



KNOWLEDGE...INNOVATION...ACTION

food chain intelligence

m 0404 353 571

f +61 2 9460 1239

abn 34 305 914 076

silvia@food-chain.com.au



VEIL | victorian eco
innovation lab

Victorian Eco-Innovation Lab

m 0425 794 848

www.ecoinnovationlab.com

klarsen@unimelb.edu.au

VEIL Project Title:

Best Practice Food Distribution Systems

Project completion date: 30/06/2010

Authors:

Dr Silvia Estrada-Flores

Principal Consultant

Food Chain Intelligence

Kirsten Larsen

Policy Research Manager

Victorian Eco-Innovation Lab (VEIL)

Best Practice Food Distribution Systems

Project Leader:	Dr Silvia Estrada-Flores. Principal Consultant, Food Chain Intelligence.
Contact details:	PO Box 1789. North Sydney 2059, NSW. Ph 0404 353 571; e-mail: silvia@food-chain.com.au
Company's website:	www.food-chain.com.au
Delivered on:	June 2010.

Disclaimers:

Any recommendations contained in this publication do not necessarily represent VEIL or FCI policy. No person should act on the basis of the contents of this publication, whether as to matters of fact or opinion or other content, without first obtaining specific, independent professional advice in respect of the matters set out in this publication. Neither the Victorian Government nor any of its Departments nor its employees or agents endorse the contents of this Report.

The report has been prepared by Food Chain Intelligence through the use of primary and secondary data sources and interviews. While every effort has been made to ensure the accuracy of the analyses, the uncertain nature of some data is such that Food Chain Intelligence (FCI) is unable to make any warranties in relation to the information contained herein. The FCI disclaims liability for any loss or damage that may arise as a consequence of any person relying on the information contained in this document.

Funding acknowledgements:

The authors acknowledge the financial support for this project from the Department of Innovation, Industry and Regional Development, Sustainability Victoria, the Department of Planning and Community Development and the Victorian Eco-Innovation Lab.

Table of Contents

Executive summary	3
Acknowledgements	7
Glossary, abbreviations and units	8
Project Background	9
Chapter 1: The contribution of food supply chains to greenhouse gas emissions.....	11
1.1. Relative contribution of food distribution to emissions	15
1.1.1. Refrigerated transport.....	18
1.2. Sustainable food distribution systems	19
1.2.1. Measuring emissions from food distribution systems.....	23
1.3. The structure of Australian food supply chains.....	24
1.3.1. Differences between Australian and overseas food distribution systems	27
1.3.2. Australian horticultural chains and carbon emissions.....	29
Chapter 2: Methodology	31
2.1. Selection of food distribution systems	31
2.2. General observations of the initiatives selected	36
2.3. Case studies	37
Chapter 3: Farmer and consumer-led initiatives	38
3.1 Drivers and motivations for F&CL initiatives	46
CASE STUDY: FOOD CONNECT (AUS)	50
CASE STUDY: eFARM (INDIA)	52
CASE STUDY: ZESPRI AND THE NEW ZEALAND KIWIFRUIT EXPORT INDUSTRY.....	53
3.2 Innovative aspects and opportunities for F&CL initiatives.....	54
3.3 Obstacles and challenges for F&CL initiatives.....	58
3.4 Lessons learned and applicability to future initiatives.....	60
Chapter 4: Retailer-led food distribution initiatives	63
4.1 Drivers and motivations for retail-led initiatives.....	63
CASE STUDY: WAL-MART STORES INC.....	69
4.2 Innovative aspects and opportunities for retail-led initiatives.....	70
4.3 Obstacles and challenges for retail-led initiatives.....	74
4.4 Lessons learned and applicability to future initiatives.....	76
Chapter 5: Global manufacturer-led initiatives	77
5.1 Drivers and motivations for global manufacturer-led initiatives	82

CASE STUDY: KRAFT FOODS INC.....	84
5.2 Innovative aspects of global manufacturer-led initiatives	85
5.3 Obstacles and challenges for global manufacturer initiatives	87
5.4 Lessons learned and applicability to future initiatives.....	90
Chapter 6: Logistics-led initiatives.....	92
6.1 Drivers and motivations for logistics-led systems.....	96
CASE STUDY: THE LOWHUB EXPERIENCE (UK).....	98
6.2 Innovative aspects of logistics-led systems	100
6.3 Obstacles and challenges of logistics-led initiatives.....	103
6.4 Lessons learned and applicability to future initiatives.....	104
Chapter 7: Government-led initiatives	106
7.1 Drivers and motivations of government-led initiatives.....	110
CASE STUDY: THE VON HIER EXPERIENCE (GE)	111
7.2 Innovative aspects of Government-led initiatives.....	112
7.3 Obstacles and challenges for Government-led initiatives	114
7.4 Lessons learned and applicability to future initiatives.....	115
Chapter 8: Final Remarks.....	117
References	125
Appendix 1. Food Distribution Initiatives Investigated	132
Appendix 2. STEEP Factors Analysed for F&CL Initiatives.....	144
Appendix 3. Farmers' Markets in Victoria, Australia	152
Appendix 4. Retail-led innovations in Areas Related to Food Supply Chains	158
Appendix 5. Examples of policy instruments in the supply chain of fruit and vegetables ...	161
Appendix 6. Examples of council-led initiatives	162

Executive summary

The objectives of the project “Best Practice Food Distribution System” were:

- a) To identify, describe and analyse novel food distribution systems, including examples of urban, local and regional chains; government led and self-regulatory approaches; and supermarket-led initiatives.
- b) To analyse the patterns, motivations and trends in the development and implementation of novel food distribution systems.
- c) To provide an overview of the barriers and opportunities for the application of novel food distribution systems to reduce greenhouse gas emissions in Australia and Victoria.

Context: To provide context for this work, a review was undertaken of the contribution of food supply chains to greenhouse gas emissions; the factors influencing emissions; and how they are measured. Key findings from this review include:

- The global footprint of logistics and transport is 2,800 Mt CO₂-e per year, or 5.5% of the total annual GHG emissions generated by human activity. Road freight contributes around 57% of the total, followed by ocean freight (17%).
- It is now clear that ‘food miles’ cannot be used as a sole indicator of the environmental impact of food supply chains. More local sourcing can greatly reduce the distance travelled by food, but the reduction in transport impacts may be offset by the use of smaller vehicles, lower load factors, or differences in production efficiency.
- International comparisons are difficult. For example, while about half of all vegetables and 95% of all fruit consumed in the UK are imported, Australia imports 30% and 4.2% of all processed and fresh fruit and vegetables consumed, respectively.
- For meat and dairy products the carbon footprint is dominated by primary production, but for non- or minimally processed foods grown outside (such as many fruit and vegetables), absolute differences in primary production impact are small relative to storage and transport impacts.
- The carbon footprint of Australian vegetables production and marketing ranges from 7.4 and 8.5 Mt CO₂-e. Transport (including refrigerated and non-refrigerated) represents 15-17% of this figure.
- In the calculation of carbon footprints, the excessive simplification of distribution activities can underestimate logistics emissions by about 30%.

Investigation: To investigate best practice food distribution systems, a framework of analysis was developed, according to the supply chain player taking a leadership role to decrease food distribution carbon footprints. On this basis, five initiative categories were detected:

- a) Farmers and consumers.
- b) Food retailers.
- c) Food manufacturers and marketers.
- d) Third party logistics providers.
- e) Local councils, State and Federal Governments.

A large number of initiatives were found to fit under these categories. From these, 38 were selected for an in-depth review, including the following aspects:

1. Organisational structure: country, scale (*e.g.* national, global), annual revenue (when the information was available) and type of organisation (*e.g.* non-profit, policy maker, company).
2. Supply chain relations; role in the chain (*e.g.* marketer, manufacturer, farmer), the sharing of risk among supply chain partners (risk structure), distribution links, sourcing strategy (*e.g.* national, local, seasonal), type of fuel used and type of commerce platform used.
3. Mission statements: GHG emissions, vulnerability, fair trade, cost efficiency.

The key results for each type of category are summarised below.

FARMER AND CONSUMER-LED (F&CL) INITIATIVES

- The type of initiatives considered as F&CL include: farmers' markets; marketing cooperatives; community supported agriculture direct and online sales hubs.
- F&CL systems can: (1) promote shorter distances between producers and consumers; (2) promote seasonal sourcing; (3) engage with small, niche farms; (4) implement food purchasing venues (*e.g.* cooperatives, farmers markets); (5) show a commitment to the social, economic and environmental dimensions of sustainable food chains; and (6) promote fair trade.
- Motivations for F&CL initiatives include: the emergence of consumers' concerns on food carbon footprints; social and geographical population trends; power imbalance in food chains and the perception that farmers are not been fairly rewarded in retail chains, among others.
- Challenges for F&CL initiatives include: the varying definition of what "local food" means; the willingness of consumers to eat seasonally and the lack of certification processes for environmental food production and distribution.
- Opportunities include: using localisation as a strategy to reduce distances traveled by food and time in storage; marketing of products that do not reach the quality standards of supermarket chains; increasing communal gardens or organised cooperation with farmers in CSA schemes; and distribution of produce from urban agriculture in vertical farms, urban greenhouses and rooftops.
- Innovative concepts based on the principles of farmers' market could become the future distribution models for fresh produce in urban centres. Examples of concepts for future Farmers' Markets include Farms on Wheels, Hydroponic Farmers' Markets and the Urban Field Farm Stop, which uses existing channels of mass transit and bus stops to sell produce in cities.

RETAILER-LED INITIATIVES

- The direct and indirect GHG emissions of global retailers are significant. For example, Wal-Mart estimates that their total global GHG emissions are 210 Mt CO₂-e per year, including the activities developed by their suppliers (*i.e.* Scope 1, Scope 2 and Scope 3 activities).

- In Australia, Woolworths estimates that their total global GHG emissions are 85.3 Mt CO₂-e per year, including the activities of their suppliers. This represents 13% of Australia's direct and indirect GHG emissions.
- Motivations for retail-led initiatives include: cost reduction; the effects of drought and severe weather events on retailers' suppliers; and regulatory concerns on future carbon pollution reduction measures.
- Challenges for retail-led initiatives include: financial payback of low carbon transport technologies; inconsistent national and international approaches to carbon reduction targets; and a lack of trust and transparency in the retail supply chain.
- Opportunities include: the use of private label and category management as platforms for vertical integration of environmental distribution initiatives; the use of local sourcing strategies to appeal to environmentally conscious consumers; collaborative initiatives between retailers and suppliers to optimize distribution networks; and developing formats (*e.g.* store size) and delivery systems that reduce emissions from consumer trips.
- Innovative concepts can also be driven in other commercial areas where retailers have influence. For example, in financial services, restaurants, liquor and petrol stores.

GLOBAL MANUFACTURER-LED INITIATIVES

- Global manufacturers are exposed to regulatory risks and costs through mechanisms/policies that affect the entire value chain, including raw material production (*e.g.* biofuels policies), transportation, product design and use and consumer habits.
- Motivations for manufacturer-led initiatives include: cost reduction; exposure to regulatory risks (as abovementioned); the initiatives undertaken by their major buyers (supermarkets) and consumer drivers.
- Challenges for manufacturer-led initiatives include: the lack of a clear business case for sustainable distribution that encompasses financial, environmental and social aspects; uncertainty in the introduction of global carbon reduction targets and policy instruments (and how they will be applied at international borders); and the use of global procurement, which increases resilience to variability in supply of raw materials but imposes a significant carbon footprint in the supply chain.
- The strongest opportunity lies in the implementation of sustainable distribution strategies with third-party logistics providers (3PLs), retailers, suppliers and even other manufacturers.
- The cumulative GHG emissions in Scope 1 and 2 activities by seven major global manufacturers investigated in this report amounts to 24.3 Mt CO₂-e per year. The global reach of large food manufacturers means that their potential to achieve reductions in GHG emissions is large. For example, a commitment of 20% reduction in GHG emissions by these seven manufacturers amounts to 4.9 Mt CO₂-e per year.

LOGISTICS-LED INITIATIVES

- Reduction in oil dependency can substantially reduce operating expenses in the transport sector, where energy purchases can range from 5 to 35% of the total cost base. In Australia, 30% of the costs during long distance road freight transport are fuel related.

- Motivations for logistics-led initiatives include: cost reduction, regulatory drivers, and the alignment of 3PLs with their client's initiatives, including sustainable distribution.
- Challenges for these initiatives include: economic factors (*e.g.* global economic volatility); the state and availability of road, sea and rail infrastructure (which are factors outside the control of logistics providers); and uncertainty in the introduction of global carbon reduction targets and policy instruments.
- Opportunities include: improving the efficiency of road vehicles in their day-to-day operation; reducing speed in shipping vessels and road freight vehicles and the re-design of distribution networks, among others. The cumulative global potential GHG emissions abatement through these three opportunities is estimated in 470 Mt CO₂-e per year.
- A key lesson is that different measures are needed to decrease the impacts of transportation. For example, the combination of transport modes, fuels and methods of transportation is more effective than one single measure.

GOVERNMENT-LED INITIATIVES

- Food distribution has social, environmental and economic impacts. It is a cross-cutting issue that needs a holistic approach to be properly dealt with, and "triple bottom line" indicators.
- Motivations for Government-led initiatives include: growing public awareness and higher expectations for environmental leadership; the Government's commitment to decrease Australia's carbon footprint, in accordance to the Kyoto protocol and a yet-to-be-agreed international target on carbon reductions; and the strong social and business case to integrate sustainable food distribution at local, state and national levels.
- Challenges include the low traction that food distribution issues have in the political and policy agenda; the complexity of food systems; and a tendency to focus on food export rather than domestic channels.
- Opportunities include government-industry collaborative efforts that can contribute to policies that align better to the realities of commercial enterprises; the use of government procurement systems to drive sustainable food distribution; and the potential developments of programs to support F&CL initiatives, such as farmers' markets and local food initiatives.

This report highlights a wide range of alternatives that can help to decrease GHG emissions derived from food distribution systems. Rather than advocating for a unique approach to be used to drive emissions out of food supply chains, this report shows that each player in the chain can have a significant role in developing sustainable food distribution systems in a local, national and international level. The opportunities for abatement are significant.

Acknowledgements

The authors gratefully acknowledge the information provided by Mr. M Venkata Subramanian (eFarm), Mr. Kevin Tullet (Lowhub), Ms Ulrike Trellert (Von hier) and Mr. Robert Pekin (FoodConnect).

Further, the authors acknowledge the review and comments of Dr Andrew Higgins (CSIRO Sustainable Ecosystems) on the drafts of this report.

This project was funded by: the Department of Innovation, Industry and Regional Development; Sustainability Victoria; the Department of Planning and Community Development; and the Victorian EcoInnovation Lab.

Glossary, abbreviations and units

Carbon footprint. The total amount of carbon dioxide equivalents and other greenhouse gases emitted over the full life cycle of a product.

CO₂-e (Carbon dioxide equivalent). The amount of CO₂ that would have the same relative warming effect as the basket of greenhouse gases actually emitted.

FF&V. Fresh fruit and vegetables.

GHGs . Greenhouse gases, or gases in the earth's atmosphere that absorb and re-emit infrared radiation. The Kyoto Protocol lists six major greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), HFCs (hydrofluorocarbons), perfluorocarbons (PFCs, a by-product of aluminium smelting) and sulphur hexafluoride (SF₆).

HGV. Heavy goods vehicle.

LGV, LCV. Light goods vehicle, light commercial vehicle

Scope 1 emissions. Direct emissions from GHG sources owned or controlled by the reporting organisation.

Scope 2 emissions. Emissions that do not physically occur from within the organisation's reporting boundary and are therefore 'indirect' emissions. Scope 2 emissions are caused by the organisation's consumption of electricity, heat, cooling or steam brought into its reporting boundary. This category is often called 'purchased electricity' because it represents the most common source of Scope 2 emissions.

Scope 3 emissions. An organisation's indirect emissions other than those covered in Scope 2. They are from sources that are not owned or controlled by an organisation, but which occur as a result of its activities. The Scope 3 emissions subcategories considered by the CDP Supply Chain Information Request are: (1) business travel emissions, (2) distribution and logistics emissions, (3) emissions from the use and disposal of a company's products, (4) supply chain emissions.

Prefixes of SI-units

k =kilo $10^3 = 1,000$

M =mega $10^6 = 1,000,000$

G =giga $10^9 = 1,000,000,000$

T =tera $10^{12} = 1,000,000,000,000$

P=peta $10^{15} = 1,000,000,000,000,000$

Kilowatt hour (kWh). The standard unit of electrical energy that represents the consumption of one kilowatt over the period of one hour.

Conversion factors for energy units

1 kWh (kilowatt-hour) = 3.6 MJ

1 MWh (megawatt-hour) = 3.6 GJ

1 GWh (gigawatt-hour) = 3.6 TJ

1 TWh (terawatt-hour) = 3.6 PJ

Conversion factors of power units

1 megajoule per second (MJ/s) = 1 MW;

1 horsepower (HP) = 0.735 kW;

Project Background

In 2008, the Victorian Eco-Innovation Lab (VEIL) at the University of Melbourne performed an initial analysis of new sustainable freight solutions. VEIL's findings suggested that most solutions are driven by economic interests to increase efficiency and reduce costs – in the context of changing fuel prices, major congestion costs (in Europe) and legislative changes. While there are undoubtedly substantial gains to be made through uptake and adaptation of these innovations throughout supply chains, many could be considered to be in the realm of 'doing more efficiently what we already do' – rather than as indicators of more systemic change.

To explore possibilities for more fundamental changes in freight systems, VEIL engaged Food Chain Intelligence and CSIRO to conduct research on food distribution systems and identify opportunities to achieve significant environmental improvements (*i.e.* reductions in emissions). The project is also supported by: the Department of Innovation, Industry and Regional Development, Sustainability Victoria, and the Department of Planning and Community Development.

This report is Part 3 of a three-part food freight project that aims to shed light on Victoria's food freight system. It does not aim to comprehensively determine greenhouse gas emissions or vulnerabilities, but to investigate the territory and provide preliminary suggestions and directions for further work. The three parts of this project are briefly outlined below.

Part 1: Summarise existing information relating to Victoria's food freight system.

- Description of Victorian food freight task
- Describe greenhouse gas emissions and vulnerabilities in Victorian food freight system (from available information)
- Outline potential impacts upon food security for Victorian communities



Part 2: Increase understanding of how fruit and vegetables are moved from production to consumers in Victoria and the greenhouse emissions implications of this operation.

- Map fruit and vegetable supply chains in Victoria, identifying: sources and destinations; transport types and amounts; key features (*e.g.* bottle-necks)
- Identify how these supply chains vary throughout the year, according to seasons and conditions
- Identify and analyse greenhouse gas emissions throughout the supply chains
 - What components of the fruit and vegetable supply chains have significant greenhouse impacts
 - What factors influence these components *e.g.* distance, temperature

Part 3: Assess "best practice" food distribution systems that can potentially achieve significant environmental improvements (*i.e.* reductions in GHG emissions).

- Identification, description and analysis of novel food distribution systems, including examples of urban, local and regional chains; government led and self-regulatory approaches; and supermarket-led initiatives.

- Analysis of the patterns, motivations and trends in the development and implementation of novel food distribution systems.
- Overview of the barriers and opportunities for the application of novel food distribution systems in Australia and Victoria.

Each chapter contains a summary table, which highlights the main points (!), possible areas for further research () and opportunities for innovation (). The figures in the summary tables are all referenced within the main body of the text.

The report was largely written in the context of an expected Emissions Trading Scheme – the Carbon Pollution Reduction Scheme. In April 2010, the Commonwealth Government withdrew its commitment to implement this scheme and it is now on hold until 2013 at the earliest. This leaves considerable uncertainty in the short term in relation to policy or regulatory drivers for emissions reduction. Where it is identified that the CPRS or an ETS may have driven change in behaviour, this is currently suspended. Reactions to new forms of mitigation policy are unknown.

