths, gaps and vulnerabilities in the food supply chain in responding to this event
- identify potential measures, responses and actions that could improve food supply chain resilience.

Appendix 2 Case studies

The case studies in this appendix examine recent Australian events that have tested or potentially tested resilience of the Australian food supply chain, or delivery of food to Australian consumers.

Most are regional in scope (localised events having major direct impacts on dependent communities) but some also have national indirect effects.

The case studies are:

- Veranus Island gas crisis in Western Australia (2008)
- tropical cyclone Larry in northern Queensland (2006)
- Longford gas crisis in Victoria (1998).

Veranus Island gas crisis

On 3 June 2008, a major explosion rocked Apache Energy's gas processing plant at Veranus Island in Western Australia, which supplies gas through Alinta. The result was substantial restrictions in the availability and use of gas in Western Australia, with gas supplies reduced by about one-third. The Western Australian gas crisis lasted for a number of months, with gas production progressively resumed from late August 2008, and 85 per cent of full output restored by December 2008.

Gas is used both directly within the food and beverage sector and by its suppliers (for example, in food-grade CO₂ production), and also indirectly as a source of electricity. It is principally used by the processing/manufacturing and foodservice elements of the supply chain:

The WA food and beverage industry is highly dependent on natural gas through the nature of the industry, where natural gas is the most economic way for heating, cooking, frying, sanitizing, homogenizing of food and beverage products. It is also required that continuous manufacturing facilities are requiring continuous gas to maintain minimum food safety standards (Berteit n.d.).

Alinta implemented rotational gas supply reductions and withdrawals to lessen demand. Reduced availability of a consistent gas supply significantly disrupted the food processing sector in Western Australia. Sector responses included:

- reducing production or rescheduling operations to non-peak energy periods
 - Western Australia's only beef abattoir (owned by Harvey Industries) operated at more than 30 per cent reduced production and for a number of weeks ceased operations
 - frozen meal and meal component manufacturer, Vesco Foods, halted operations for one week
 - smallgoods processor, Dorsogna Ltd, operated at 70 per cent production for an extended period
- using alternative power supplies
 - major dairy suppliers, National Foods and Fonterra, and other food and beverage businesses undertook unplanned capital investment into new machinery and equipment to allow their production lines to operate on diesel (Berteit n.d.).

Mechanisms for food processors to gain more reliable and consistent gas supply included entering into contracts with other gas suppliers or acquiring surplus Alinta gas on a secondary energy market;

however, both options had significant cost implications and many food processors were of insufficient scale to participate in the secondary energy market.

Western Australia is an 'import-dependent' community for most processed foods. In response to the gas crisis, additional food products were imported from other states and from overseas to make up the potential shortfall in local manufacturing (FIA WA 2008). This strategy seems to have been largely successful, although a shortage of milk was reported and there may have been lessened short-term availability of other perishable items.

Foodservice businesses were also affected. The Australian Hotels Association told the Senate inquiry into the crisis that a survey of its members suggested that '22.7 per cent reined in food and beverage operations' given more costly and unreliable gas services.

While Western Australia's food supply chain was significantly affected by the Veranus Island incident, consumers do not appear to have been greatly affected due to inbuilt system resilience and suppliers' ability to source alternative supplies. However, the responses were not costless for food supply chain participants or for consumers.

In addition, where food processing is a relatively small industry in Western Australia, a situation of similar magnitude for major food processing locations in eastern Australia would be expected to have a much more substantial effect on food availability and therefore on consumers.

Tropical cyclone Larry

Tropical cyclone Larry made landfall near Innisfail, far north Queensland on 20 March 2006 with wind gusts estimated to have reached 240 kilometres an hour. It was considered the most powerful cyclone to have hit Queensland in a century.

Dependent infrastructure for the food supply chain, such as land transport and electricity, were affected. Emergency services coordinated emergency food provision; for example, Qantas provided 6000 in-flight meals to Innisfail residents (EMA n.d.). Foodservice was substantially affected. Supermarkets used alternative transport routes to maintain stock; for example, Coles used barges and airfreight to supply stores through commercial arrangements.

One industry interviewee also noted problems getting food supplies to affected communities because emergency personnel and police did not recognise the importance of non-emergency supply chains, with trucks containing food destined for supermarkets reportedly turned back from controlled roads.

The major effects were more indirect—the price and availability of bananas nationally. North Queensland is Australia's major banana-growing area, and the cyclone devastated banana production. Crop loss was estimated at 100 per cent in the Tully and Innisfail areas, about 95 per cent on the Atherton Tableland and about 80 per cent in the Kennedy area south of Cardwell (Australian Banana Growers' Council 2006).

Recognising the danger to banana crops from severe weather, the banana industry had built some preparedness into crop management, such as planting windbreaks and using nurse-suckering bananas. However, these were insufficient for the magnitude of Larry, the impact of which was described by one banana industry representative as 'almost beyond comprehension'.

With only minor banana growing areas in sub-tropical southern Queensland, northern New South Wales and Western Australia, Larry destroyed 90 per cent of Australia's banana crop.

The supply chain's ability to meet consumer demand was constrained by government restrictions on importation of bananas. At the time, importation of bananas from the Philippines was not permitted; a national import risk assessment considering pest and disease issues was not complete.

Consumer demand for bananas could, therefore, only be met by domestic supply. The substantial impact on banana availability was compounded by seasonal easing of production in the sub-tropical areas outside north Queensland.

The result was immediate shortages of bananas at supermarkets and other grocery outlets, and resultant increases in price to manage demand. For a number of months after the cyclone, banana prices increased by more than 500 per cent, compared to a pre-cyclone retail price of generally less than \$3 a kilogram, after the cyclone bananas averaged \$12 to \$15 a kilogram, in some cases approaching \$17 a kilogram (*The Age* 2006).

To get back to production, north Queensland banana growers needed to restore farms to working conditions (clear debris and restore buildings) and replant crops. The industry organised staggered production of new crops, which while slowing the immediate availability of bananas at pre-cyclone quantities, avoided a potential production glut and subsequent shortage. Australian banana availability and prices did not return to pre-cyclone levels until the end of 2006.

In this case, the supply chain for a particular food product was highly dependent on a particular production site, and consumers were substantially affected by an incident at this site. Food supply resilience was supported by an organised industry, but also constrained in the short and medium-term by import restrictions given biosecurity considerations, reducing flexibility.

Longford gas crises

In September 1998 a major rupture at a gas plant at Longford, Victoria caused explosions and fires that killed two employees, injured others, and led to closure of the immediately affected plant and two others at the same location. The affected plants supplied some 98 per cent of Victoria's gas; as a result of the plant closures, gas consumers remained without supplies for up to 19 days, with Victoria's capital, Melbourne, particularly affected.

According to a study prepared for the Victorian Government:

The Longford gas plant accident and subsequent loss of supply is considered to have been one of Victoria's worst disasters ... 1.4 million households and 89 000 businesses were affected ... the estimated cost of the accident to the Victorian economy was ... \$1.3 billion ... Sectors particularly affected included the car industry, plastics production, food and drink manufacturers and the hospitality sector ... Immediate impacts included temporarily curtailed production of some basic consumables including bread, milk and other dairy products. Supply lines of basic consumables were quickly established from interstate sources to overcome local shortfalls ...

In emergency management terms, Longford highlighted the need for closer coordination of response and particularly recovery issues including communication to the community. Information flow to the community, especially during the first 24-hours was largely uncoordinated and left to the media (Department of Human Services Victoria 2006).

The Royal Commission (Victorian Government 1999) into the Longford gas crisis was limited by its terms of reference to investigate the causes of the accident, and concentrated on the errors and

failings that led to the events rather than the implications for the Victorian community in terms of issues, such as food supply.

There was, however, considerable media and academic commentary about the broader implications of the event. In terms of the impact on consumers, although choice was restricted—some goods were unavailable or scarce during the emergency and for some months following—ongoing supply of basic foodstuffs was maintained. The major source was stocks held in New South Wales, delivered through existing supply chains.

A more significant impact was further upstream; in food manufacturing. Many of Victoria's food producers rely on gas as a major input into manufacturing processes, and were severely disrupted by loss of supply. Nevertheless recovery in the food sector was rapid once gas supply was restored.

The Australian Government allocated funding of \$100 million to Victorian gas emergency assistance, a major component of which was assistance to small businesses. This was in large part a response to anecdotal claims reported in Melbourne media about the difficulties food manufacturers, fast food outlets and restaurants were facing. However, the program received few applications for assistance, and little of the available funds were spent; 'As the value of applications for assistance under the scheme was significantly less than the anticipated \$100 million, total Commonwealth assistance provided under the scheme was \$8.1 million' (ANAO 2000) (a figure which included payments to individuals).