Chapter 1: The contribution of food supply chains to greenhouse gas emissions

!	<i>The activities required to feed the world's population are estimated to account for 20% of GHG emissions annually. In Australia, food production, distribution and consumption contributes 16% of the per capita GHG footprint.</i>
!	<i>The global footprint of logistics and transport is 2,800 Mt CO₂-e per year, or 5.5% of the total annual GHG emissions generated by human activity. Road freight contributes around 57% of the total, followed by ocean freight (17%).</i>
!	<i>It is now clear that 'food miles' cannot be used as a sole indicator of the environmental impact of food supply chains. Within consideration of the carbon footprint of transport, consideration must be given to:</i> <ul style="list-style-type: none"> <i>- Combinations of road vehicles used;</i> <i>- Effect of logistics technologies and fuel types;</i> <i>- Transport mode, efficiency and loading capacity;</i> <i>- Differences in production systems; and</i> <i>- Distribution strategies: full and partial loads; backhauling and load matching; cooperative and competitive transport approaches.</i>
!	<i>The comparison of food carbon footprints between Europe and Australia are difficult for several reasons, including:</i> <ul style="list-style-type: none"> <i>- Differences in international trade. For example, about half of all vegetables and 95% of all fruit consumed in the UK are imported. In Australia, imports represent 30% and 4.2% of all processed and fresh fruit and vegetables consumed, respectively.</i> <i>- Differences between production systems. For example, while the UK and Australia use almost the same area for protected vegetable cropping, the former produces 4 times more vegetables under this system than Australia, while the latter is 1.3 times more productive in field vegetable cropping.</i>
!	<i>For meat and dairy products, the carbon footprint is dominated by primary production. For non-processed or minimally processed foods grown outside such as many fruit and vegetables, absolute differences in primary production impact are small relative to storage and transport impacts.</i>
!	<i>The carbon footprint of Australian vegetables production and marketing ranges from 7.4 and 8.5 Mt CO₂-e. Transport (including refrigerated and non-refrigerated) represents 15-17% of this figure.</i>
!	<i>In the calculation of carbon footprints, the excessive simplification of distribution activities can underestimate logistics emissions by about 30%.</i>
!	<i>More local sourcing can greatly reduce the distance travelled by food, but the reduction in transport impacts may be offset to some extent by the use of smaller vehicles or lower load factors</i>
📖	<i>The development of accurate supply chain carbon footprints requires an accurate representation of the distribution system – this is not yet available in Australia.</i>
📖	<i>Impact of greenhouse (protected) horticulture on emissions in Australian context.</i>
📖	<i>Health assessment of consuming a seasonal-only diet with a variety of foods changing throughout the year</i>
📖	<i>Cost-benefit calculations for energy saving technologies, including effects of variable temperature regimes on product quality and safety</i>
📖	<i>Costs and benefits of different vehicle types / uses for food transport within Australian urban conditions – for example, relative advantages considering efficiency, speed, and congestion.</i>

The activities required to feed the world's population are estimated to account for 20% of GHG emissions annually. In Australia, food is thought to contribute 16% of the per capita GHG footprint (Hertwich and Peters, 2009).

Agricultural production, for example, contributes 13.5 % of all human-induced GHG emissions globally (US Environmental Protection Agency, 2008). Australian agriculture contributed with 16.5% of the total national direct GHG in 2008 (Department of Climate Change, 2009a)¹ and in Victoria agricultural emissions accounted for 12% of total emissions in 2007 (Department of Climate Change, 2009c).

However, primary production is only the first step of a chain of events that lead to bring food to the table of consumers. These food supply chains have a significant (and often unmeasured) impact on the environment. This impact is observed upstream and downstream the chain, as illustrated in Figure 1.1.

A 2008 study estimated that the total carbon footprint of British food supply chains (including both perishable and non-refrigerated foods) was 19% of the national carbon footprint (Garnett, 2008). More recent estimates that include the impact of land use change in primary production have increased this proportion to 30% (Audsley et al., 2009). The latter results align with an evaluation of the contribution of the entire European food system, which is believed to be responsible for 27% of environmental impacts in the European Union (Tukker et al., 2009).

There are several scientific articles, reports and web pages that deal with the impacts of food on the environment. For example, a search on ScienceDirect² revealed that from the year 2000 to 2010 there have been over 1,000 papers on this subject. Also, interest in pioneering papers that analysed the environmental impact of human diets in the 1990's (Carlsson-Kanyama, 1998a; Kendall and Pimentel, 1994) is resurging³.

One aspect that is clear from the different assessments of food chains as a source of GHG emissions is their complexity. Foods are agricultural products that have a naturally high variability, further increased throughout their production, manufacturing, distribution and

¹ Comprehensive discussions on the issues that need to be attended to in agriculture through the use of mitigation and adaptation technologies can be found in Deuter, P., 2008a. Defining the impacts of climate change on horticulture in Australia, Garnaut Climate Change Review. Horticulture Australia Ltd,, pp. 1-23, Estrada-Flores, S., 2010b. Technology Platform 3: Emerging Technologies for Quality and Safety., Opportunities and challenges faced with emerging technologies in the Australian vegetable industry Horticulture Australia Ltd, pp. 1-90, Hennessy, K., B. Fitzharris, B.C. Bates, N. Harvey, S.M. Howden, L. Hughes, J. Salinger and R. Warrick, 2007. Australia and New. Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge University Press, Cambridge, UK, pp. 507-540, O'Halloran, N., Fisher, P., Rab, A., 2008a. Options for mitigating greenhouse gas emissions for the Australian vegetable industry, Discussion Paper 6.Vegetable Industry Carbon Footprint Scoping Study. Horticulture Australia Ltd, pp. 1-31, The Garnaut Review Secretariat, 2007. Issues Paper 1. Climate Change: Land use- Agriculture and Forestry, Garnaut Climate Change Review

² A scientific database with more than 2,500 peer-reviewed journals, more than 11,000 books and over 9.5 million articles/chapters.

³ According to the tool "citation tracker" in Scopus, an Elsevier database of abstracts and citations for scholarly journal articles. It covers nearly 18,000 titles from more than 5,000 international publishers, including coverage of 16,500 peer-reviewed journals in the scientific, technical, medical and social sciences (including arts and humanities) fields.

consumption stages. This complexity makes comparisons of product carbon footprints very difficult. Some comparisons that have been attempted include (but are not limited to):

1. The effect of types of products, encompassing comparisons between animal and other protein-based products, grains and legumes, and horticulture products.
2. The effect of production systems, encompassing comparisons between conventional, biological and organic farming (amongst other systems), extensive and intensive production and others.
3. The relative impact of the use of renewable energy during production.
4. The effect of manufacturing processes, for example, fresh, processed, frozen, chilled, canned and other processes and combinations.
5. The effect of waste as related to sourcing, processing, marketing and consumption.
6. The effect of food packaging. This encompasses comparisons between recyclable crates, cardboard, plastic and several others.
7. The effect of logistics and transport operations, encompassing studies about the impact of imported and domestically grown product; seasonal sourcing; nationally-sourced and locally-sourced product; supermarket and direct marketing channels (*e.g.* farmers' markets, e-commerce); and modes of transportation, among others.
8. The effect of different types of consumption at household level, which relates to the level of processing.

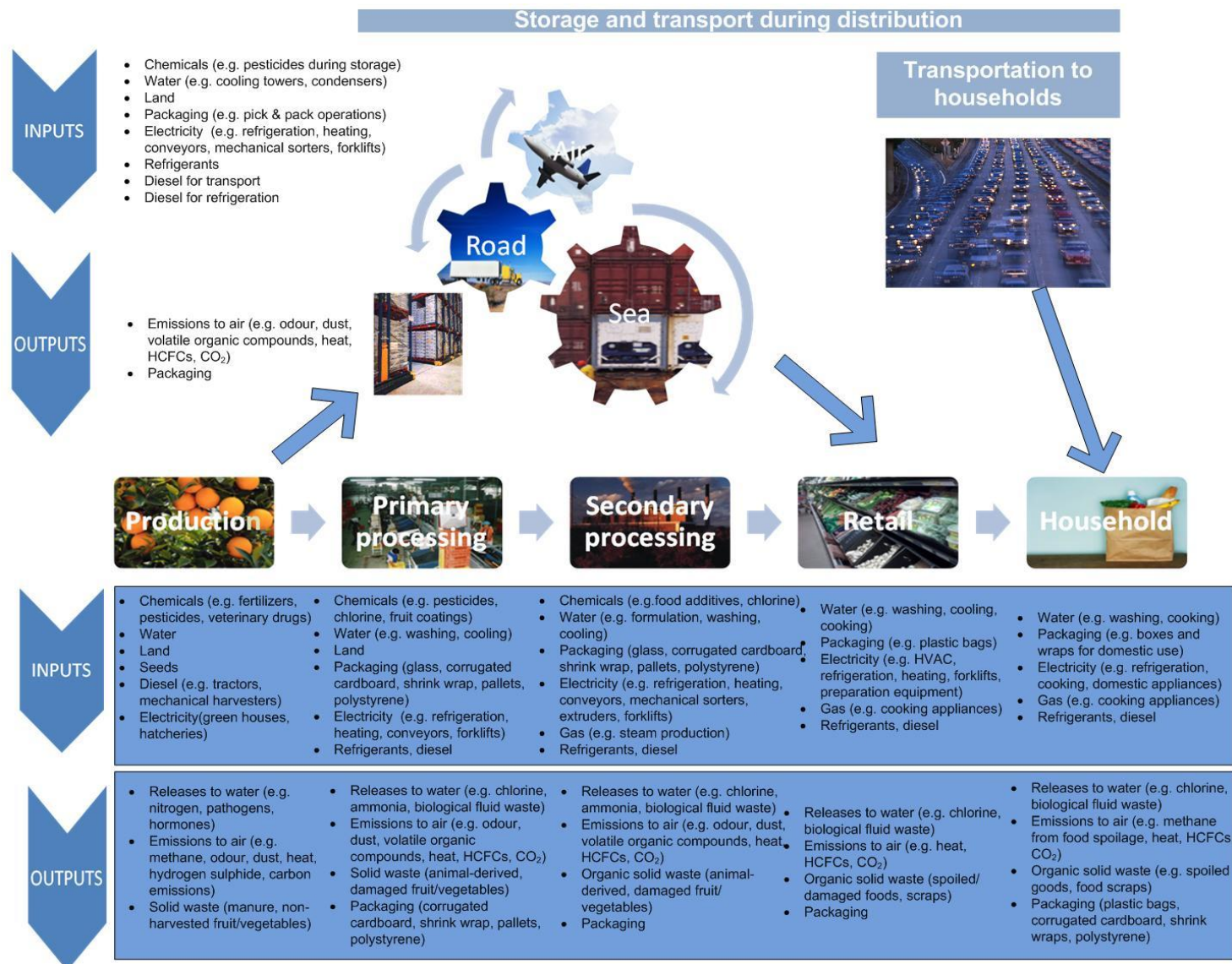


Figure 1.1. ...

The combined effect of all the variables aforementioned can deliver significantly different results. However, some rules-of thumb have been developed:

1. For non-processed or minimally processed foods grown outside such as many fruit and vegetables, absolute differences in primary production impact are small relative to storage and transport impacts (Cleland, 2010). This needs to be reassessed in greenhouse (protected) horticulture (Williams et al., 2006).
2. For seasonal products, domestic chains in general deliver a smaller carbon footprint than longer (global) supply chains (Hospido et al., 2009).
3. Longer chains may be partially compensated by shorter storage periods but this particularly depends on refrigerants used and leakage rates, electricity emission factors and transport type and distance. For example, refrigerated storage in NZ has a relatively low impact because about 70% of electricity generation is renewable (Cleland, 2010).
4. The carbon footprints for meat and dairy products are much higher than for fruits and vegetables due to the high farm emissions (*e.g.* ruminant methane), greater processing, the need for refrigeration in the retail and consumer sectors and more cooking by the consumer (Williams, 2009; Williams et al., 2006).
5. For meat and dairy products, the carbon footprint is dominated by primary production. Therefore, transport and storage are less influential on the difference between supply chains (Williams et al., 2006).
6. Irrespective of the factors from 1 to 5, the impacts of the retail and consumer sector are significant. Transport from retailers to consumer households represents a significant proportion of the carbon footprints of food chains (Cleland, 2010).

1.1. Relative contribution of food distribution to emissions

The World Economic Forum (2009) estimates that the global footprint of logistics and transport is 2,800 Mt CO₂-e per year, or 5.5% of the total annual GHG emissions generated by human activity. In absolute terms, road freight is the greatest part, contributing around 57% of the total. It is followed by ocean freight at 17%.

The relative contribution of transport to food carbon footprints is unknown and highly variable. However, the aforementioned report suggests that food transportation (alongside minerals transportation) is one of the largest contributors by product category. For example, Eurostat road freight data suggests that across the EU and Norway, “foodstuff and animal fodder” and “agricultural products and live animals” cumulatively accounted for 27% of all tonne-kilometers moved in 2006 (Eurostat, 2006). In the United States, the volume of food manufacturing goods transported annually exceed 500 megatonnes and travel about 488 kilometers per shipment ⁴. In Australia, food (for human and animal consumption) alone accounted for 22% of tonne-kilometres travelled as Australian road freight and 14% of the tonnes in 2000 (ABS 2002). Inclusion of the broader food-related categories (cereal grains

⁴ http://factfinder.census.gov/servlet/QuickReportsServlet?ds_name=EC0700A1&_lang=en

and live animals) accounts for 29.7% of tonne-kilometres and 23.3% of total weight (T) carried by road (ABS 2002).

However, while the contribution of transport to emissions of particular foods is difficult to ascertain without specific research, the contribution of food transport to overall emissions is likely to be significant. It includes:

- Distribution activities pre-consumption, for example, inbound and outbound logistics from farms, factories, wholesalers and retailers; and
- Travel by consumers in cars or public transport to buy their weekly groceries from stores.

Some available carbon footprint values for food transport in three countries are presented in Figure 1.2.

Direct comparisons are difficult, due to differences in calculation methodologies and due to the transport segments included in the calculation. For example, Webber and Matthews (2008) used an economic input-output LCA approach and emission factors taken from the U.S. EPA Inventory of US Greenhouse Gas Emissions and Sinks 1990-2002. The DEFRA value was calculated through the use of a process-based LCA, where specific transport statistics and emission factors were provided by AEA Consulting (Smith, 2005). The estimate provided by Estrada-Flores was calculated taking into account that road transport emissions in Australia in 2007 amounted to 68.5 Mt CO₂-e (Department of Climate Change, 2009a)⁵. When measured by kilometre per tonne, road bulk transport accounts for 31.6% of this footprint, with food transport representing 22% of the road bulk transport footprint⁶. Using these factors, it was estimated that in 2007 road bulk transport of food represented about 4.8 Mt CO₂-e. Adding an extra 0.5 Mt CO₂ –e per year that accounts for emissions from diesel used for refrigeration purposes (Estrada-Flores, 2008), the total estimated emissions for road bulk food transportation was 5.2 Mt CO₂ –e per year.

Given these differences, these values need to be taken as indicators of the magnitudes of food transport emissions, rather than in a comparative and absolute manner.

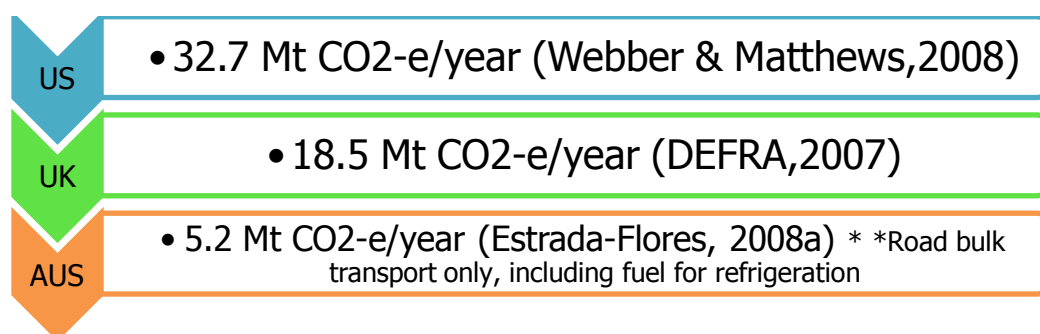


Figure 1.2. Estimated values of annual food transportation emissions (CO₂ –e) in three countries.

⁵ Therefore the calculation implicitly uses the National Greenhouse Accounts emissions factors, accessible at <http://www.climatechange.gov.au/en/climate-change/~media/publications/greenhouse-gas/national-greenhouse-factors-june-2009-pdf.ashx>.

⁶ ABS (2002a), *Freight Movements, Australia, Summary*, Mar 2001 (Reissue), Cat. No. 9222.0, p10

In export operations, distribution is a significant component of product carbon footprints. For example, shipping contributes with 30% and 45% to the carbon footprint for kiwifruit and apples being supplied from NZ to the UK, respectively (Hume, 2009; Mithraratne, 2008). The transport of bread and its ingredients also contributes in a significant proportion to carbon footprints (Jespersen, 2004; Meisterling et al., 2009).

In published LCA studies, the calculation of GHG emissions from distribution is often performed through simplified approaches. The origins of this approach can be traced back to 1996, when a weighted average source distance (WASD) calculation was proposed to deal with the complexity of tracing supply chains in detail for food LCA analyses (Carlsson-Kanyama, 1997). The WASD calculation combines information on distances from producers to consumers and the amounts of product consumed into a single parameter. The method typically uses an “as the crow flies” calculation for distances and ignores the existence of infrastructure (*e.g.* DCs) along the way or ramifications in the supply chain that affect the weighted distance.

Garnett (2008) acknowledged the effect of the numerous distribution links required to deliver foods to households, different product types, marketing channels, seasonality and the differences between localised and distributed food production. However, no calculations on the effect of these variables on the UK emissions from food were presented.

In an earlier study assessing the impact of fruit and vegetable products on British GHG emissions (Garnett, 2006), the evaluation of the impact of distribution was performed by using a top-down approach, whereby transport within the UK was estimated from the results of a survey of roads goods transport.

Audsley et al., (2009) assumed the existence of a Regional Distribution Centre (RDC) to represent a point where all primary production inputs arrived. In some cases, the manufacturing, processing and packaging were included in the pre-RDC side. Post RDC, the only distribution segment considered was food transportation to households by consumers.

Williams (2009) compared the carbon footprint of apples and meat products consumed in the UK but originating either in NZ or the UK. However, the study excluded the supply chain after the regional distribution centre (RDC) in the UK because this would be identical for both supply chains. This study therefore omits between 20 and 40% of the complete footprint (Cleland, 2010).

Simplifying assumptions on the actual logistics and distances that food travels have been sometimes necessary to deal with the high degree of complexity, the wide variety of approaches used for different products and the lack of information on the flows of product that travel through each chain segment. This complexity is highlighted in a recent report on the UK food distribution system (Steedman and Falk, 2009):

- Food travels from overseas via a handful of ports and from over 300,000 farms across the UK into distribution networks dominated by the major food retailers.
- Wholesalers service over 50,000 convenience stores, and many manufacturers deliver directly to smaller stores or to the distribution centres of the biggest retailers.

- The foodservice sector – pubs, cafés, restaurants and canteens – is worth almost the same as food retail, but is considerably less concentrated.
- Finally, consumers are responsible for nearly half of all vehicle kilometers involved in transporting food. Weekly shopping trips are highly car-dependent, although innovations in town centre convenience retailing may see a rise in the number and frequency of walking and cycling trips to shop for food.

A significant downside of simplifying supply chain segments is that opportunities to decrease GHG emissions can be overlooked because no attribution of impacts to different segments of the chain is possible. A recent study (Blanco and Craig, 2009) compared five global logistics networks when using a carbon screening methodology versus detailed operational data. While the screening level calculation was able to identify the major emission sources, it underestimated logistics emissions by about 30%. Thus, the development of accurate supply chain carbon footprints also requires an accurate representation of the distribution system.

1.1.1. Refrigerated transport

On a global scale, the refrigerated transport fleet encompasses more than 1.2 million of refrigerated road vehicles (Gac, 2002), about 830,000 reefer containers⁷ (Containerisation International, 2008), 80,000 refrigerated railcars and about 1,300 specialised refrigerated cargo ships (Heap, 2007). Further, the amount of perishables transported by air freight globally is about 8% of all air cargo shipped (Catto-Smith, 2006).

The contribution of refrigerated transport to global warming is mainly derived from the following components:

- a) The direct and indirect emissions from the use of fuel and oil for motion and refrigeration purposes.
- b) The use of ozone depleting substances such as hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) as cooling agents in the refrigeration circuit and as foam blowing agents in the manufacture of insulation of refrigerated equipment.
- c) The role of food transport on road congestion.

The maintenance of cold chain conditions is an energy-intensive endeavour. Using data from Garnett (2008, 2007), Cleland (2010) estimated that refrigerated transport contributes with about 0.5 to 1% of the UK food carbon footprint.

Given the significant financial and environmental impacts of refrigeration energy expenditure, it is tempting to assume that the world is “over-cooled” and that the solution to a global excess of refrigeration capacity is to decrease the use of refrigeration. However, there are several reasons as to why this can be counter-productive:

- a) Recent IIR figures indicate that about 360 million tonnes of food are lost annually due to insufficient refrigeration worldwide (IIF-IIR, 2009).

⁷ 1.425 million TEU

- b) Climate change impacts include warmer climatic conditions and refrigeration would be a much needed technology to ensure food safety and maximum shelf-life (Estrada-Flores, 2008, James and James, 2010).
- c) As production from agriculture is projected to decline over much of the southern hemisphere by 2030 (IPCC, 2007), the value of perishables could increase and cold chain maintenance may become even more important than it is now to preserve food security (Estrada-Flores, 2008).
- d) Perishables deteriorate even in relatively short periods of time. For instance, for every 10°C increase above the optimum temperature, the shelf-life of delicate fruit and vegetables is halved (Paull, 1999).
- e) Further, ambient temperatures would provide optimum conditions for the development of pathogenic microorganisms, which would otherwise be controlled through the application of a cold chain (Estrada-Flores, 2009a). Therefore, the reduction of refrigeration for perishables needs to be tempered with the potential increase in food wastage, the decrease in quality and the potential food safety risks introduced (Estrada-Flores, 2010a).

Garnett (2007, 2008) also suggested reducing the UK's refrigeration dependence by changing food diet and habits. If the population was willing to change their habits to eat local seasonal products, then the need for long-term storage and long distance transport of food could be reduced. The effect of seasonal-only and potential limited availability and variety of foods would need to be assessed from a health perspective to ensure that any potentially negative effects do not offset the direct environmental benefits. The relative impacts of these changes would be highly dependant on the climate and growing conditions of any particular locality. In addition, limiting the intake of some foods may well complement efforts to reduce other current health issues such as obesity (Noakes, 2010).

Although there may be opportunities to reduce the need for refrigeration, energy efficiency can deliver systemic change in the refrigeration sector. 'Low hanging fruit' opportunities lie on preventive maintenance, and the review of practices, standards and certification processes. More sophisticated measures include the implementation of new energy labelling and minimum energy performance standards in all links of the chain, the introduction of alternative refrigeration systems and the development of smart management systems (Estrada-Flores, 2010a).

The importance of science-based decisions in all the measures described above cannot be stated enough. In particular, cost-benefit calculations for energy saving technologies require a full investigation on the effects of variable temperature regimes on product quality and safety.

1.2. Sustainable food distribution systems

In the context of this report, *food distribution* refers to the complex network of organisations involved in the production, manufacturing, transport, storage, packaging and trading of foods. While the focal point of this report is in the shipment (*i.e.* transport) of goods between the different partners of a supply chain, there are several other factors that affect

distribution including warehousing, materials handling, protective packaging, inventory control, plant and warehouse site selection, order processing, market forecasting, the type of marketing channel, and the interrelations among supply chain partners, among others (Christopher, 2005; Mena and Stevens, 2010). On occasions we will refer to some of those aspects, while maintaining our focus in food freight transportation.

While discussion on *sustainable food distribution* systems is developing, there are no formal definitions on what this term exactly means. For example, sustainable transport is defined as (Transport for London Freight Unit, 2007):

"The balanced management and control of the economic, social and environmental issues affecting freight transport that:

- *Complies with or exceeds environmental standards, regulations or targets aimed at reducing emissions of climate change gases, improving air quality and minimising impacts from accidents, spillages or wastes.*
- *Ensures freight is run efficiently, reduces unnecessary journeys, minimises journey distances and maximises loads with effective planning.*
- *Complies with labour, transport and human rights standards and regulations ensuring that employees and communities affected by freight can function in a healthy and safe environment.*
- *Minimises the negative impacts of freight activities on local communities'*

The measurement of sustainability in freight systems is still being discussed in policy and academic circles. However, there is consensus about aspects that need to be included in such metrics for food chains (Smith, 2005):

1. **Transport mode.** The impacts of food transport are highly dependent on the transport mode, as illustrated in Fig. 1.3, which shows the carbon dioxide emissions associated with different types of freight and different distances. The impact of distribution modes in local and domestic freight is illustrated in Fig. 1.4, which shows a comparison of carbon emissions for different types of transport in the context of London's freight systems.

Figure 1.3 was used to assess the impact of switching freight from light commercial vehicles (LCVs or LGVs) to fully loaded heavy commercial vehicles (HCVs or HGVs), which could potentially result in 84 % less emissions, in London. If lorries under 7.5 tonnes are used instead, a decrease of 51% could be achieved with respect to smaller vehicles. In view of the global urban market trends towards a greater use of smaller freight vehicles, which are less efficient in terms of fuel emissions per tonne kilometre than larger vehicles —and also impacting traffic levels and congestion (ATC, 2008) — these comparisons are important to support changes that benefit both the environment and congestion aspects. Similar comparisons performed for the conditions and types of vehicles encountered in Australian cities are needed.

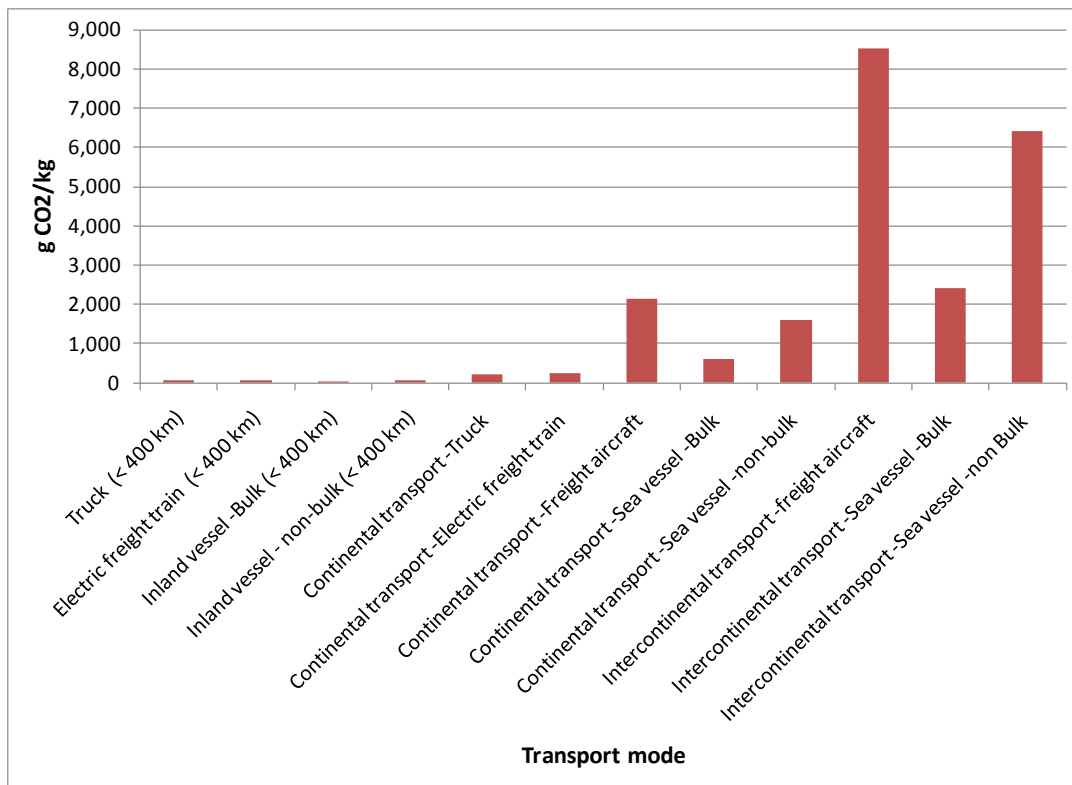


Figure 1.3. CO₂ emissions associated with different freight transport modes and different distances (van Hauwermeiren et al., 2007).

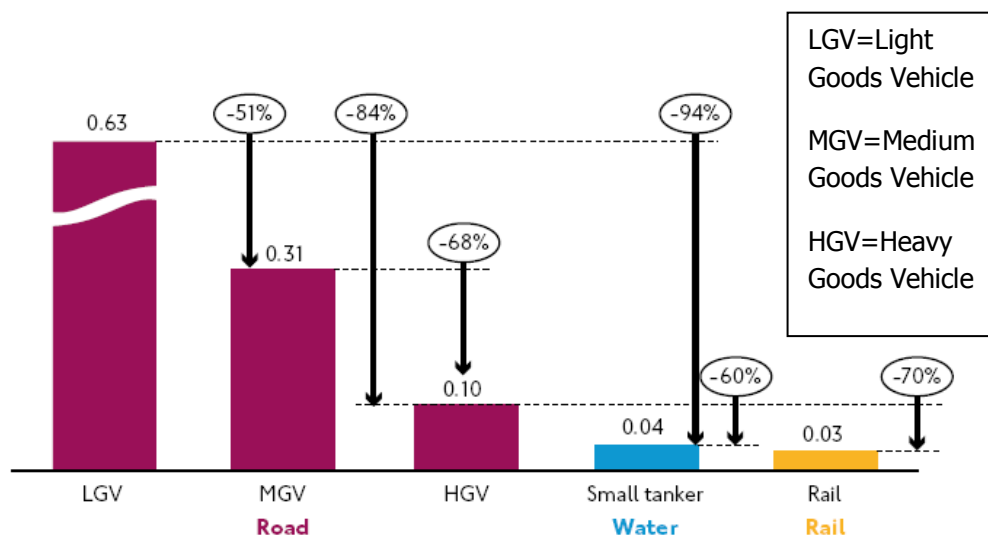


Figure 1.4. Comparison of carbon emissions for different domestic freight methods (Kg CO₂ per tonne kilometre) (Transport for London Freight Unit, 2007).

2. **Transport efficiency.** There is a trade-off between transport distance, vehicle size and transport efficiency. Currently, 97% of the food transported in Australia is carried in

rigid⁸ and articulated⁹ trucks travelling long distances between suppliers and distribution centres (Australian Bureau of Statistics, 2008a).

Transport efficiency measures include decreasing the average length of transport (see point 3), decreasing the load transported, improving vehicle load factors and fuel efficiency, switching modes (see point 1), reducing truck idling, and reducing empty running, among others. Empty runnings have an effect on overall loading (or lading) factors.

However, transport efficiency is also affected by supply chain strategies. It has been suggested that just-in-time (JIT) delivery and increased outsourcing of production are factors that have contributed to increases in total freight kilometres of travel in many countries, since these trends often require more and longer delivery trips and therefore result in lower average truck loadings (Jolley, 2006). The effect of lean strategies is also discussed in the context of retailer-led food distribution initiatives in this report.

On the basis of transport efficiency, mass distribution can decrease the impact of food distribution. More local sourcing can greatly reduce the distance travelled by food, but the reduction in transport impacts may be offset to some extent by the use of smaller vehicles or lower load factors (see below). Further research is required.

3. **Differences in food production and consumption systems.** The impact of food transport can be partly offset if food is sourced locally or within a determined radius of the consumer. However, there are trade-offs to consider: imported food that has been produced more sustainably than the food available locally is an example. A study showed that it can be more sustainable to import organic food into the UK than to grow non-organic food in the UK. However, this was only true if the food was imported by sea, or for very short distances by road (Williams et al., 2006).

The effect of seasonality is also important: a study showed that tomatoes imported from Spain can be more sustainable (at least in energy efficiency terms) than producing them in heated greenhouses in the UK, outside the summer months (Williams, 2009).

Also, emission comparisons between food distribution systems should address the effect of how consumers travel to the shops and prepare food. In the UK this segment typically generates more CO₂ emissions than all the upstream logistical activities in domestically produced goods (Bowne et al., 2008; Edwards and McKinnon, 2009). For example, a comparison of consumer shopping trips *versus* home delivery emissions showed that home delivery (commonly used as a distribution channel for online retailing) produces 13 to 14 times less emissions (in CO₂-e grams per delivery) than one dedicated car trip (in CO₂-e grams trip) (Edwards and McKinnon, 2009).

4. **Wider environmental, economic and social costs and benefits.** Environmental, economic and social issues bound up in the way we distribute food include international

⁸ Motor vehicles exceeding 3.5 tonnes GVM.

⁹ Motor vehicles constructed primarily for load carrying, consisting of a prime mover and a a semitrailer.

food trade in the context of globalisation, water pollution, waste, rural economics, landscape amenity and several others.

In this report, we are particularly concerned with points 1 to 3. Previous studies found that consideration on environmental, economic and social costs does not lead to a clear case for a move to a particular food distribution system. However, knowledge of food transportation distances is crucial to analyse the complex trade-offs mentioned in point 4.

1.2.1. Measuring emissions from food distribution systems

According to the Stern report, transport accounts for 14% of total GHG emissions globally, with 75% of these emissions from road transport (Stern, 2006). This percentage holds true in Australia, where transport emissions were 79.1 Mt CO₂-e in 2006 and represent the fourth highest of any OECD country and the seventh highest in the world (Garnaut, 2008). Light commercial vehicles (LCV), heavy and medium trucks contribute with a cumulative 32% of our domestic transport emissions.

Early attempts to measure the environmental impact of transport focused on the distance travelled by foods ("food miles"), recognising that there is a direct correlation between food travelling large distances and energy use. However, it is now clear that "food miles" cannot be used as a sole indicator of the environmental impact of food chains (Rama and Lawrence, 2008; Saunders et al., 2006; Smith, 2005). Even in the context of "distance travelled", the common approaches of "food miles" overlook aspects such as:

- a) The embodied energy of supply chain infrastructure such as ambient and refrigerated warehouses and transport vehicles, which varies according to the distribution strategy.
- b) The different combinations of road vehicles that can be utilized during the lifecycle of the product (*e.g.* car, small vans, medium and large trucks).
- c) The effect of varying degrees of logistics technologies on transport emissions (*e.g.* diesel-electric hybrid trucks, traditional diesel trucks).
- d) The different types of fuel used (*e.g.* petrol, diesel, ethanol) and its different contribution to global warming.
- e) The differences between conventional production and intensive (*e.g.* glasshouse) production in the distances between farmers and consumers.
- f) The effect of different distribution strategies on the distance travelled. For example:
 - The effect of loading factors in both backhaul and fronthaul trips.
 - The effect of cooperative approaches through transport and storage sharing.

Although "food miles" cannot be used as a representative sustainability indicator across all food supply chains, measures such as the reconfiguration of food distribution systems to reduce distances travelled, the application of logistics innovation and the management of supply chain flows can indeed lead to significant reductions in the carbon footprints of foods. Further, broader sustainability and regional / community development benefits can be derived from increasing the contribution of local and regional food chains in a national food distribution system.

1.3. The structure of Australian food supply chains

The Australian fresh and processed food, beverage and grocery industry had a turnover of AUD\$100 billion in 2006-07, which represented 28% of the total manufacturing turnover for that period (KPMG, 2009). Figure 1.5 shows a snapshot of the businesses encompassed in these chains and the revenue captured at each stage (KPMG, 2009).

From a domestic supply chain perspective, there are seven major sub-chains that characterize the industry:¹⁰

- 1. Primary production.** In Australia, this sector encompasses a large number of relatively small firms, particularly upstream in the chain. In 2007-08, there were about 140,704 farms in Australia,¹¹ including those for whom farming is not their primary business. However, there are 125,594 farms solely dedicated to agricultural production¹².
- 2. Secondary production.** This is a diverse sub-chain, ranging from marketing and packaging activities to food manufacturing. In 2006-07, a total of 9,200 businesses were involved in the manufacturing sector, including 7,200 food and beverage manufacturers, 2,000 in grocery manufacturing and 28,600 businesses in the fresh produce sector. The food manufacturing industry worldwide tends to be dominated by large, multinational firms and Australia is no exception, with the largest 50 food and beverage global corporations producing close to 75% of the domestic industry's revenue.
- 3. Food wholesalers.** This sector is highly fragmented and comprises over 15,000 wholesalers that handle fruit and vegetables, dairy, fish, meat, poultry and smallgoods, groceries and confectionery and soft drink wholesalers¹³. Depending on the sector, the proportion of small to medium size wholesalers ranges from 50 to 90% (except confectionery and soft drinks, which is largely dominated by 5 companies).
- 4. Food retailing.** This sector includes supermarkets and grocery stores, non-petrol sales of convenience stores at petrol stations. A total of 4,340 supermarket and grocery stores and 4,165 convenience stores are estimated in 2009¹⁴. Supermarkets and grocery stores in 2009 earned \$68.6 billion in revenue, while convenience stores achieved \$6.8 billion in the same period.
- 5. Foodservice.** This sector encompasses take away food businesses, ranging from large chains (*e.g.* McDonalds, Yum!), to small cafes and restaurants. The sector comprises 35,770 businesses, which earned \$13.5 billion in 2009. There are about 15,938 cafes and restaurants in Australia, with revenues of \$9.7 billion in 2009.

¹⁰ For a description of the Victorian system, see VCEC (2007), "Simplifying the Menu: Food Regulation in Victoria" and Larsen et al (2008), "Sustainable and Secure Food Systems for Victoria", Victorian Eco-Innovation Lab

¹¹ ABS, 2008. 7121.0 - Australian Commodities.

¹² <http://www.nff.org.au/farm-facts.html>

¹³ IBISWorld, 2009.

¹⁴ IBISWorld 2009

6. Consumers. There are over 22 million of Australians distributed in about 7,926,200 households. About 77% of the population live in New South Wales, Victoria and Queensland. Food and non-alcoholic drinks accounted for 21% of the expenditure on goods and services of low income households in 2003-04, compared with 15% for high income households ¹⁵.

7. International trade. In 2008-09, the exports of food, beverage, groceries and fresh produce were valued at \$25 billion, which represent 11% of Australia's total exports. The three largest exports were meat (minimally processed), dairy products and wine. Of these, meat contributed with 45% of the total food export value.

While in 2004-05 the cumulative trade surplus of food and grocery manufacturing and fresh produce sectors was \$4.5 billion, in 2008-09 the surplus was \$150 million, indicating a shift toward a greater dependency in imports (KPMG, 2009). In particular, the value of vegetable exports has declined over the past 6 years.

The value of Australian imports of foods, groceries and fresh produce increased substantially in the period 2004 – 2009. As mentioned before, the value of imports was fairly close to the value of exports in 2008-09. The largest food and beverage import by value was processed fruit and vegetables from New Zealand, China, USA, Italy and Thailand, which together represent 52% of the total imported processed horticultural products. Seafood from Asian countries is the second largest import.

Naturally, the carbon footprint of exports and imports are highly affected by sea and air transport because of the geographical distances to our closest trade partners. Figure 1.6 presents Australia's top 10 food trading partners and some representative distances, assuming ocean transport. These 10 partners account for 60% of the total value of international trade.

¹⁵ <http://www.abs.gov.au/Ausstats/abs@.nsf/mf/3201.0>

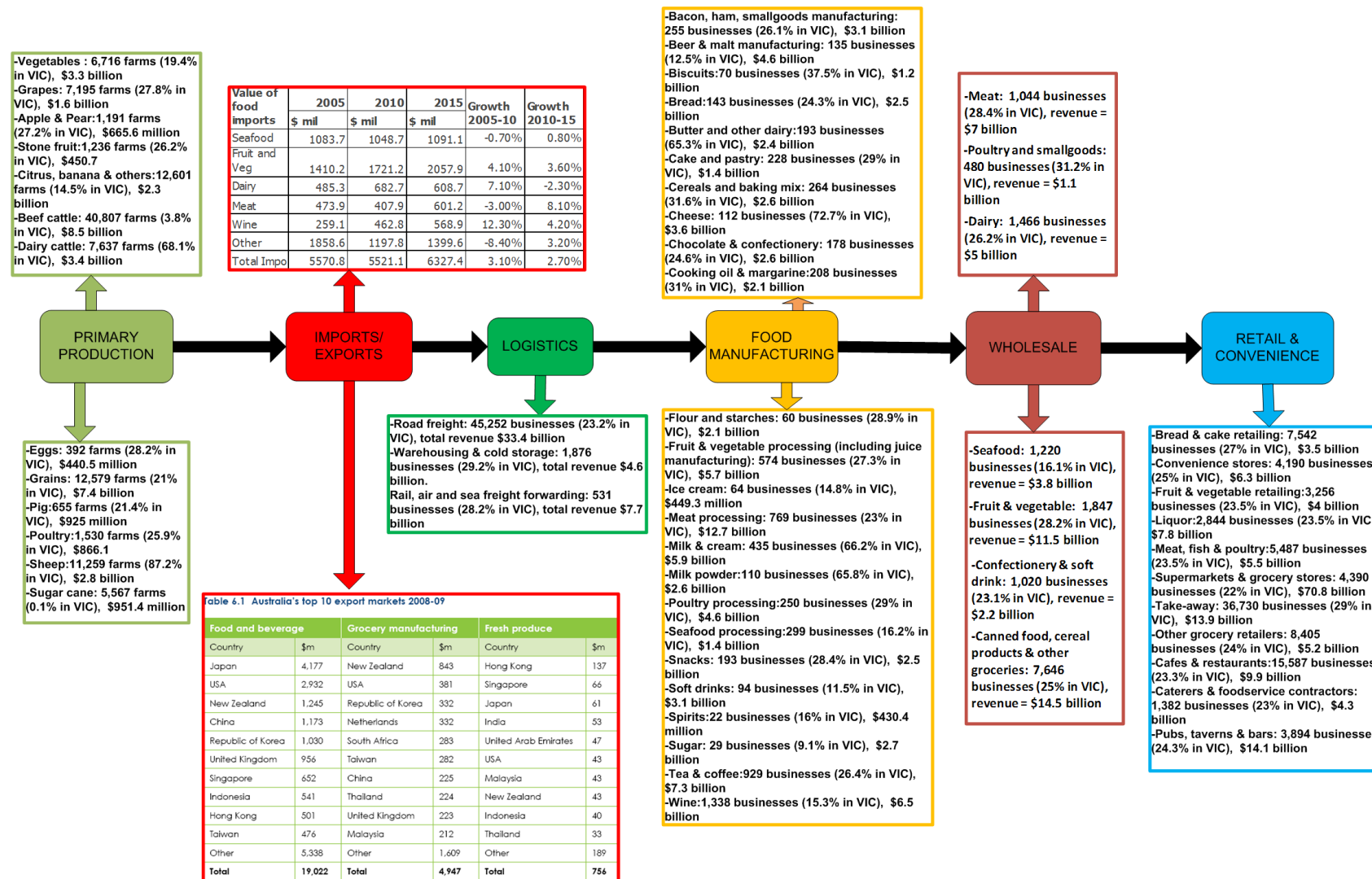


Figure 1.5. Snapshot of the number of businesses, proportion of these in Victoria and total revenue (\$) perceived in Australian food supply chains. Note that the total revenue from the logistics sector also encompasses services to other industries. Sources of information: 60 IBISWorld reports 2010 (see list in the references section); KPMG, 2009.