An important element of managing the crisis was widespread distribution of information through multiple channels to households on how to prepare and preserve food without gas; most Melbourne households rely on gas for cooking. One observer commented, although based on anecdotal evidence, that:

the elderly who had weathered the landmark disruptions of war and economic depression ... dealt with the stress of life without gas better than the less robust young ... [and] were more imaginative in the solutions they developed to cope without gas (Buckle 2001).

Key lessons from the Longford experience are that:

- food supply chains are highly resilient to localised disasters that affect only one element of infrastructure
- consumers adapt quickly and cope effectively with shortages of products by substitution
- recovery is rapid once full infrastructure is restored.

However, a note of caution must be observed: the time of year was favourable, avoiding temperature extremes, which made adaptive responses easier; patterns of food consumption have changed in the decade since the Longford gas crisis; and the suggestion that younger generations found adaptation more difficult indicates that a future event with a similar effect on infrastructure might be more difficult for the current generation of consumers.

Appendix 3 Queensland flood review

Objectives of the review

The objective of the project was to contribute to a better understanding of the resilience of the Australian food supply chain by examining a specific case study, the impact of the widespread Queensland flooding in December 2010–January 2011. Interviewees were told in a discussion paper circulated to them in advance that:

The reviewers are consulting with a wide range of different stakeholders with an interest in the matter, in Queensland and elsewhere. These include national food retailers, distributors, government officials and industry representative bodies. In addition a survey has been sent to a sample of Queensland participants in the food supply chain, seeking their views on the impact of the flooding on their business and their relationships with suppliers and customers.

The input from stakeholders with a direct experience in the Queensland floods will be a crucial input that will help strengthen Australia's resilience in future situations. It will be important for both national and State level consideration of preparedness.

Methodology

The reviewers consulted a range of stakeholders with an interest in the matter, in Queensland and elsewhere. These included national food retailers, distributors, government officials and industry representative bodies.

In addition, a survey was sent to food supply chain participants, seeking their views on the effect of the flooding on their business and their relationships with suppliers and customers. The online survey was voluntary and confidential, with no more than 50 business respondents to be contacted. Both the Australian Food and Grocery Council and the Food Industry Association of Queensland agreed to distribute the survey to a sample of their members.

The discussion paper was circulated to interviewees who agreed to participate in an in-depth interview for the study. It contained a set of core questions common to all. It adopted a semi-structured interview technique, designed to elicit a common set of comparable information while allowing interviewees to express particular perspectives.

Previous study

This work builds on a 2010 report on the resilience of the Australian food supply chain. The Minister for Agriculture, Fisheries and Forestry released that report after the meeting of the National Food Policy Working Group on 11 April 2010. It found that the extent to which the food supply chain is resilient in the face of disruption, especially how quickly can it regain its capacity to distribute food to consumers in the event of a crisis or emergency, is crucial to Australians' wellbeing.

The key finding was that the Australian food supply chain had demonstrated a high degree of resilience, but that factors on both the demand and supply side of the chain are decreasing future resilience, including lengthening supply chains in terms of distance, and lower stocks held at all points along the chain. Some key elements of resilience in relation to the Australian food supply chain were not well understood, and therefore posed potential threats to supply of food in Australia in the event of a severe emergency. Among the potential threats were:

- risks of concurrent loss of a number of distribution centre facilities (including power loss beyond that which generators can sustain)
- concurrent loss of a number of transport links to and between major cities (from, for example, extensive east coast storm events that cut land transport links between Brisbane and Sydney)
- shortage of fuel (diesel) for food distribution in the case of a national fuel emergency
- ongoing workforce availability constraints beyond which affected companies can manage using standard backfilling and casual pool arrangements
- an extended, material disruption to Australia's access to key finished foods or inputs to foods that are only produced overseas.

The recent experience with such a widespread disaster as the Queensland flooding means past findings can be tested by reference to actual experience, and lessons documented while they are still easily recalled.

The interviews

Interviews were arranged around a set of core questions common to all interviewees, but interviewers were flexible, wanting to leave space to explore issues of importance to each organisation or individual. The core questions were:

- What problems were identified by your organisation in the food supply chain during the recent Queensland floods?
- What were the underlying causes of any problems identified in the food supply chain?
- How did the food supply chain deal with, adapt to and/or mitigate any problems?
- Were you aware of any stockouts and/or supply shortages arising from the Queensland floods?
- Are there any medium to long-term implications arising from the floods for the food supply chain?
- In your opinion, how resilient is the food supply chain in dealing with natural disasters such as floods?
- In your opinion, what can be done to improve the resilience of the food supply chain?