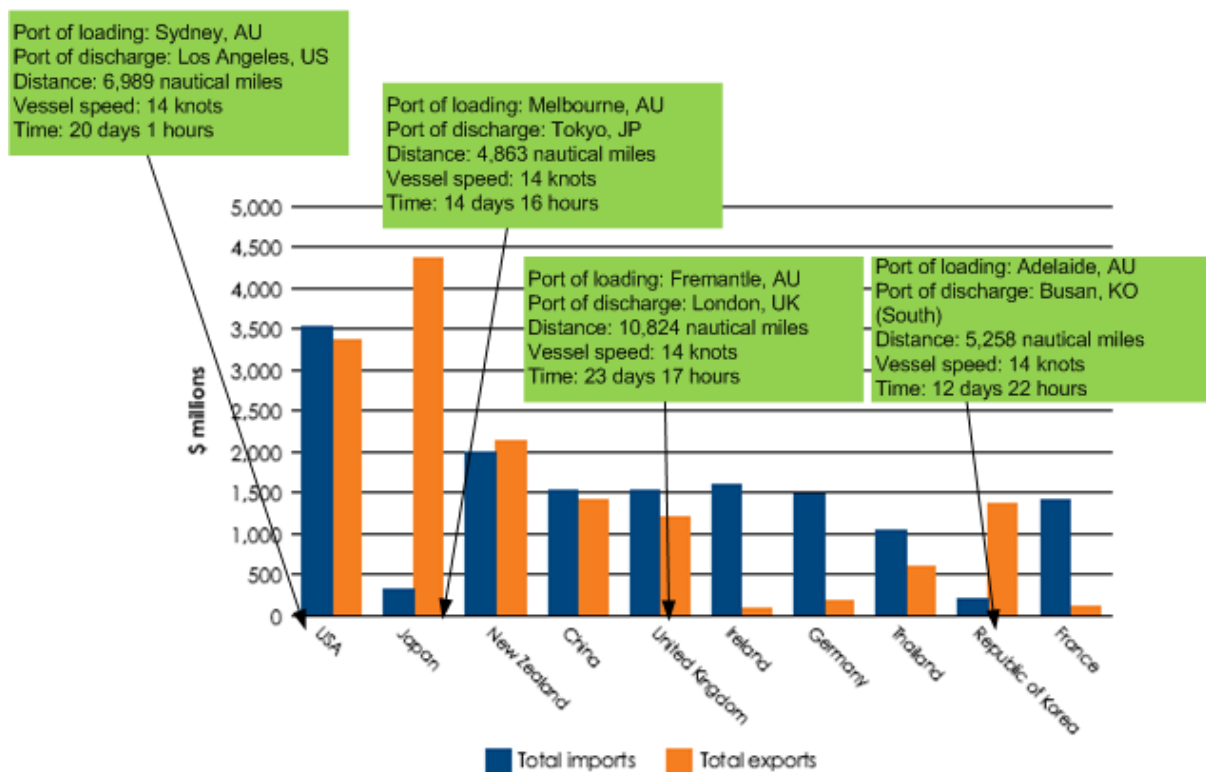


Figure 1.6. Australia's top 10 food trading partners and some representative distances between selected ports in the two countries, assuming ocean transport. Adapted from (KPMG, 2009). Distances calculated through <http://www.portworld.com/map> and <http://www.worldportsource.com>.

1.3.1. Differences between Australian and overseas food distribution systems

International studies that have provided invaluable insights on the debate of the contribution of food supply chains to greenhouse gas emissions include: the establishment of LCA calculation methodologies (Carlsson-Kanyama, 1998b, 2003; Pimentel, 1997); the assessment of the role of transport on the overall food chain emissions (Paxton, 1994; Smith, 2005); and those that have moved discussion on food supply chains beyond 'food miles' to account for the way foods are produced, manufactured, utilised and wasted (Coley et al., 2009; Quested and Johnson, 2009; Saunders et al., 2006).

Given the relative abundance of literature on the subject of food-derived emissions in European countries compared to that in Australia, the temptation to extrapolate data from other countries and regions without taking into account key differences between food systems is high. Indeed, recent publications address the need to balance such generalisations with differences between countries and productions systems (Kim and Neff, 2009; Ossés de Eicker et al., 2010; Peters et al., 2010; Saunders et al., 2006).

These aspects are particularly relevant in investigations on food distribution systems, where significant differences between international and Australian systems exist. Some of these differences are presented below.

1. European food systems are fundamentally based on international trade (within Europe and beyond). For example, about half of all vegetables and 95% of all fruit consumed in the UK are imported (Smith, 2005). In Australia, 20.4% of the total fruit and vegetable consumed is imported. Breaking this down, 30% of all processed fruit and vegetables and 4.2% of all fresh fruit and vegetables consumed by Australians this year are likely to be imported¹⁶. Large supermarket chains claim that between 95% and 97% of the fresh produce sold in supermarket stores is grown in Australia¹⁷ (Woolworths Ltd, 2008).
2. Following the rationale of point (1), the impact of transcontinental voyages by air or sea on domestic carbon footprints is expected to be considerably less in Australian food chains than in their European counterparts, and the largest contribution is expected to arise from road transport systems¹⁸. However, these trends are changing. While on average Australian total food imports as a share of consumption are expected to remain stable at 10.4% in the next five years, by 2015 imports of fruit and vegetables are expected to increase to 23.1%¹⁹.
3. Differences in horticultural production systems are also a point of difference. For example, the areas used for field and protected production of vegetables in the UK and Australia are similar, as presented in Table 1.1. However, the UK produces 4 times more vegetables under protected cropping practices than Australia, while the latter is marginally a better producer in field horticulture.

Table 1.1. Statistics of protected vegetable cropping in the UK and Australia 2007-08 (Australian Bureau of Statistics, 2008b; Department for Environment Food and Rural Affairs, 2009a, b).

Country	Total area used (outdoors and protected)	Protected area (ha)	Protected production ('000 tonnes)	Field production ('000 tonnes)	Protected production yield (t/ha)	Field production yield (t/ha)
UK	118,439	680.0	247.4	2,339.7	363.8	19.87
Australia	119,610	673.6	60.1	3,177.4	89.16	26.12

The reason as to why these differences are occurring needs to be investigated, given that protected horticulture can significantly influence the carbon footprints of fruit and vegetables in both countries. The potential benefits of increased glasshouse production close to cities, which can reduce the distribution footprint and increase yields as

¹⁶ <http://www.ibisworld.com.au/pressrelease/pressrelease.aspx?prid=227>

¹⁷ <http://theland.farmonline.com.au/news/nationalrural/horticulture/general/woolworths-says-fruit-rejection-attack-a-furphy/1476728.aspx?storypage=0>

¹⁸ Rail movements play a minimum contribution to the overall food transport (Higgins et al., 2007). Therefore, truck freight is the dominant mode of transportation for foods.

¹⁹ <http://www.ibisworld.com.au/pressrelease/pressrelease.aspx?prid=227>

compared to field production, need to be tempered with the higher energy needs of glasshouse production. For instance, one hectare of glasshouse production can deliver between 4 and 10 times more product than field cropping in Australia (Smith, 2009). However, it does so by consuming about 900 times more energy than the same area in field cropping (Estrada-Flores, 2009c). This significant expenditure is due to the need of constant ventilation, temperature, humidity, irrigation and carbon dioxide for the optimum growth of crops. Table 1.1 indicates that Australia is yet to reap the full potential of protected horticulture.

In a food distribution context, part of the GHG emissions generated during glasshouse production can be offset if glasshouses are located close to the consumption centres. This differs from conventional field production, which depends on the availability of soils with adequate soil and weather conditions for each type of crop. The flexibility of glasshouse production needs to be tempered with the country's (and State) specific policies for suburban/urban production of food.

The production of Australian-focused published reports that deal with the impacts of food chain emissions is slowly gaining speed (Estrada-Flores, 2008; Gaballa and Abraham, 2007, 2008; Hogan and Thorpe, 2009; Larsen et al., 2008; Rama and Lawrence, 2008). These studies have provided meaningful insights, but have also highlighted the need for further research that takes into account the distinctive conditions prevalent in domestic (as distinct from export) food chains in Oceania.

1.3.2. Australian horticultural chains and carbon emissions

Although the turnover of Australia's fresh produce sector was only \$6 billion in 2008-09, this sector accounts for over 75% of all businesses in the broader food industry (KPMG, 2009). Queensland, Victoria and New South Wales contribute with 38%, 24% and 16% of the total fresh produce turnover²⁰, respectively.

Figure 1.7 presents a comparison of the impacts of the most significant contributors to the agricultural emissions in Australia and the estimated contribution of horticulture in 2007 (Deuter, 2008b). The Australian vegetable industry contribution has been calculated to range from 1 and 3 Mt CO₂-e (O'Halloran et al., 2008b). However, this value only includes: (a) field horticulture (thus excluding the protected production component discussed in Table 1.1 above); and (b) the activities before farm gate.

A more recent estimate, illustrated in Figure 1.8, takes into account the energy expenditure in protected cropping, manufacturing and cold chain activities post-farm indicates that the carbon footprint of vegetables production and marketing ranges from 7.4 and 8.5 Mt CO₂-e (Estrada-Flores, 2009c). Transport (including refrigerated and non-refrigerated) represents 15-17% of this figure. These values exclude the fruit sector and purely reflect energy consumption, thus ignoring embodied energy, water and land use, packaging and waste

²⁰ Turnover as defined in the KPMG 2009 report is an aggregate measure of the value of the goods up until the point of sale by the food manufacturer.

generation from farm to consumption. No estimates of the emissions generated from the entire fruit and vegetables chains at National or State level are available.

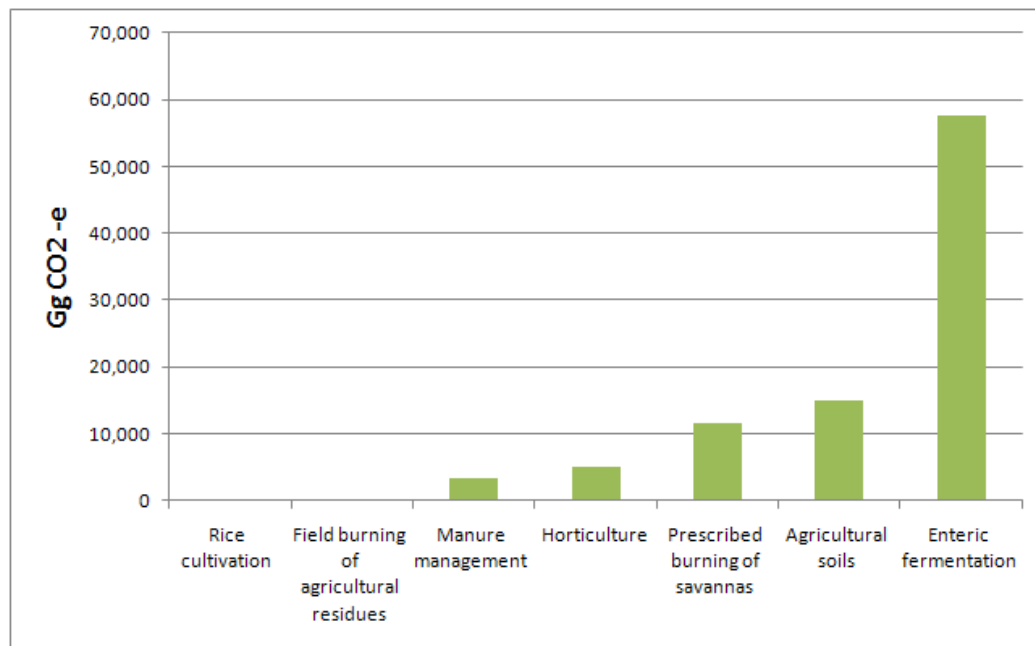


Figure 1.7. Components of agricultural emissions in Australia during 2007 (Department of Climate Change, 2009b).

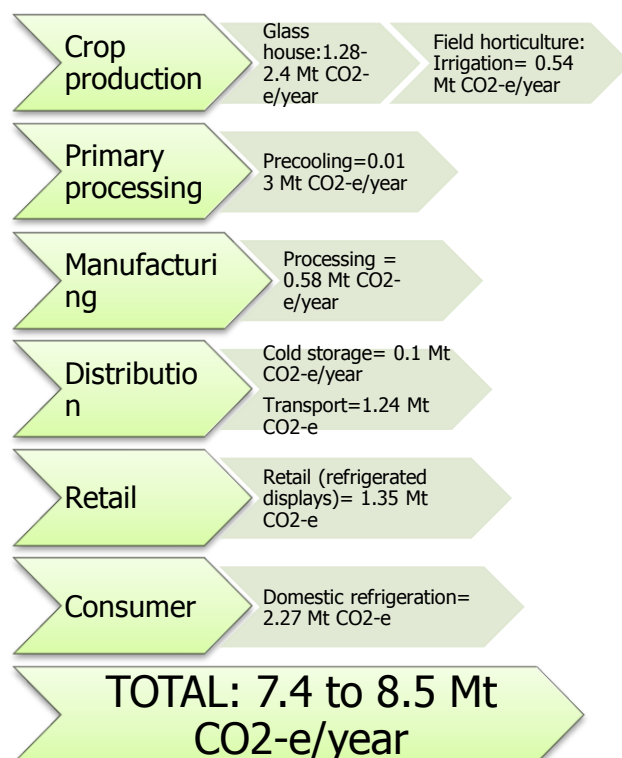


Figure 1.8. Summary of estimated energy expenditure during the production, manufacture and distribution of vegetable products in Australia (Estrada-Flores, 2009c).

Chapter 2: Methodology

!	<i>A framework of analysis for different food distribution systems was developed, on the basis of the supply chain player taking a leadership role on specific actions to decrease food distribution carbon footprints.</i>
!	<i>To accomplish the review in each of the chapters mentioned, a wide range of literature resources were used, including:</i> <ol style="list-style-type: none"> <i>Business reports sourced from general internet searches, ABI/INFORM Global and ProQuest ;</i> <i>Scientific publications sourced from Scopus and ScienceDirect.</i> <i>Over 60 IBISWorld reports (2010), which provide independent research on over 500 industries, including statistics, analysis and forecasts.</i> <i>The Carbon Disclosure Project (CDP) database (https://www.cdproject.net), encompassing GHG emissions disclosures and reduction strategies of about 2,500 organisations in 60 countries around the world.</i>
!	<i>38 initiatives were selected for an in-depth review, including the following aspects:</i> <ol style="list-style-type: none"> <i>1) Organisational structure: country, scale (e.g. national, global), annual revenue (when the information was available) and type of organisation (e.g non-profit, policy maker, company).</i> <i>2) Supply chain relations; role in the chain (e.g. marketer, manufacturer, farmer), the sharing of risk among supply chain partners (risk structure), distribution links, sourcing strategy (e.g. national, local, seasonal), type of fuel used and type of commerce platform used.</i> <i>3) Mission statements: GHG emissions, vulnerability, fair trade, cost efficiency.</i>
!	<i>Of this sample of initiatives, 50% are companies, 23% are cooperatives or associations and 21% are non-profit. The rest are government -related initiatives. Therefore, most initiatives have to work in a competitive environment and need to be profitable.</i>
!	<i>44% of the initiatives state environmental missions in their company's website or reports, but there are no specific targets set.</i>
!	<i>31% of the initiatives selected have both an environmental mission and performance targets set.</i>
!	<i>57% of the initiatives investigated do not consider vulnerability of food chains in their organisational values or missions, although at least 21% do consider sustainability, which is linked to vulnerability.</i>
!	<i>29% of the initiatives are experimenting with or using alternative fuels.</i>
!	<i>All of the initiatives considered have other missions driving the company's agenda. Cost efficiency has been stated as a mission for 42% of the initiatives investigated, while fair trade drives 32% of the initiatives. Fair trade is mentioned in 55% of the cases as part of the missions statement of the initiatives investigated. The explicit mention of food security was only found in one organisation.</i>

2.1. Selection of food distribution systems

The analysis of different food distribution systems required a framework that recognised the different characteristics and motivations of the supply chain players undertaking distribution-related environmental initiatives. In parallel, a comparison of some key characteristics relevant to the organisational structure, supply chain relationships and commitment to such initiatives was necessary, to evaluate the motivations and drivers of implementation.

Firstly, the "ownership" of environmental initiatives was investigated. This ownership relates to the supply chain player taking a leadership role on the development of specific actions to decrease food distribution carbon footprints. We detected five parties that have taken this position:

4. Farmers and consumers.
5. Food retailers.
6. Food manufacturers and marketers.

7. Third party logistics providers.
8. Local councils, State and Federal Governments.

Figure 2.1. illustrates this framework and categorises the initiatives mentioned in this report. The structure of this report reflects the initiatives mentioned above.

Chapter 3 deals with farmer and consumer-led (F&CL) initiatives, analysing strategies of organisations created by these two forces that are downstream and upstream the chain. The number of F&CL initiatives investigated with respect to other categories reflects the numerous efforts that were found in this category, which surpass efforts undertaken under any other category investigated. For example, the Center for Integrated Agricultural Systems –a sustainable agriculture research center at the University of Wisconsin, Madison– lists over 50 distribution models for local food in the US²¹. A similar search for local food distribution systems (associated to F&CL initiatives) in Australia led to a wide range of initiatives, including Farmers' Markets, food cooperatives, council-led initiatives and several others. To reflect these facts, the report deals with a larger number of F&CL systems than for other categories. Zespri is the only global farmer-led initiative mentioned in Chapter 3.

Chapter 4 describes the motivations, opportunities and barriers for retail-led initiatives. Major global retailers are developing distribution strategies with their major suppliers, with a view to mitigate these and other types of emissions. Retailers channel a significant volume of fresh and processed food and their influence in cutting emissions can be significant in the Australian context.

Chapter 5 focuses on the strategies undertaken by global manufacturers to decrease their distribution carbon footprints. The study of global manufacturers recognizes the fact that the largest 50 food and beverage corporations in Australia produce close to 75% of the domestic industry's revenue and the top ten of those companies have operations beyond Australia (Business Monitor International, 2009). Therefore, the examples mentioned include several of the top global manufacturers including Coca-Cola, Nestle, Cadbury (recently acquired by Kraft), Kraft, Unilever and other organisations of similar profiles.

Chapter 6 presents initiatives led by third party logistics (3PL) providers, either as an individual effort (*e.g.* Lowhub) or as a collective effort (*e.g.* the Clean Cargo Working Group). Logistics providers outsourced by retailers and manufacturers that have environmental directives to decrease their distribution emissions need to align with these policies. Under this context, 3PLs act on the reduction of transport emissions regardless of (or in spite of) their own core values. However, some carriers are starting to adopt environmental stewardship as part of their own values. Both types of initiatives are considered in this chapter.