Organisations interviewed or contacted for interview included AgForce (Brisbane); Agriculture, Food and Tourism, within the Department of Employment, Economic Development and Innovation (Queensland); Australian Food and Grocery Council; Australian National Retailers Association; Department of Defence; Emergency Management Division, Attorney-General's Department (Canberra); Food Industries Association of Queensland; Queensland Reconstruction Authority; Queensland Trucking Association; and SES Queensland.

Surveyed businesses that agreed to follow-up contact will be used for case studies where a narrative will be developed of their experiences during the Queensland floods.

Confidentiality

All material from interviews was confidential; the key purpose of the interviews was to document important lessons. Where the source of the comment was clear from the context the researchers sought the respondent's permission before including it in the report.

Media scan

In addition to interviews and survey, this review conducted a detailed scan of all media reporting on the Queensland floods. A sample of information gleaned from the scan, providing a chronological account of the impact of the flooding on food supply chains, is included below:

Food, disease fears plague flooded towns, 30 December 2010, Australian Broadcasting Corporation (ABC) News

Queensland authorities are increasingly concerned about the spread of disease and supplying food to thousands of people affected by record floods. Representatives from the state's independent and major supermarkets are today talking with authorities about how to open new supply routes. One option could be to send food to the state's north and then try to move it inland. In the meantime supermarkets are trying to stockpile essentials in flood-affected areas.

Flooded towns exempt from trading laws, 31 December 2010, Australian Associated Press, General News

Retail public holiday trading laws have been relaxed in flood ravaged Bundaberg and Rockhampton in central Queensland. Queensland attorney general Cameron Dick said a direction has been made under disaster management laws to permit retail trading for groceries and other essential items on New Year's Day and the national public holiday on Monday.

Floods threat to food supply, 31 December 2010, *The Cairns Post*

Supermarkets in the Far North have started restocking their shelves by shipping food into the region on barges as road and rail routes remain cut by floods. Independent retailers in Cairns are already looking interstate for produce. Emergency Management Queensland staff met Coles and Woolworths managers yesterday to arrange logistics for replenishing stock in needy regions throughout Queensland.

It's operation airlift as towns run out of food supplies, 1 January 2011, *The Courier-Mail*

Food drops are being organised well in advance, whether by road or by air. With both major supermarkets in Emerald flooded, helicopters were ferrying in supplies to the town and also to Blackwater, Springsure and Dingo. Last night, emergency management in Rockhampton was deciding when and where to drop supplies, while freight companies were desperately trying to deliver supplies to north Queensland before floods closed the Bruce Highway again.

Military help called in as flood crisis deepens—thousands forced out of their homes, 1 January 2011, *The Australian*

A massive logistical operation is under way across Queensland to evacuate thousands of people and deliver emergency supplies to communities and properties isolated by the floods. A convoy of trucks yesterday delivered 250 tonnes of food and supplies to Rockhampton while the roads were still clear, with two supermarkets flooded. Residents had already stripped the shelves of essentials. Plans are being devised to use alternative methods of transport—including barges and military airdrops—

to deliver supplies if the city and surrounding region remain cut off for up to a week, as some local authorities fear.

Trucks begin to haul in supplies, 1 January 2011, *The Australian*

Roads to many centres were opened yesterday as water levels receded. The supply of basic foodstuffs, emergency bedding and medical needs in flood-devastated Queensland towns and cities has been taken over by the Queensland government. The State Disaster Coordination team is managing the resupply of necessities to Springsure, Emerald, Blackwater and Rockhampton where supermarkets have been inundated or their shelves stripped bare. The Disaster Coordination officials met yesterday morning with representatives of major retailers to plan supermarket restocking. In the 24 hours to 5pm yesterday, 2772 pallets holding 1582 tonnes of essential items as well as 478 tonnes of fresh food were delivered by truck to supermarkets and other outlets from Cairns to Gladstone.

Race to get food into flooded Rockhampton—Hercules arriving in Mackay, 3 January 2011, Australian Broadcasting Corporation (ABC) News

The Fitzroy passed the nine-metre mark today on its way to an expected peak of 9.4 metres on Wednesday. The central Queensland city's airport is closed and road links to the south and west are cut, making normal deliveries of groceries and other household items impossible.