Chapter 7 presents government-led initiatives and also collaborative efforts between government, primary producers and industry. The initiatives investigated include initiatives where federal, state or local councils are involved in developing low carbon food distribution strategies.

²¹ <http://www.cias.wisc.edu/uncategorized/distribution-models-for-local-food/>



Figure 2.1. Overall structure used for the analysis of best practice food distribution systems and initiatives mentioned in each category in this report. The red flags highlight the 38 initiatives that were investigated in-depth.

The analysis of the motivations, obstacles, opportunities and innovative aspects for all categories investigated was important for the following reasons:

1. An optimum food distribution system at a national or state level is likely to require a balance between several models described here, as distinct to "picking winners" out of the initiatives analysed.
2. Following from 1, there are lessons to be learned from each of the initiatives investigated here to reduce greenhouse gas emissions and increase food chain

resilience, regardless of the drivers and motivations that inspired the implementation of environmental strategies and policies in each case. For example, while some organisations initiated their distribution initiatives to better respond to consumer and economic drivers, these measures also decrease the impact of emissions from food distribution. Some initiatives related to local sourcing that may have been developed to enhance fair trading and regional job creation also have a positive impact on the environmental performance of food chains.

To accomplish the review in each of the chapters mentioned, a wide range of literature resources were used. These included:

- a) Business reports sourced from general internet searches, ABI/INFORM Global²² and ProQuest²³;
- b) Scientific publications sourced from Scopus and ScienceDirect²⁴ specifically addressing activities considered in the realm of food distribution –including transport, storage, packaging and the geographical relationship between production and consumption.
- c) Over 60 IBISWorld reports (2010), which provide independent research on over 500 industries, including statistics, analysis and forecasts. A complete listing is providing in the *References* section.
- d) The Carbon Disclosure Project (CDP) database (<https://www.cdproject.net>). About 2,500 organisations in 60 countries around the world measure and disclose their GHG emissions and climate change strategies through CDP, in order that they can set reduction targets and make performance improvements. This data is made available for use by a wide audience including institutional investors, corporations, policymakers and their advisors, public sector organisations, government bodies, academics and the public. CDP is headquartered in London, UK, and has offices in New York, Berlin, Paris, Sao Paulo, Stockholm and Tokyo.

Although all of the organisations in Figure 2.1 are mentioned in this report, only 38 of these were selected for an in-depth review, including details on the following aspects:

- 1) Aspects related to the organisational structure, including country, scale (*e.g.* national, global), annual revenue (when the information was available) and type of organisation (e.g non-profit, policy maker, company).
- 2) Aspects related to the supply chain relations of each initiative, such as role in the chain (*e.g.* marketer, manufacturer, farmer), the sharing of risk among supply chain partners (risk structure), distribution links, sourcing strategy (*e.g.* national, local, seasonal), type of fuel used and type of commerce platform used.

²² This bibliographic database indexes and abstracts more than 1000 business-related (mainly US) professional, academic and industry journals.

²³ Electronic database providing indexing and abstracting of over 7,000 scholarly and general interest publications. It provides access to the combined information from a number of leading online databases which cover subjects including business, law, education, computing, science, technology and engineering, among others.

²⁴ See page 11 for an explanation of these resources.

- 3) Aspects related to the *ethos* of the organisations selected, as established in their mission statements (*e.g.* greenhouse gas emission statements, vulnerability, fair trade, cost efficiency).

The specific initiatives were selected to provide examples of organisations with varying degrees of understanding of the impacts of their supply chain activities, and different levels of commitment to decrease their distribution-related emissions. The availability of information for each initiative selected was also an important factor for selection.

The 38 initiatives investigated are highlighted in Figure 2.1 and the proportion of each type of category in the 38 selected initiatives is illustrated in Figure 3.2. For the purposes of assessing the balance between consumer-led and farmer-led initiatives, we have separated these two in Figure 3.2.

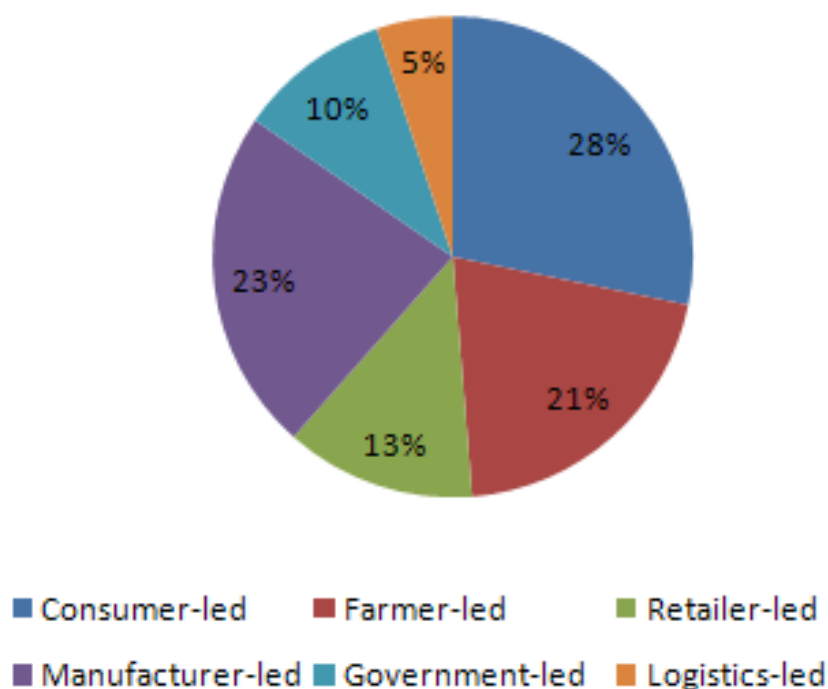


Figure 3.2 Proportion of the 38 initiatives categories analysed in depth in this report.

Appendix 1 presents a summary of the aspects investigated for each initiative.

It should be noticed that some initiatives can be classified in more than one category. For example, “The Co-operative Group” is a consumer-led cooperative that operates a supermarket. As such, it classifies in both retailer –led and consumer –led. CERES is an initiative associated to environmental education and urban agriculture, while at the same time maintains a market for their own produce and other social food enterprises they support ²⁵. Therefore, the boundaries between the five groups selected for the classification of initiatives are flexible.

²⁵ <http://www.ceres.org.au/market>

2.2. General observations of the initiatives selected

Some general observations about the 38 initiatives investigated were:

- a) While the role of retailers and manufacturers is relatively one-dimensional in the chain as buyers, several organisations investigated have two or more roles in the chain. For example, Platform Agrologistics has a double role by providing education and an innovation platform for Dutch exporters in a range of issues, including environmental distribution. While marketing is the major reason of existence of Zespri, the organisation is also driving the investigation of more environmentally friendly distribution strategies. Red Tomato, The Intervale Center and CERES Food Connect are based around the concept of Community Supported Agriculture, but they also provide consultancy services and other support for other CSA-orientated initiatives. Other initiatives such as efarm, LocalHarvest and FarmReach act as information hubs while also providing an electronic commerce platform for growers and buyers.
- b) 50% of the initiatives are organised as companies, 23% are cooperatives or associations (*e.g.* farmers, consumers, processors, logistics providers), and 21% are non-profit. The rest are government -related initiatives. Therefore, most of the 38 initiatives have to work in a competitive environment and do need to be profitable.
- c) 23% of the initiatives do not have explicit GHG-related missions nor do they have any targets set. However, the distribution activities of all organisations selected can potentially have a positive impact on the environment. Examples of this case include Aussie Farmers Direct and efarm.
- d) 44% of the initiatives state environmental missions in their company's website or reports, but do not have specific targets (*e.g.* "we will achieve a reduction of 30% of fuel by 2012"). Examples of this case include the Clean Cargo Group and FoodConnect.
- e) 31% of the initiatives selected have both an environmental mission and performance targets set. For example, all the global manufacturers mentioned have specific environmental targets to be achieved through distribution strategies.
- f) 57% of the initiatives investigated do not consider vulnerability of food chains in their organisational values or missions, although at least 21% do consider sustainability, which is linked to vulnerability²⁶. Further, this percentage may not reflect a lack of thought on supply chain vulnerability. These considerations may be part of the company's risk and hazard assessments, which is normally confidential information not released in their websites.
- g) All of the initiatives considered have other missions driving the company's agenda. Cost efficiency has been stated as a mission for 42% of the initiatives investigated,

²⁶ Vulnerability is the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor. Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A., Schiller, A., 2003. A framework for vulnerability analysis in sustainability science. Proceedings of The National Academy of Science of the USA 100, 8074-8079.

while fair trade drives 32% of the initiatives. This fair trade dimension is more concerned about local fair trade –as distinct to concerns about farmers in ‘developing’ countries. The explicit mention of food security was only found in one organisation (Farmers Market Hub).

- h) In terms of sourcing strategies, 29% of the initiatives support global sourcing of supplies; 24% support national sourcing and the rest of the initiatives relate to local and regional sourcing. In terms of seasonality, 37% of the initiatives require an “all year round” supply of ingredients, while 47% follow a seasonal supply strategy. The rest of the organisations selected do not follow any particular sourcing strategy (*e.g.* Lowhub provides a service to the suppliers but does not source itself; Second bite receives donations of any kind).
- i) In regards to the sharing of risks among supply chain partners, it was difficult to draw any conclusions given the variety of approaches used. In cases such as FoodConnect, risks of crop failure are shared between growers and consumers. In supermarket chains, all crop failure risks are run by the farmers while distribution risks are run by at least three parties in the chain (farmers, carriers and retailers). In other cases, the organisation may only act as a portal of contact between buyers and suppliers. In this case, the risk is entirely placed in them.
- j) 11 initiatives (or 29%) are involved in trials with alternative fuel systems. For example, Lowhub uses small trucks run with biofuels and electricity. The ECR Sustainable Distribution Group and Smartway are promoting the use of hybrid and biofuel powered systems.

2.3. Case studies

As part of this study, case studies illustrating some examples of low carbon food distribution strategies implemented by different organisations were developed.



Some of these cases were developed from the views of key people directly involved in the development of these initiatives. The interview conducted sought a response of the interviewees on the following aspects:

- 1) The major motivations and driving forces behind the establishment of a food distribution initiative that lowered the environmental impact of transport.
- 2) The obstacles and challenges faced during the development of the initiative.
- 3) The lessons learned.

From the responses received, four more detailed case studies were developed: the case of FoodConnect in Australia (in Chapter 3), the development of eFarm in India (in Chapter 3), the Lowhub transport company in the UK (in Chapter 6) and the von Hier council initiative in Germany (Chapter 7).

The other cases developed are based on information directly sourced from the company’s website and similar publicly available information. These cases include Zespri (in Chapter 3), Wal-Mart (in Chapter 4) and Kraft Foods (in Chapter 5).

Chapter 3: Farmer and consumer-led initiatives

!	<i>F&CL systems can: (1) promote shorter distances between producers and consumers; (2) promote seasonal sourcing; (3) engage with small, niche farms; (4) implement food purchasing venues (e.g. cooperatives, farmers markets); (5) show a commitment to the social, economic and environmental dimensions of sustainable food chains; and (6) promote fair trade.</i>
!	<p><i>Motivations for F&CL entrepreneurs include:</i></p> <ul style="list-style-type: none"> <i>a) Emergence of consumers' concerns on food carbon footprints. Global trends in internet searches show an upward trend on searches about local food chains since 2007</i> <i>b) Social and geographical population trends, such as the fact that 50.5% of the world's population are living in cities in 2010.</i> <i>c) Power imbalance in food chains and the perception that farmers are not been fairly rewarded in retail chains.</i> <i>d) The effect of future carbon abatement policies and carbon trading schemes in food chains. Costs increases for horticulture in an ETS scenario could lead to a small decrease in farm revenue of up to 1.3% in fruit and up to 0.5% in processed vegetables, considering only cost increases in farm inputs. However, these projections do not take into account cost pressures on retailers and manufacturers cascading down the chain to suppliers.</i>
!	<i>The willingness of consumers to eat seasonally, often with less control over selection, is a crucial challenge for local and seasonal food chains.</i>
!	<i>The lack of certification processes for environmental food production and distribution can be a barrier for F&CL initiatives.</i>
	<i>Feasibility of peri-urban and urban food production, including trade-offs between energy, water, distance reduction and land availability/quality.</i>
	<i>The LCA impact of local distribution channels</i>
✎	<i>F&CL initiatives can be first movers in the uptake of government-led efforts for sustainable food distribution systems.</i>
✎	<i>In some cases, localisation can be an effective strategy to decrease emissions from food distribution. Sourcing of local foods can decrease GHG emissions up to 79–94%, compared to non-locally sourced foods.</i>
✎	<i>Hunger relief agencies can decrease the impact of food waste considerably. In Victoria, about 750,000 tonnes of food are thrown out every year. Assuming that 10% of this food is recovered, the potential environmental benefits are an avoidance of 113,000 tonnes CO₂-e and 4.2 GL of water.</i>
✎	<i>F&CL distribution systems can be a viable channel for produce that does not meet the quality specifications set by retailers.</i>
✎	<i>Innovative concepts based on the principles of farmers' market could become the future distribution models for fresh produce in urban centres. Examples of concepts for future Farmers' Markets include Farms on Wheels, Hydroponic Farmers' Markets and the Urban Field Farm Stop, which uses existing channels of mass transit and bus stops to sell produce in cities.</i>
✎	<i>In the Australian/Victorian context, there are opportunities to further develop F&CL distribution initiatives, and potentially to connect them with modern urban agriculture (e.g. urban greenhouses) and the peri-urban agriculture.</i>

The F&CL initiatives investigated are summarized in Table 3.1.

Table 3.1. FC&L initiatives investigated in this chapter.

Company	Distribution strategy
Aussie Farmers Direct (AFD) A nation-wide Australian company which provides free delivery services of fresh quality products that are 100% Australian. Current products offered include meat, milk, bread, eggs, cream, cheese, smallgoods, juice and fresh fruit and vegetables. AFD has franchised the business, with a current membership of 120 franchisees. Franchisees distribution network cater for 70,000 customers in Melbourne, Brisbane and Sydney.	Free home deliveries of Australian produce in 1-tonne refrigerated vans. In terms of GHG emissions, AFD uses a more direct chain than for traditional retail. Further, the company is moving to vertically integrate their dairy operation by processing 15-20 million litres of milk in its operation at the former Bonlac factory (Camperdown, VIC) ²⁷ . Vertical integration will allow better supply chain efficiencies upstream the chain. Supply chain links: Farm to AFD DC (farmers)→AFD DC to homes (AFD).
CERES (CER) An umbrella project that encompasses education, organic farming, urban production in an environmental park, marketing and other sustainability aspects.	Direct marketing channel, selling what is produced in the urban gardens direct to the public. CERES also maintains an organic Farmers Market, a food co-op and a small manufacturing project for organic preserves, jams, sauces & chutneys. CERES recently replicated the FoodConnect model in Melbourne ²⁸ . In this model, CERES farm and eco-friendly growers close to Melbourne are the suppliers. Produce is transported to a warehouse in Northcote, where orders are picked and packed. The boxes and extras are then delivered to the "City Cousins" drop-off points around metropolitan Melbourne.
Efarm (EF) A farm-to-home supply chain platform for procuring and delivering farm produce. Distribution is made through "mobile shops", deliveries from a central warehouse or by consolidated bulk shipments.	The initiative is novel in that it combines a modern e-commerce platform (able to carry out supply-demand matching, forecasting of demand and pricing) with localized distribution run by community groups. Supply chain links: Farm to efarm DC (farmers) → efarm DC to mobile shops or markets (efarm) → mobile shops/markets to home (consumers)
Farm Buyers Club (FBC) A farmer's cooperative project supplying to Northern Virginia from 16 farmers & processors. The structure is consumer-orientated but was created by farmers & local processors.	Direct marketing grower-consumer. Delivery is to specific drop points in different suburbs/towns. Supply chain links: farm/processor to drop points (farmer/processor) → drop points to consumer (consumer).
Farm to folk (F2F)	Direct marketing supplying fresh produce to Story City, an Iowa city with a population of

²⁷ <http://sl.farmonline.com.au/news/state/dairy/general/big-hopes-for-aussie-farmers-direct/1828135.aspx>

²⁸ <http://www.ceresfoodconnect.org.au/about-us/>

<p>F2F connects farmers using sustainable methods of agriculture with consumers seeking fresh, locally grown farm products. F2F sells CSA shares, whereby consumers select their produce from the distribution stores and fill their basket according to the seasonal produce of five types of shares available (<i>e.g.</i> vegetables, dairy, meat).</p>	<p>3,228 people. Supply chain links: farm to drop point (farmers) → drop point to household (consumers)</p>
<p>Farmers Market Hub (FMH)</p> <p>A model proposed for Los Angeles (USA) (Zajfen, 2008). The model encourages farmers' markets associations and managers to organise distribution of locally grown foods to institutions. The Hub can address issues such as limited or inconsistent food supply, seasonal fluctuations, and high price points by optimizing the structure of a farmers' market as a gathering point for multiple farmers from across the state, and therefore points of congregation for large amounts of produce. The consolidation of multiple farmers and their food products can help in addressing barriers such as seasonal fluctuations and supply issues that a single farmer cannot overcome alone.</p>	<p>The model is similar to a Melbourne Market hub. However, the difference is that it targets institutional buyers.</p> <p>Resource sharing, such as utilizing empty trucks returning home from the farmers' market to deliver wholesale orders, is proposed as one of the means to build viable distribution models.</p> <p>Supply chain links: Farm to market hub (farmers) → market hub to homes (consumers OR farmers in the case of home deliveries).</p>
<p>Farms Reach (FR)</p> <p>An online, nationwide farm food marketplace that connects local farmers to business buyers. FarmsReach launched in the San Francisco Bay Area. By the end of 2010, they hope to support buyers and producers nationwide.</p>	<p>FarmsReach does not handle deliveries itself. This is arranged by farmers and buyers. The environmental benefits of this system relate to the promotion of local food. However, there are plans to calculate the carbon footprint of products purchased through the website (data such as food volumes, weight, and distances are kept in the system). Therefore, each buyer and seller can compare their FarmsReach footprint to "typical" food footprints. This can be later used to promote themselves by telling their customers how much they have reduced their impact on the planet.</p>
<p>Food Routes Network (FRN)</p> <p>FRN provides communications tools, technical support, networking and information resources to organisations nationwide that are working to rebuild local, community-based food systems.</p>	<p>FRN mainly acts as a provider of information, maintaining a website and social networking sites. However, FRN also maintains a second website (http://www.communityfood.com) which acts as a marketplace for local products. The environmental benefits of this system relate to the promotion of local food.</p>
<p>FoodConnect (FC)</p> <p>An enterprise that markets local, sustainably produced food.</p> <p>Food Connect has been replicated in Sydney, Melbourne and Adelaide, with new branches being planned in Wollongong, on the Coffs Coast and in Tasmania. An umbrella organisation called the Food Connect Foundation will co-ordinate the activities of the regional Food Connects and steer projects such as the New Farmers' Pathway and the Participatory</p>	<p>FC has several features that relate to a lower carbon footprint during distribution:</p> <ul style="list-style-type: none"> -The promotion of local produce for local consumers. -The simple supply chain used: Farm to FC DC (farmers) → FC to "city cousins" (FC) → "city cousins" to home (consumers). <p>FC manages products for 1,400 buyers in Brisbane from 60 farmers in QLD under this system. Product that has been picked & packed is</p>

Farmer Assessment scheme.	transported to the 60 "city cousins" 3 days per week (5 van trips are required to accomplish this). -In the near future, FC plans to introduce electric vehicles for the movement of produce.
Gruppi di Acquisto Solidale (GAS) In this model, a group of people with the same beliefs in sustainable and ethical consumption collectively buy large quantities of products from small local producers and distribute it among themselves. GAS normally starts as a social network. This model was developed in Italy, where there are about 350 GAS organisations ²⁹ .	This is the most direct marketing channel possible. There are only two links: Farm to GAS buyer's home → buyer's home to the rest of the GAS partners. Goods are purchased locally, which further decreases the impacts of transport.
Homerville Wholesale Produce Auction (HWP) A wholesale auction targeting farm marketers for consumers in the Cleveland urban areas. Advantages are: volumes traded, compatible with off-farm jobs, low investment. There are about 45 produce auction sites of this type in USA. Minority-friendly (<i>e.g.</i> Amish producers).	The initiative receives about 500 shippers which use wagon loads (horses). 90% of the produce that is auctioned comes from about 100 larger growers. Over 99% of produce sold is from Ohio (state-sourced produce is considered to be "local").
Just Local Food Cooperative (JLF) A community supported, worker owned cooperative store serving 3 local areas of Wisconsin. The store sells seasonal, local food.	The environmental benefits of this system relate to the promotion of local food.
LocalHarvest (LH) Online selling hub that matches consumers with local/regional food providers.	Similarly to FRN, LH mainly acts as a provider of information. However, LH also maintains an electronic portal which acts as a marketplace for local products. The environmental benefits of this system relate to the promotion of local food.
Melbourne's community farmers' markets (MFM) A group of markets (St Kilda, Abbotsford, Albert Park) dedicated to Victorian grown food and producers, regional food cultures, seasonal produce, biodiversity, sustainable farming practices and the strengthening of relationships between producer and consumer.	Direct marketing channel. Fresh produce in these markets is sold by its grower, and manufacturers who grow their own ingredients. No re-sellers/agents are permitted. A small proportion of manufacturers who hand make their product attend on an occasional/seasonal/rotational basis.
Red Tomato (RT) A non-profit organisation that markets sustainably grown fruits and vegetables in New England, New York, New Jersey, and Pennsylvania. They are also consultants specialized on regional food system development across the US.	Red Tomato coordinates marketing, sales, and wholesale logistics for a network of over 40 family farms. Growers in the RT network harvest, process, pack, and store what they grow. RT coordinates the design and production of packaging. Growers either have the facilities and equipment to pack and store on the farm, or work in collaboration with other growers in the network to pack and/or store their

²⁹ <http://www.retegas.org/index.php?module=pagesetter&func=viewpub&tid=2&pid=10>

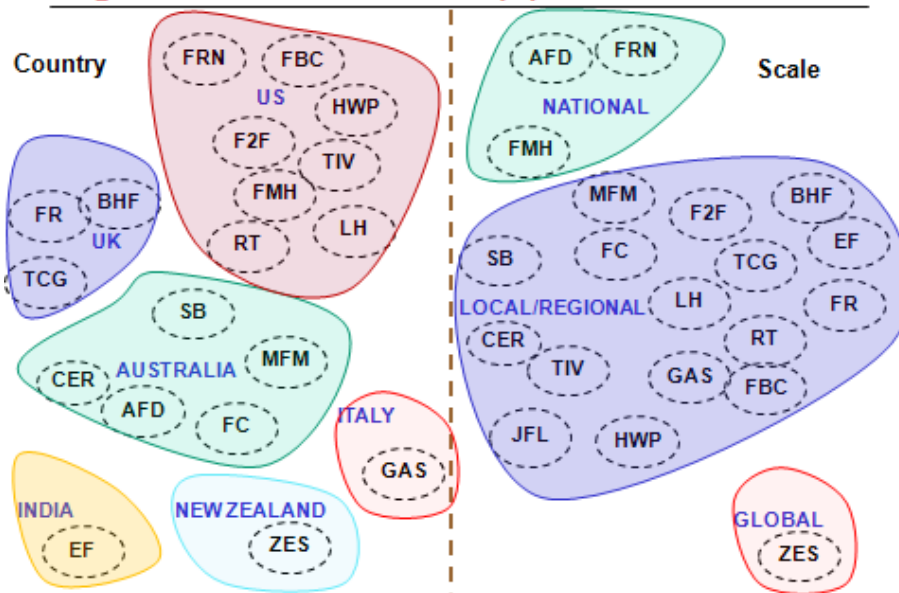
	<p>product.</p> <p>In order to streamline trucking routes, RT works closely with farmers to gather product at consolidation points on centrally located farms, at the produce market, or at distribution centers (DCs). Consolidation is the crucial GHG emissions savings point, when orders from a single farm are less-than-full loads. RT works to consolidate product at one pickup point.</p> <p>RT products arrive to a retail produce department either as direct store delivery or through a DC. RT trucking is done by a network of regional growers and 3PLs. To speed up deliveries, products may ride on two or three different trucks in a 24 hour-period.</p>
<p>Second bite (SB)</p> <p>A non-for-profit charitable organisation that distributes food to disadvantaged population. Its primary mission is hunger relief. However, Second bite redistributes over 600 tonnes of nutritious fresh food, which would otherwise go to waste. From a waste avoidance point of view, the role of organisations such as Second bite is significant.</p>	<p>The value of initiatives such as SB is the avoidance of food waste in the supply chain. Australian research has shown that, on average, every kilogram of food recovered results in savings of 1.5 kg GHG CO₂-e and 56 litres of water (O'Farrell, 2008).</p>
<p>The Co-operative Group (TCG)</p> <p>TCG is the world's largest consumer-owned business, with over 4.5 million members and 87,000 employees. Regional and local retail co-operative societies are corporate members of the Group. Its distribution arm is Cooperative Retail Logistics. The group has a strong commitment to decrease environmental impacts of their operations.</p>	<p>Logistics are vertically integrated from farm to retail. CG is collaborating with the Carbon Trust to develop methods to calculate the carbon footprint of retail products and services. CRL Primary is working with CG in smart route planning to reduce carbon emissions and to support nationally-sourced food initiatives (<i>e.g.</i> Welsh lamb and Scottish Aberdeen Angus beef).</p>
<p>The Intervale Center (TIV)</p> <p>A non-profit organisation that engages local farmers and consumers through a local food philosophy. It has an education program, a farm enterprise business incubator for new farmers, business consulting services for established farmers, and a land preservation initiative. Plans are under way to develop a network of Regional Food Centers that expand local food access, shorten supply chains, promote fair prices to farmers, increase efficiency, and support the success of farmers and food related business.</p>	<p>TIV farmers sell their produce through a variety of markets — wholesale, farmers' markets, retail stores, and CSA shops. TIV organises farmer collaboration to aggregate supply and demand and distribute local foods to the surrounding community in a way that ensures fair prices for farmers. Multiple farmers working together benefit from economies of scale in both marketing and distribution, allowing them more time to focus on production.</p>
<p>ZESPRI (ZES)</p> <p>Zespri is the worlds' largest marketer of kiwifruit, selling the fruit on 60 countries. The organisation groups 2,700 kiwifruit growers in NZ, over 150 in Italy, 800 in Japan, 130 in Korea and around 50 in France, Chile and the United States, to provide an all-year-round supply of kiwifruit.</p>	<p>Shipping and transporting kiwifruit is responsible for the greatest carbon output in the ZESPRI Kiwifruit supply chain - accounting for 35% of all emissions. Zespri has developed packaging initiatives to increase the volume of fruit per tray –thus requiring less fuel required for forklifts to move the same amount of fruit into coolstores, onto</p>

	trucks and into containers.
<p>The Brighton & Hove Food Partnership (BHF)</p> <p>The Food Partnership is an example of consumer and city council partnership. The non-profit organisation began in 2003 to bring together the elements of food, health, environment and economic sectors and encourage a more sustainable food system throughout Brighton & Hub, a city of 250,000 people. The Partnership works as an information provider and promoter of local food. It has now has over 200 members.</p>	<p>BHF works with councils and community members to introduce procurement policies within public institutions such as schools, hospitals, etc., that favour the use of regional and locally produced food, and which support environmental sustainability, animal welfare and fair-trade.</p> <p>BHF has undertaken an ecological footprint of the city's activities, including the way food is produced, transported, packaged, cooked and disposed of. A Freight Quality partnership will enable the council, community and local freight companies to work on ensuring that movements of freight within the city are as effective as possible.</p>

Figures 3.1 to 3.3 show the classification of these initiatives according to the three characteristics of importance discussed in section 2.1, namely organisational structure, supply chain structure and missions related to GHG emissions, vulnerability and others.

In general, F&CL systems can present one or more of the following characteristics: (1) they promote shorter distances between producers and consumers, thus minimizing transport distances, oil consumption and bypassing middlemen in the distribution chain; (2) F&CL venues are largely seasonal; (3) they engage with small, niche farms, as distinct to large scale, industrial agribusiness; (4) they implement food purchasing venues such as food cooperatives, farmers markets, and CSA and local food-to-school linkages; (5) they show a commitment to the social, economic and environmental dimensions of sustainable food production, distribution and consumption (Jarosz, 2008); and (6) they promote fairer conditions of trade for farmers. These concepts provide a categorisation of concepts associated to farmer-led and consumer-led efforts, depending on their impact in the supply chain.

Organisational structure (a)



Organisational structure (b)

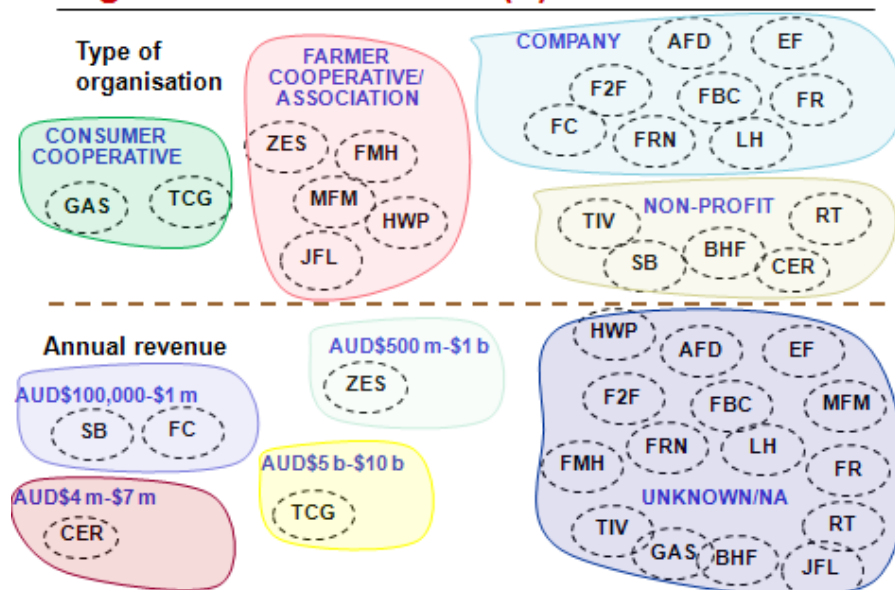


Figure 3.1. Categorisation of farmer-led and consumer-led initiatives, depending on their organisational characteristics: (a) country and scale; (b) type of organisation and revenue.

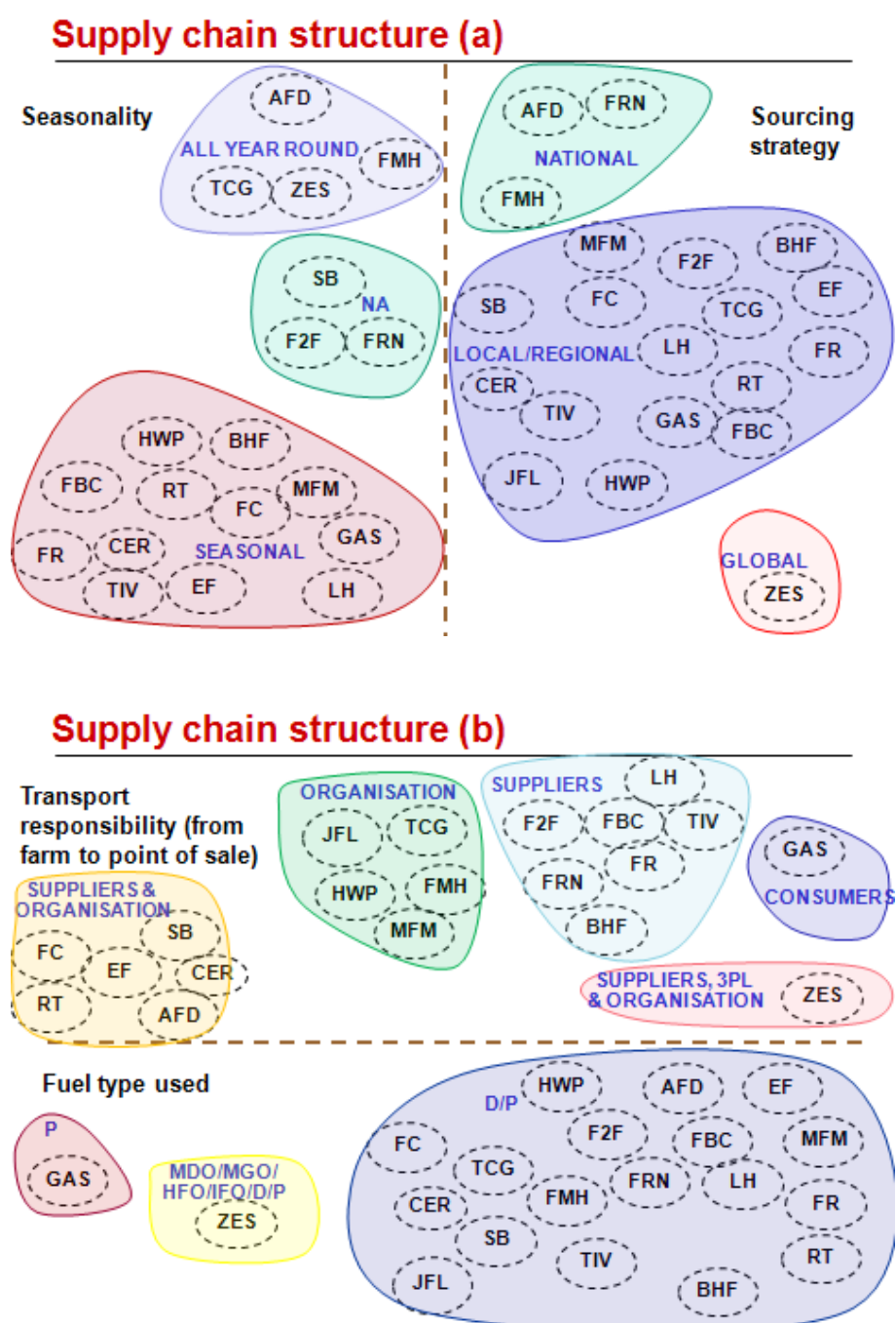


Figure 3.2. Categorisation of farmer-led and consumer-led initiatives, depending on their supply chain characteristics: (a) seasonality and sourcing strategy; (b) transport responsibility (from farm to point of sale) and fuel type used.

Mission

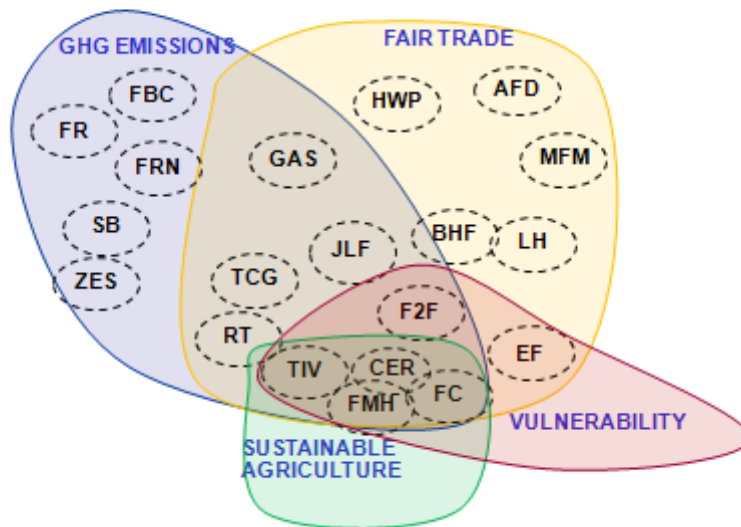


Figure 3.3. Categorisation of farmer-led and consumer-led initiatives, depending on their type of mission.

Farmer or consumer led entrepreneurial efforts in food distribution systems follow social, environmental and economic/business drivers, the same drivers that any other enterprise follows. Even in the case of socially-orientated enterprises in the food distribution arena (as is the case of several of the models investigated here), there is an imperative of financial survival. Therefore, socially-orientated goals (*e.g.* fair trading) and environmental goals have to be balanced with the necessity of making a reasonable profit to maintain viability.

As explained in Chapter 2, some of these initiatives can classify in more than one category. Farmer or consumer led initiatives can exist at a range of scales and can be competitive with other chains, for example:

- The Cooperative Group is a consumer cooperative, yet it competes with ASDA and TESCO in the UK supermarket sector;
- Aussie Farmers Direct (AFD) and FoodConnect (FC) are both marketed in the “local” segment, yet AFD sources nationally while FC has an additional commitment to source seasonal produce within a five hour radius from their Brisbane distribution centre;
- Zespri is a farmer-led organisation, yet it competes and sources product in a global scale³⁰.

3.1 Drivers and motivations for F&CL initiatives

The general motivations, opportunities and barriers in the establishment of F&CL initiatives were analysed in the context of current social, technological, economic, ecological and

³⁰ Zespri is further analysed in the “global marketer” category in Section 6 of this report.

political/legal factors (also known as STEEP factors) affecting the food industry. These factors were compiled from views expressed in a variety of articles, industry reports and forums, which are included in the References section.

This section emphasizes some of the major factors found to drive the development of food distribution initiatives of the F&CL type. For a complete summary of other factors analysed, the reader is referred to Appendix 2.

a) Emergence of consumers' concerns on food carbon footprints. It has been argued that current challenges in global food systems (*e.g.* food security, power imbalances in food chains, environmental impact of food transport, obesity and other health aspects) have led to a disillusionment of a segment of consumers and farmers with modern food systems and a growth in enterprises that embrace the concept of sustainability and fair trading (Andrews, 2008; Chang and Lusk, 2009).

"Food miles" and "local" food movement are indeed becoming popular, as illustrated by the trends observed in Figure 4.1. Global trends in internet searches using the terms *food miles* and *locavores*³¹ show that, while the *food miles* issue gained popularity in 2005, a response from consumers to favour local food chains (as embodied by the *locavore* concept) started to gain momentum in 2007 and the volume of searches is now comparable to the interest in *food miles*.

Several F&CL initiatives mentioned in this section (*e.g.* Gruppi di Acquisto Solidale, FoodConnect, Red Tomato) harnessed these concerns to create direct marketing channels between growers and consumers and communicate the principles of local food.

³¹ A locavore is a consumer who prefers food produced locally or within a certain radius of his/her neighbourhood (50, 100, or 150 km). The locavore movement encourages consumers to buy from farmers' markets or even to produce their own food, with the argument that fresh, local products are more nutritious and taste better.

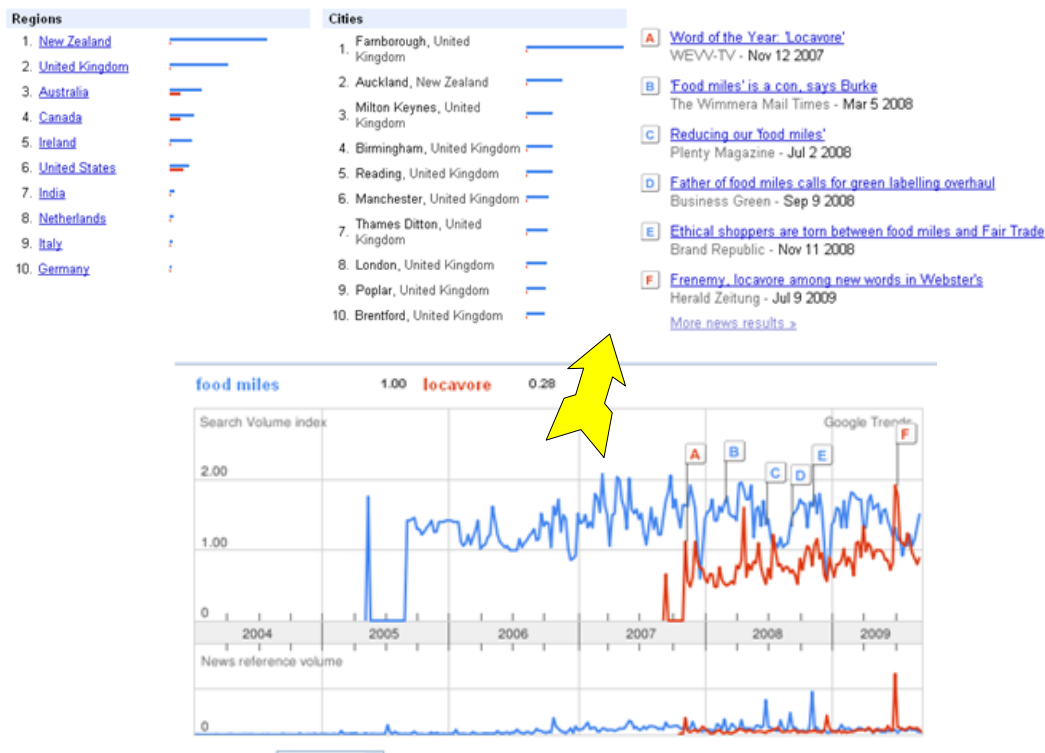


FIGURE 4.1. Volume of internet searches using the terms "food miles" (blue line) and 'locavore' (red line). Source: www.google.com/trends. Search performed in 25 Sept 2009.

b) Concentration of population in urban centres. With 50.5% or 3.5 billion of the world's population living in cities in 2010 and urban populations growing, often at the expense of rural areas, the global population as a whole has become more urban and less rural (United Nations Press Release, 2010). Further, land use plans generally prioritise peri-urban land as a future resource for urban development, and not as potential food production areas (Jewell, 2008).