The Defence Force has stepped in to help deliver much-needed food to the city's 75 000 residents, many of whom are being forced to evacuate their homes as the waters rise.

Barges and trucks to bring in essentials, 4 January 2011, Australian Associated Press, General News

Barges are being used to transport food from Gladstone to Rosslyn Bay, on the coast east of Rockhampton, while the town of Jericho waits for a delivery on Wednesday.

Queensland floods—foodstuffs arrive, 6 January 2011, *Townsville Bulletin*

Large quantities of food will begin to replenish Townsville supermarket aisles today after 340 tonnes of dry food was shipped to the city just after midday yesterday. The emergency barge supply was organised by Walters Supa IGA to replenish desperately depleted stocks in their three supermarkets across the city, as well as three further north.

Maryborough braced for new flood peak, 10 January 2011, Australian Associated Press, General News

Fraser Coast Regional Council Mayor Mick Kruger said a food crisis was emerging at Granville, on Maryborough's outskirts, which was isolated and where many travellers had been stranded. Fresh supplies were delivered via boat and helicopter on Sunday but the town was again running short of food.

Flooded shoppers urged to stay calm 11 January 2011, Australian Associated Press General News

Flood-fearing Queenslanders are apparently converging on supermarkets to stock up on basic supplies such as bread, water and toilet paper. Food producers, manufacturers and retailers are all working together to maintain supply. The challenge is to find alternative routes and alternative means of transport.

Retailers unite to supply towns, 12 January 2011, *The Australian*

Supermarket giants Coles, Woolworths and Metcash have joined forces to ensure Queensland food supplies are maintained after floodwaters severed road and rail transport routes. Almost 300 delivery trucks have been stranded across the state as the retailers coordinated their logistics efforts to establish alternative delivery methods, with efforts concentrating on supplies of essentials such as bottled water, tinned food and nappies.

Reopened highway opens supply route, 14 January 2011, Australian Associated Press, Financial News Wire

The Bruce Highway, the primary link between Brisbane and Queensland's major population centres reopened at Gympie on Thursday, allowing much needed food supplies to reach towns and cities as far north as Gladstone.

Help arrives for thousands, 14 January 2011, *The Age*

A massive airlift of food and other essential supplies is under way across Queensland after panic buying emptied supermarket shelves in major towns and cities cut off by floods. Australia's big supermarket chains called in the army yesterday to move desperately needed supplies on military planes to isolated areas in the state's north. The nation's biggest supermarket chains—Woolworths, Coles and IGA—yesterday used two giant C17 military planes to help get basic supplies to northern parts of the state that have been cut off by the floods. The planes, loaded with milk, bread, canned and baby food, bottled water, cleaning products and other basics, left Sydney and Brisbane for Townsville. The Australian Defence Force also used C130 planes to get food to Bundaberg, while the supermarket chains sent a convoy of 15 B-double trucks early yesterday, with police escort, for Gympie and Hervey Bay. With floods receding in some areas, authorities began reopening some major road links north of Brisbane. The Bruce Highway at Gympie reopened yesterday afternoon, and the highway was expected to reopen at Rockhampton about 4pm today.

We're not running out of food: Bell, 14 January 2011, *Central Queensland News*

The State Government, police and emergency services have lifted road restrictions and closures around Queensland's largest fresh fruit and vegetable market, ensuring produce transport can go ahead. A temporary site has been established on Boundary Road in Brisbane which will give fresh produce wholesalers and buyers adequate room to store supplies ready for transport to wider Queensland. Transport companies are also sourcing alternative routes into the Central Highlands reminded shoppers not to panic-buy.

Big supermarket players team up to restock city, 15 January 2011, *The NewsMail*

In a rare display of collaboration, Coles, Woolworths and IGA have cooperated to send fleets of trucks to the Bundaberg region to restock supermarket shelves.

Vital supply chains must be kept open, 22 January 2011, *The Daily Mercury*

Ways to protect major transport lifelines in the future needs to be considered according to members of Mackay's business community. Coastal shipping, an improved Bruce Highway and a Whitsunday fresh food distribution centre are proposed solutions to protect supply chains in the future.

Growers call for funds to flood-proof roads, 7 February 2011, *The NewsMail*

According to Bundaberg Fruit and Vegetable Growers executive officer, Peter Peterson, Australia had a third-rate transport system, unable to maintain the distribution of food and medical supplies

to not only small towns but also regional cities. He calls for investment into flood-proofing the nation's transport networks.

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