In terms of food distribution, this means that the transportation necessary to deliver primary production to manufacturers, retailers and consumers is also increasing, as less people live near production areas and more shops are located in population centres (Marquez et al., 2010).

The integration of horticultural production in urban settings is one potential way to improve urban food security, while also decreasing the impact of food transport. Examples of such integration include the concept of "vertical farm"³², which consists on the indoor production of products typically grown in glasshouse production, such as herbs, strawberries, tomatoes, peppers and cucumbers. City-based glasshouses could be run in some large roof areas, for example, warehouses and shopping centres. Urban gardens, such as the project run by CERES, are another option of urban production.

c) Power imbalance in food chains. The perception that farmers are not been fairly rewarded in their commercial relationships with retailers is another driver influencing the development of F&CL initiatives. In Australia, Woolworths and Coles continue to hold the majority of the retail value share of the national packaged grocery market. The outcomes of

³² <http://www.verticalfarm.com/>

the ACCC investigation (Australian Competition and Consumer Commission, 2008) did not appease concerns on the lack of transparency in grocery chains and the dominance of retail interests in grower-retailer transactions³³.

Retailer dominance has a significant effect on supply chain practices. Examples include:

- Demands that product be delivered on pallet sizes that suit the retailer distribution centre pallet racking, which sometimes leads to under utilization of a truck's capacity. As a consequence of this sub-utilisation, the transport cost per kilogram increase (CDI Pinnacle Management, 2008).
- Packaging prices increased between 5-12% during 2003-2008, potentially as a result of the introduction of Returnable Plastic Crates, supported by retailers (CDI Pinnacle Management, 2008; Fruit Growers Victoria Ltd., 2008).
- Imports of processed food (particularly seafood and processed fruit and vegetables), which compete with nationally sourced produce.

Farmers' markets (FM) can be considered as the earliest F&CL initiative developed to establish a direct channel between growers and consumers. There are about 120 markets of this type in Australia, of which 55 are based in Victoria (see Appendix 3). In comparison with other countries, the establishment of FM in Australia has been limited. For example, in the US there are 16 FM for every million people³⁴. In Australia the concentration is 6 FM for every million people.

While initiatives such as Melbourne's Community Farmers' Markets and Homerville Wholesale Produce Auction follow this traditional farmers' market model, other initiatives that take advantage of modern e-commerce platforms are starting to emerge, such as eFarm, FoodConnect, FarmsReach and LocalHarvest.

d) The effect of future Emissions Trading Schemes in food supply chain players.

Modelling of impacts on farm revenue developed by the Centre for International Economics (Jiang et al., 2009) indicates that costs increases for horticulture in an ETS scenario could lead to a decrease in farm revenue of up to 1.3% in fruit and up to 0.5% in processed vegetables, considering only increases in farm inputs (*e.g.* fuel, materials, fertilisers, water). In particular, the model projected a price increase in transportation services of 4.6% by 2030 and 8.7% by 2050. However, the model did not take into account price pressures from retailers and manufacturers cascading down the chain to suppliers.

The Government's decision to delay introduction of an Australian ETS until 2013 has decreased the immediate urgency of this driver. However, it is worth considering if F&CL initiatives will be alternative channels for producers that are not willing to meet price arrangements under ETS conditions in traditional supermarket chains.

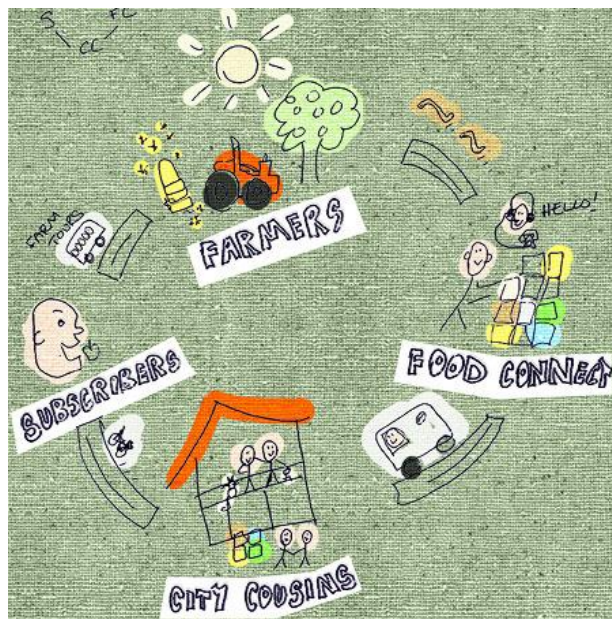
³³ As an example of remaining concerns, see <http://theland.farmonline.com.au/news/nationalrural/agribusiness-and-general/finance/how-two-supermarket-giants-divide-your-weekly-spending/1540087.aspx> and <http://www.abc.net.au/unleashed/stories/s2710011.htm>.

³⁴ <http://www.ams.usda.gov/AMSV1.0/FARMERSMARKETS>

CASE STUDY: FOOD CONNECT (AUS)

The Food Connect (FC) enterprise in Brisbane links local growers with local markets directly. FC is a community shared agriculture enterprise that distributes ecologically sustainable, affordable produce by collaborating with local farmers for a financial return. The produce from FC is all sourced from within a 5-hour radius of Brisbane. Green vegetables will have been picked with the shortest time frame being possible between picking and delivery. FC is expanding its model to Adelaide and Melbourne in the near future.

Robert Pekin shares some insights and lessons learned during the development of FC, from a small business delivering a few boxes per day to delivering over 1000 boxes each week.



How does FC work?

The concept is relatively simple: the farmers transport their produce to a FC warehouse, where the products are packed into 11 types of boxes with different mixes and quantities of products. Customers can choose among those boxes, but cannot choose specific produce. This means that the seasonality factor is important in the expected type of fruit and vegetables. Bread, honey, eggs and other non-horticultural products can also be added.

The boxes are then transported to about 60 "city cousins", who are distributed around Brisbane. Customers pick up their boxes from these distributors during the allocated

delivery days and times.

Customers also pay 4 weeks in advance of produce, as a way of sharing the risks and becoming involved with FC's philosophy of putting greater value on the farmers labour. Both customer and FC undergo a trial period of 3 months.

While farmers get paid about 3 times what they would receive in traditional supermarket chains, prices that customers pay for FCs produce are about 40% cheaper than their organic equivalents. This means that costs need to be squeezed out of the middle steps to get to the consumer (*i.e.* the distribution network).

What was Robert's major motivation to establish FC?

Many years ago Robert ran a dairy farm during drought, rapidly declining farm gate returns for milk, and dairy deregulation. Times were indeed tough. He had to lay off his staff and milk his herd of 310 cows himself, twice a day, every day. Eventually, he had no choice but to walk away from his farm with not much more than the clothes on his back and significant debt.

Robert came across the Community Shared Agriculture (CSA) concept. He quickly recognised that this form of agriculture offered opportunities for a relationship between farmers and those who eat their food. Equally important was the fact that CSA offered an alternative to the dependence of farmers on retailers. When Robert came face to face with a CSA operation in Tasmania, he realised something "if every farmer could get a grasp of this concept, if every

farmer could see the customer and sell to the customer, what magnificent food they would eat!"

Consequently, he spent the next 12 months helping to set up nine CSAs, including his own. Once this community farm was operating successfully Robert travelled, helping other farmers set up CSAs, researching CSAs and advocating for more equitable food distribution systems.

What obstacles has FC faced?

In the process of setting up CSAs around Australia, Robert realised that a CSA is not a venture to set with only one farmer involved. The output of one farmer's produce will not necessarily meet the demands of city consumers by itself. Developing the required farmers' collaborative network also proved difficult, as many small farmers had evolved their farms in isolation and had not developed basic skills of communication, trust and cooperation with their neighbours.

Robert became involved in a first attempt to set a direct CSA, farm-to-consumer scheme. Several logistics problems arose: the sheer amount of work, the need for a database for all the products and the general lack of knowledge on how to run an enterprise with 30 growers involved proved to be unsurmountable challenges at that stage and after 4 months, the trial ended.

In 2005 Robert and collaborators initiated a new CSA scheme, developing the concept of "city cousins" or distributors in Brisbane that would receive and distribute the produce from their homes or places of work.

FC is a for-profit company, but they have not been able to deliver a profit yet. Further, FC finds it difficult to borrow money from banks. Social businesses always struggle in finding good people because the lack of cash flow means that salaries are under the industry's benchmark. While FC can find people that are able to think and strategise, they struggle in finding people that can make things happen in the business.

One challenge that social and environmental businesses face is the high expectations placed on them by supply chain partners, customers and employees. FCs executive have to face this pressure to maintain FCs *ethos* as a social business.

What lessons can FC share in regards to establishing a company that encourages sustainable food distribution?

All 80 farmers supplying FC are located within a 5-hr radius. Once that geographical circle was established, a lot of varieties that were disappearing from Queensland orchards (because they could not compete with Tasmania, Victoria or other states produce), started to make a comeback within that circle. For example, farmers can look at growing carrots without fearing the competition from Tasmanian growers when they become suppliers to local food networks.

Another crucial step in building trust with farmers is the payment of a flat fee established by the farmers themselves. Further, the continuity of FC's operations is guaranteed by the company's constitution, which prohibits the sale of FC. This guarantee goes over the hurdle that many social and green enterprises face: the sale out of the company to competitors or big business. A recent example of this occurrence in food businesses was the sale of the organic food chain Macro Wholefoods to Woolworths in May 2009 (Speedy, 2009).

What are FCs plans in the near future?

The "City Cousins" operation is likely to be spun off as a separate company.

There are now 5 replications of FC that are autonomous but aligned with FCS principles. FC is

preparing improvements to their structure and business model. Further, a Cradle-to-Crate carbon environmental impact analysis for the operations in FC Brisbane is planned.

Sources: Robert Pekin, personal communication, Jan 2010; the Food Connect website: <http://www.foodconnect.com.au/>, accessed on Jan 5, 2010; a presentation of Robert Pekin at The Greenhouse in the Woodford Folk Festival, Sunday 27 Dec, 2010. Accessed at <http://www.thegreenhouse.org.au/index.php/0910-audio/sun-27-dec-09> on Jan 5, 2010.

CASE STUDY: eFARM (INDIA)

eFarm is a Farm-to-Home supply chain platform for procuring and delivering farm produce in a transparent, economical and efficient manner.

eFarm connects farmers, intermediaries, logistics providers, distributors and small retailers to local road side vendors. The objective is to deliver high quality produce at farm prices. eFarm clients include household buyers, food and hospitality providers, institutional buyers and exporters. They now have over 500 clients using "Word of Mouth" as the marketing strategy. eFarm makes a revenue of 5 to 10% per successful transaction.

The eFarm concept grew out of the need to improve on the state of agriculture in India through the application of technology and supply chain efficiencies in a rural setting. eFarm currently delivers vegetables and fruits in the Chennai area, using techniques which have evolved from collaboration and discussions with key traders in the area.

M Venkata Subramanian (Venky) is the founder of eFarm. The company is currently based in Mylapore, Chennai.



What was your major motivation to establish eFarm?

Though India was primarily an agrarian economy, the plight of farmers was very shocking. Even basic technology and business processes and quality norms were lacking. Majority of operations were dominated by illiterate, unorganised sector resulting in huge losses and fluctuating availability.

Most solutions which were tried out by government and private firms used an 'elephant & blind men' approach, whereby both types of organisation worked in silos and were not connected. People working on cold storages had no idea of infrastructure issues such as power availability and roads. People working on microfinance/loans did not work much on creating marketing linkages to enable revenue streams before lending money, for example. Often the 'transport' piece was totally overlooked.

We felt a 'inter connected' platform where all such stakeholders interests are taken into account, together with a comprehensive approach, backed by technology, would work better.

What lessons can you share in regards to establishing a company that encourages sustainable food distribution?

Firstly, a person may be illiterate as less 'formally' educated, but they are still 'wiser' and 'street smart' in many other ways.

Secondly, what looks like an unorganised approach is in fact beautiful 'order in chaos', which has survived over hundreds of years. The farm-to-market-to-home linkages in India have not changed much since the British days! Even many modern retailers here have to depend on this distribution mechanism 'behind the scenes', as the volumes and dynamics are too complex for them.

Thirdly, people often say they want to 'bypass' the middlemen. Every industry has middlemen- they often add value. But in India the value addition is often minimal and price fixing mechanisms are not transparent. We need to optimise and upgrade the middlemen into 'value added resellers', in such a way that their commissions are justified.

As customers are becoming more globally aware owing to travel and media, they demand specific fruits & vegetables, even if they are imported. In India, for instance, Washington apples and Australian oranges have become a more popular choice over their Indian counterparts, even though prices are higher.

Though ideally foods should be grown locally, it is becoming increasingly difficult for a growing nation like India to depend on locally grown products. The farm lands are shrinking rapidly owing to the rapid growth of cities. The land real estate price is far higher than the return on investment for agri-products, so farmers are tempted to sell off land instead of growing food. India is not even subsistent anymore - this year (2009) we had to import rice, wheat, pulses and sugar - long considered our staple strongholds in surplus.

In contrast, Chinese imports are becoming cheaper and available all the year!

This is a challenging area for food scientists & researchers ...

Sources: M Venkata Subramanian, personal communication, Jan 2010;

<http://www.matchboxsolutions.in/eFarm.html>;

<http://startupstory.in/2009/04/12/efarmin-innovating-the-indian-agri-supply-chain>. Accessed on Jan 2010.

CASE STUDY: ZESPRI AND THE NEW ZEALAND KIWIFRUIT EXPORT INDUSTRY

ZESPRI International Limited is the world's largest marketer of kiwifruit, selling kiwifruit into more than 60 countries. Every year ZESPRI sends tens of millions of trays of ZESPRI® Kiwifruit out to its markets on ships: 80% is transported in charter vessels to their main markets (e.g. Asia, North America and Europe. The other 20% is transported in container vessels.

Carbon footprint

Zespri recognises that people around the world have now a greater interest in where products come from and the impact of their purchases on the planet, climate change and carbon footprints.

This motivated ZESPRI to undertake a comprehensive study to measure the carbon footprint across the lifecycle of New Zealand Kiwifruit for export. The methodology followed aligns with the UK PAS 2050 (2008), acknowledged as the most robust carbon emission measurement standard available.

The study found that ZESPRI® kiwifruit shipped and consumed in Europe contributes 1.74 kg of CO₂-e per 1 kg of kiwifruit across its lifecycle from orchard to consumer.

The emissions at each stage of the lifecycle of ZESPRI® Kiwifruit destined for Europe were:

- Orchard operations make up 17% of total emissions for EU exports.
- Packhouse and coolstore processes account for 11% of total emissions.
- Shipping accounts for 41% of total emissions.
- Repacking and retailer emissions amount to 9% of total emissions.
- Consumer consumption and disposal comprises 22% of total emissions.

ZESPRI is now working with the kiwifruit industry on a series of initiatives to reduce its carbon footprint, namely:

- Climate change adaptation – adjusting on-orchard practices to accommodate the changing environment. For example, one grower has converted a natural gully into two lakes which now serve as an efficient irrigation system for his orchard.
- Focus orchard network – sharing best practice to optimise orchard product quality, yield and efficiencies.
- Waste utilisation – turning kiwifruit waste into bio-plastics which can be used for packaging.
- Lean manufacturing - streamlining processes, reducing waste, increasing efficiency in the packhouse.
- Pack optimisation - allowing a greater quantity of fruit to be shipped at one time without compromising quality.
- Slow-steaming ships – reducing a ship's speed by 2km/h at certain points in the season lowers diesel use by 17%.
- The potential future use of SkySails technology. SkySails is a company offering a wind propulsion system to harness this energy, in the form of a sail, flown at an altitude of 100 to 300m off the front of ships. This can be fitted to all existing cargo ships. Depending on wind conditions, average annual fuel costs can be reduced by 10 to 35%, with temporary fuel cuts of up to 50% in optimal conditions.

Other distribution strategies include feasibility studies in the use of bio-diesels and studies comparing the relative efficiency of reefer and container vessels.

Sources: <http://www.zespri.com/about-zespri/newsroom.html>
<http://www.zespri.com/sustainability-home.html>

3.2 Innovative aspects and opportunities for F&CL initiatives

There are several innovative aspects of F&CL initiatives that fall outside the scope of this report, including their role on education and extension and as business incubators (e.g. CERES in Melbourne) and the social benefits that urban agriculture can bring to a community. In the following paragraphs we focus on the most relevant aspects for food distribution systems:

a) F&CL as first movers in the uptake of government-led innovations for sustainable food distribution systems. Council-led initiatives, the adoption of environmental management systems for food production and other innovations find fertile ground in F&CL initiatives.

The uptake of Government-led social programs through farmers' markets (FM) is illustrated by the following case: Most FM in the US have traditionally accepted payments through Supplemental Nutrition Assistance Program or SNAP (formerly known as food stamps), which helps population nutritionally at risk to buy food. A consortium of LA certified FMs recently announced that 22 markets throughout LA County will begin accepting Food Stamp Electronic Benefits Transfer (EBT) cards as a method of payment. The effort is part of a statewide campaign to improve health through nutrition education and lifestyle changes, particularly among socioeconomic and ethnic groups that suffer disproportionate rates of hunger, obesity and chronic disease.

The system utilizes a card similar to a bank account debit card to process participants' purchases electronically. Utilizing wireless point-of-sale devices provided by the state's Department of Social Services, farmers' market staff can swipe a food stamp participant's card and deduct a chosen amount from his or her account. Participants can then shop at the market using market dollars equivalent to the deducted amount. Any unused amount can be redeemed at a later date, or returned to the market manager to be credited back to the participant's card ³⁵.

Chapter 7 discusses other examples of Government and F&CL initiatives working together.

b) Consumer activism and open source innovation. Food provenance has become a topic discussed in social media, entrepreneurship, and design ³⁶. The need for education about where food comes from, what it takes to grow it, data regarding the source and practice behind the food we eat, and the travel of food to households are starting to be tackled by consumers through the use of Web 2.0 interactive technologies. Examples of this interactivity can be seen in websites such as SureHarvest³⁷, IBM³⁸, Earthster³⁹, NextLab⁴⁰ and Sourcemap⁴¹, and at an educational consumer level, Foodgeeks⁴².

Such education can lead to innovative consumer activism. One example is the US-based movement carrotmob, which organises mass purchases of products in small businesses that proactively work on improving energy efficiency. Proceedings of these events go to improving lighting, refrigerated appliances and similar equipment in the businesses that commit to have the largest environmental improvements. This movement, which has extended to several countries – including Australia⁴³ – could potentially reward enterprises that shorten food distribution distances.

The use of Web 2.0 tools to develop farmer-led and consumer-led food distribution systems is illustrated in a NextLab case study. The project consisted in developing a PDA tool to help Mexican farmers to forecast grain market prices. A team of researchers and students

³⁵ <http://www.ams.usda.gov/AMSV1.0/getfile?dDocName=STELDEV3002986&acct=wdmgeninfo>

³⁶ From the blog of Elizabeth McVay: <http://provenancefood.blogspot.com/>

³⁷ <http://www.sureharvest.com/>

³⁸ <http://www.ibm.com/smarterplanet/>

³⁹ <http://www.earthster.org/>

⁴⁰ <http://nextlab.mit.edu/>

⁴¹ <http://www.sourcemap.org/>

⁴² <http://www.foodgeeks.com/>

⁴³ <http://sydney.carrotmob.org/>

developed the tool and tested the concept through evaluation with farmers and wholesalers. The tool was well received by the potential rural users and the Mexican University involved is now taking the concept to the market ⁴⁴.

c) Decreasing food transport distances to decrease emissions. Notwithstanding the fact that there are trade-offs between the location of production zones with respect to consumer markets, the type of production systems and seasonality, localisation can be an effective strategy to decrease emissions from food distribution. In 2002, a study concluded by the Leopold Center for Sustainable Agriculture indicated that transportation of local foods would save 79–94% of the CO₂ emissions, as compared to non-locally sourced foods in Iowa, US (Pirog et al., 2001). Further, two European studies indicate that more energy is used in importing apples produced in New Zealand (NZ) to Sweden and the UK, respectively, than in producing them in Sweden or the UK, even though apple production is more energy efficient in NZ (Jones, 2002; Stadig, 1997). Further, a study of three local food distributors outside Stockholm indicated that local food production might entail a considerable energy decrease for food transport when supplying food locally (Thomsson and Wallgren, 2005).

d) Decreasing food waste. In Table 3.1, the role of hunger relief agencies to decrease food waste was mentioned. Using Victorian food waste as an example, Hyder Consulting (2008) identified that about 750,000 tonnes of food are thrown out every year. Assuming that 10% of this food is recovered, the potential environmental benefits of its recovery are savings of 113,000 tonnes CO₂-e or the annual equivalent of switching off 173,078 refrigerators, and 4.2 GL of water or the annual water consumption of 18,000 households.

The analysis of Hyder Consulting focused on the impacts of food recovery only and did not consider the supply chain of recovered food itself. In the UK, it has been estimated that around 40% of food donated by retailers for human consumption returns uneaten to the waste stream (Alexander and Smaje, 2008). Further, the typical logistics approach of hunger relief agencies is to engage individual small businesses (such as a sandwich outlet) or major retailers using a small refrigerated van. However, other models exist: the proposed 'FareShare First' business in the UK is attempting to change the charitable donation model in which FareShare figures as one more (small-scale) option or process in the retailer's logistics chain by offering instead a complete waste disposal solution for retailers. This role involves brokerage with existing waste management companies, such that FareShare First can divert fit-for-purpose food into its existing charitable network and pass on the remainder without having to build the full infrastructural capacity that would otherwise be required (Alexander and Smaje, 2008).

e) Protecting regional farming. Local sourcing depends on the sourcing of food within a certain distance (e.g. 100 km) of markets and consumers. Even if one particular geographical area is less competitive than others (e.g. carrot crops in Queensland are less competitive than Tasmanian), preference is given to locally produced foods because that is the commitment of local food distribution. Further, when a farmer sells produce directly to retailers or customers, the farmer becomes the producer, pack house operator, and distributor. This makes the farmer's share of consumer payments larger than under other

⁴⁴ http://nextlab.mit.edu/index.php?option=com_content&view=article&id=67&Itemid=3

selling arrangements and increases his income (Gregoire and Strohbehn, 2002). These characteristics encourage the creation of small enterprises at a regional level (see Government-led initiatives).

f) Market opportunity for products that do not reach the quality standards of supermarket chains. F&CL distribution systems are less concerned about long shelf-life and consistent size or shape than conventional (*e.g.* supermarket) chains. Fruit and vegetable cultivars that underperform in any of these aspects are not grown for conventional chains because they are either not sold or they are unprofitable in those markets. However, they may be profitable in markets targeting consumers that judge quality differently. By lowering the lead-time between production and consumption, local production offers an alternative to extending the shelf life of produce. The acceptance of fruit in local food distribution that does not conform to the quality standards marked by supermarkets can also decrease wastage due to rejected fruit.

g) Opportunity to increase plant and diet diversity. The use of alternative, non-commercial F&V varieties, promoted by some F&CL systems, provides an opportunity to replenish the plant diversity in horticultural production. The aspect of diversity is also of benefit to consumers, who can have access to food varieties that the conventional food distribution system does not offer. While it is not known whether this would lead to potentially better outcomes from a nutritional point of view, the benefits of a varied diet are well established (Royo-Bordonada et al., 2003).

h) Shorter transport and storage times. High-quality local products can be harvested at a more mature stage, while maintaining current shelf life levels (Berruto et al., 2009). This is the reason behind the fact that specialised fruit and vegetable grocers still hold a substantial share of the consumer market and supermarkets do not dominate this product category. In conventional supermarket chains, the product matures after it is harvested and over much larger time frames.

i) Decreased chain complexity and improved traceability. Shorter and less complex supply chains also mean decreased possibilities of produce contamination by pathogens, as compared to global, longer chains (FAO/WHO, 2008). Local produce is also relatively easy to trace since, often, the only links in the supply chain are the producer and the consumer. In particular, it is easier to trace the source of a problem when customers are dealing one-on-one with a farmer. Under these circumstances, any problem can be quickly identified and resolved (Berruto et al., 2009). It has been suggested that locally-grown food and dietary changes that complement the seasonal availability of these can reduce risks of diet-related chronic diseases (Wilkins and Eames-Sheavly, 2001).

j) Flexibility. Innovative concepts based on the principles of farmers' market could become the future distribution models for fresh produce in urban centres. Recently, a contest sponsored by GOOD, The Architect's Newspaper, The Urban & Environmental Policy Institute, CO Architects, and The Los Angeles Good Food Network in USA delivered over 60 original concepts to transform Farmers' Markets into a more viable option for city procurement, from a financial and environmental point of view ⁴⁵. The following concepts were particularly novel:



Farms on wheels

- *Farm on Wheels:* a mobile vending concept consisting of a fleet of electric trucks dispatched from three permanent markets, which double as stores and disperse fresh produce more effectively in Los Angeles.
- *The Urban Field Farm Stop:* an urban distribution system that uses existing channels of mass transit and bus stops to sell produce in L.A. It envisions the entire city map as a "decentralized farmers market", integrated directly with the mass transit circulation system of the city.
- *Hydroponic Farmers Market:* a site-specific concept for a hydroponic farm in San Francisco that harvests fog to feed a growing population.
- *The New City Center of Urban Farming:* a permanent farmers' market hub in Hollywood that makes the farm experience visible to urban residents with vending, greenhouses, social programs and educational facilities (also see the Farmers' Market Hub concept in Table 3.1, which is a similar concept).

3.3 Obstacles and challenges for F&CL initiatives

We have listed an extensive list of opportunities and challenges in Appendix 2. Some challenges for F&CL that are of particular importance are mentioned in the following paragraphs.



Hydroponic farmers' market

a) The changing definition of local. Many farmer and consumer-led initiatives are based on more direct relationships between regional producers and nearby consumers. However, there is no consensus as to what the most appropriate catchment areas might be. "Local food" means for some that the main food ingredient was grown in the same county or council. For others, "local" means

that the product was sourced in the same state or even in the same country (Department for Environment Food and

Rural Affairs, 2003). A survey in the UK showed that the idea of local could vary from food produced within 30 miles of the consumer, to country limits (*e.g.* England, Scotland or to Britain as a whole) (IGD, 2008). The flexibility of the "local" concept can be a positive

⁴⁵ <http://www.good.is/post/redesign-your-farmers-market-winners/>

characteristic from the point of view of organising such a venture and developing the necessary supply networks. However, consumers may feel misled if their understanding of “local” is different from the concept used by the company advertising “local food”.

b) Local F&CL distribution does not always mean sustainable food distribution.

The assumption that all types of local food systems are beneficial and sustainable has been challenged recently. For example, a study investigated the carbon emissions from a large-scale vegetable box system and those resulting from a system where the customer travels to a local farm shop. The study found that if a customer drives a round-trip distance of more than 6.7 km in order to purchase their vegetables, their carbon emissions are likely to be greater than the emissions from the system of cold storage, packing, transport to a regional hub and final transport to customer’s doorstep used by large-scale vegetable box suppliers (Coley et al., 2009). Other published work (Edwards-Jones et al., 2008; Jarosz, 2008; Lebel and Lorek, 2008; Webber and Matthews, 2008) have raised questions about the environmental credentials of some local food distribution systems.

c) Competition and economies of scale. In local food initiatives, small farming enterprises may have volumes above what they can sell within their local market. In these occasions, they often need to transport their goods to markets located in urban centres, which often present high congestion. The time and fuel spent in these activities is difficult to recoup and also adds to the chain carbon footprints (Webber and Matthews, 2008).

For larger producers, it is often not sensible to move high volumes of product through small distribution channels. Wholesalers and supermarkets are the most likely buyers.

With high metropolitan population concentration, there are also challenges in terms of responding to the highest demand for fresh, top quality, sustainable grown fruits and vegetables (generally in the metropolitan areas) with production of these F&V (generally in regional areas). Attempting to work with smaller population groups means that purchases are rarely enough to channel the entire production of food, except in the case of very small producers.

d) Lack of governance and certification processes for environmental food production and distribution. Although the Australian Competition and Consumer Commission has acted against misleading environmental claims (*i.e.* greenwashing) and marketing practices (*e.g.* portraying a product to be of local origin, having been sourced from non-local origins), this mechanism is only reactive and does not encourage proactive assurance of environmental practices. Even in cases where certification is available (*e.g.* organic and biodynamic products), this certification is provided by various private bodies and the minimum standards required to get certification may vary. In Australia there are seven certification bodies for organic food crops, namely: the National Association for Sustainable Agriculture (NASAA), Australian Certified Organic, Organic Growers of Australia (OGA), Organic Food Chain (OFC), Safefood Production Queensland, Tasmanian Organic-Dynamic Producers (TOP), and the Bio-dynamic Research Institute (BDRI) ⁴⁶.

⁴⁶ <http://www.organicguide.com/australia/organic-certification-and-labelling-in-australia/>

e) Consumers drivers to change. The willingness of consumers to eat seasonally, often with less control over selection, is a crucial challenge for local and seasonal food chains. Consumers may also need to potentially pay more than through conventional distribution channels.

Garnett (2007, 2008) suggested that, if the population was willing to change their habits to eat local seasonal products, then the need for long term storage and long distance transport of food could be reduced. However, it has been asserted that locally grown organic foods are primarily purchased by well educated and well-paid urban consumers, although a wide diversity of people buy food through these networks (Guthman, 2003; Weatherell et al., 2003).

It is yet unclear whether the wider consumer market (including medium and low income population) is ready to embrace food distribution systems that could bring environmental benefits, at the cost of changing their diets and purchasing habits. For example, a survey of 1,200 Australians revealed that political and ecological values in food purchasing decisions had a relatively minor role. Instead, the concept of 'naturalness'⁴⁷ was a dominant factor (Lockie et al., 2004). A more recent survey of 157 buyers in Victoria revealed that consumers that have environmental concerns have a more positive attitude to environmentally friendly food options (*e.g.* organic food). However, these attitudes were not found to be reflected in purchase intentions (Smith and Paladino, 2010).

An important observation of the aforementioned studies is that health and nutrition is a significant driver for consumer purchases. There is an opportunity to promote food produced under environmentally friendly systems (*e.g.* local and organic) by communicating their quality, taste and nutritional benefits as compared with conventionally produced foods (Lockie et al., 2004).

3.4 Lessons learned and applicability to future initiatives

Shoppers motivations to buy local food in the UK are largely based on three factors (Maton, 2010):

- a) Freshness: 57% of shoppers perceive local food to be fresher because it hasn't travelled as far.
- b) Economic factors: 54% want to support local producers, while many others see it as a way of supporting local retailers (34%) or keeping jobs in the area (29%)
- c) Environmental factors: Three in ten (30%) shoppers are motivated to buy local food because they think it is good for the environment as it hasn't travelled as far.

Therefore, it is important for F&CL initiatives that are based on local foods to clearly demonstrate and communicate the benefits that can be attributed to them, particularly in

⁴⁷ That is, food free of contemporary food treatments including genetic engineering, irradiation, pesticides, preservatives, animal growth hormones and antibiotics.

terms of the impact they have on the local economy and the freshness of their products (Edwards-Jones et al., 2008; IGD, 2008).

It is also important to clearly articulate what 'local' means in the context of each business to consumers. Given that freshness and health are the major drivers for the purchase of local foods, it is crucial to maintain the trust of consumers by ensuring that produce is truly 'local' and in season. Freshness is related to distance and time, therefore upholding 'local' values also maintains the environmental perspective in F&CL systems.

Increased local food production can be fulfilled in different ways depending on developments in the society regarding the use of time and space. Opportunities lie in:

a) Increasing communal gardens or organised cooperation with farmers in CSA schemes (Wallgren and Höjer, 2009). In terms of extending the availability of fresh, locally grown produce to a wider range of consumers, Jarosz (2008) suggested the following measures: locating farmers markets in ethnically diverse neighbourhoods, instituting federal and state subsidies enabling elderly and poor people to shop at farmers markets, and supporting initiatives to source locally grown foods in schools and other state institutions. Larger scale family operations, which involve extended families as part of the labour pool, have been showed to better stand the pressures of local production, because of the larger human resources pool and the reliance upon seasonal paid labour. However, they too must continually innovate and participate more intensively in specialty crop production and marketing, value-added products and direct forms of marketing. The pressures vary according to farm size and scale, crop mix and growing practices, labour demands and the needs and desires of individual farmers and their families (Jarosz, 2008).

b) The uptake of urban agriculture in vertical farms⁴⁸, urban greenhouses and rooftop agriculture. Advantage of growing crops in a controlled urban environment include the lack of animal vectors that transfer pathogens to the food via untreated manure; less susceptibility to weather-related disasters; and less likelihood of genetically modified "rogue" strains entering the plant habitat. Using sustainable farming practices, urban crops could be organically grown, decreasing the use of herbicides, pesticides, fertilisers and eliminating agricultural runoff (Chamberlain, 2007). At the moment, there is little Australian data regarding the use of green roofs⁴⁹.



An example of intensive crop growing for cities: the VertiCrop systems for lettuce
(<http://www.valcent.net/S/HDVGS.ASP?REPORTID=266563>).

c) The retention of peri-urban agricultural land, and potential of

modern urban / peri-urban protected production, as has been put forwards to the Committee in charge of the inquiry into

⁴⁸ www.verticalfarm.com

⁴⁹ <http://www.cityofsydney.nsw.gov.au/Environment/documents/ConsultantsRecommendations.pdf>

sustainable development of agribusiness in outer suburban Melbourne (Smith, 2009). The extended use of peri-urban greenhouse horticulture has to be tempered with the ability of this industry to optimise energy consumption and the economic, social and political factors on the use of peri-urban land.

Chapter 4: Retailer-led food distribution initiatives

!	<i>The direct and indirect GHG emissions of global retailers are significant. For example, Wal-Mart estimates that their total global GHG emissions are 210 Mt CO₂-e per year, including the activities developed by their suppliers (i.e. Scope 1, Scope 2 and Scope 3 activities⁵⁰).</i>
!	<i>In Australia, Woolworths estimates that their total global GHG emissions are 85.3 Mt CO₂-e per year, including the activities developed by their suppliers. This represents 13% of Australia's direct and indirect GHG emissions.</i>
!	<i>Cost-reduction is a major driver for sustainable retail-led distribution initiatives. For example, the supply chain consolidation of Woolworths led to financial savings of \$7 billion.</i>
!	<i>The effects of drought and severe weather events on the supply and price of foods are a threat to retailers' suppliers and therefore, a threat to the retailers' own sustainability.</i>
!	<i>Retailers in general support the establishment of an ETS and clear carbon reduction goals. However, their suppliers do not share this view. This may be due to the accounting of emissions produced by retailing activities: about 96.5% of the annual emissions as a result of Woolworths' activities are created by their suppliers. Wal-Mart estimates that 90% of their total global footprint lies on the activities of Wal-Mart's suppliers (Scope 3 emissions).</i>
!	<i>Consumer concerns on climate change do not necessarily translate into environmentally friendly purchases.</i>
!	<i>The influences of major supermarket chains can drive sustainable distribution strategies. However, the balance of market power between food suppliers, manufacturers and retailers works against this idea.</i>
📖	<i>The effect of lean and just-in-time distribution strategies on distribution GHG emissions, particularly in Australian conditions.</i>
📖	<i>Consistency in global carbon emissions accounting systems</i>
📖	<i>The financial payback of low carbon transport technologies and systems</i>
⚡	<i>Wider implementation of retail-led home delivery systems, which decrease the 'last mile' or the distance driven by consumers to purchase food.</i>
⚡	<i>Retail-led processes such as private label and category management can become a platform for vertical integration of environmental distribution initiatives. To ensure fair targets for each supply chain partner, a watchdog organisation either from industry or government could become the initiator of these collaborative approaches.</i>

The retailer-led initiatives investigated are summarized in Table 4.1. Figures 4.1 to 4.3 show the classification of these initiatives according to the three characteristics of importance discussed in section 2.1.

4.1 Drivers and motivations for retail-led initiatives

a) Financial reasons. In their search for cost-reduction, supermarkets are always looking for opportunities to make their transport networks more cost-efficient. For example, through their Project Refresh, Woolworths consolidated its deliveries between DCs and stores around the country and created its 31 state-based centres and product types (*e.g.* grocery, perishables, fresh, general merchandise) to 9 regional DCs and 2 national centres in 2006⁵¹. The project led to savings of \$7 billion⁵².

⁵⁰ See Glossary section for definitions.

⁵¹ [http://www.elitewinelogistics.com.au/SLDC%20Vendor%20Pack%20May%202008%20\(2\).pdf](http://www.elitewinelogistics.com.au/SLDC%20Vendor%20Pack%20May%202008%20(2).pdf)

⁵² <http://importanceofideas.com/wp-content/uploads/Portfolio/SCRMAR08b.pdf>

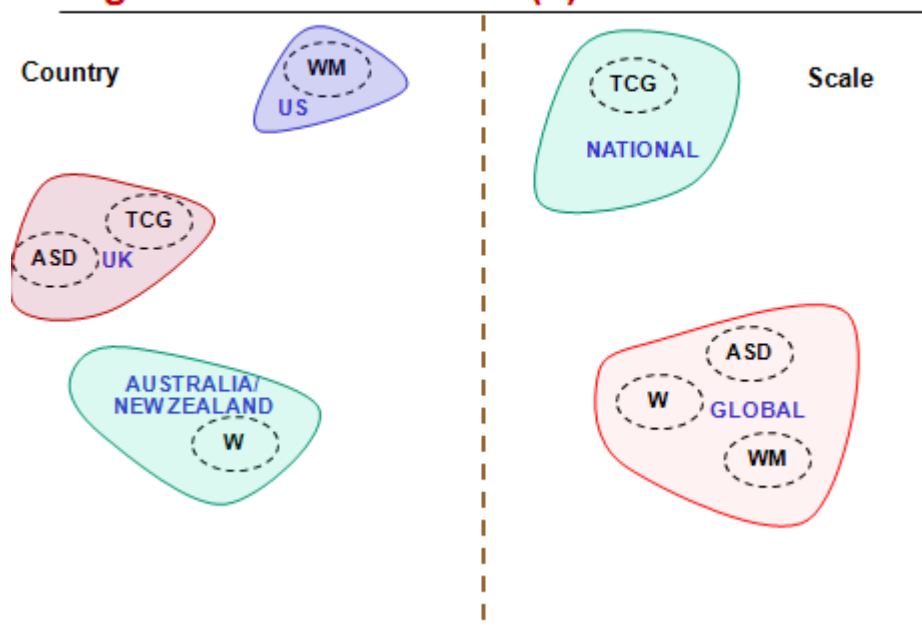
Table 4.1. Retail-led initiatives investigated in this chapter.

Company	Distribution strategy
Woolworths' (W)	The Woolworths Environmental Sustainability plan aims to achieve an overall 40% CO ₂ -e reduction by 2015 (on projected growth levels), and specifically a 25% reduction in CO ₂ -e per carton delivered by 2012 through the reduction of distance travelled, the introduction of new vehicle designs, the use of alternative fuels and the use of hybrid trucks.
Wal-Mart (WM)	The Wal-Mart's Sustainability 360 initiative (USA) aims to reduce the number of trucks by re-designing the supply chain network, changing the presentation and size of food products and using auxiliary power units in their truck fleet.
The Co-operative Group (TCG—see Table 3.1)	Although this initiative was analysed in the F&CL section, CG is also a retailer-led case. See characteristics in Table 3.1.
ASDA (ASD)	<p>ASDA is a business unit of Wal-Mart and is the second largest supermarket chain in the UK, after TESCO. ASDA has a target to decrease their fleet emissions in 40% with respect to 2007 levels by the end of 2009. To achieve this goal, ASDA is reducing empty truck runs by increasing the number of backhaul trips –redirecting empty trucks on the road to collect supplier's shipments for delivery to DCs. ASDA's fronthaul initiative see suppliers directly delivering ASDA's goods to stores, when suppliers' drivers are already headed to that destination. Total road mileage saved in 2008 through these efforts was 8 million miles and eliminated the production of 10,222 tonnes of CO₂-e. ASDA is also using trains, double-trailers and software to analyze driving patterns and their effect on fuel efficiency⁵³.</p> <p>ASDA sources 90% of the meat and fresh produce from British farmers.</p>

Another angle of financial aspects is the connection between a company's valuation in the share market and its environmental and social credentials. There are funds that target primarily "ethical investments". Environmental, social and governance performance may be now part of the assessments of investors, as companies that focus on climate change strategies and a broader sustainability focus are perceived as better long-term managers of risk and opportunity, and therefore as better investment choices (PricewaterhouseCoopers, 2009).

⁵³ http://walmartstores.com/sites/sustainabilityreport/2009/en_logistics.html

Organisational structure (a)



Organisational structure (b)

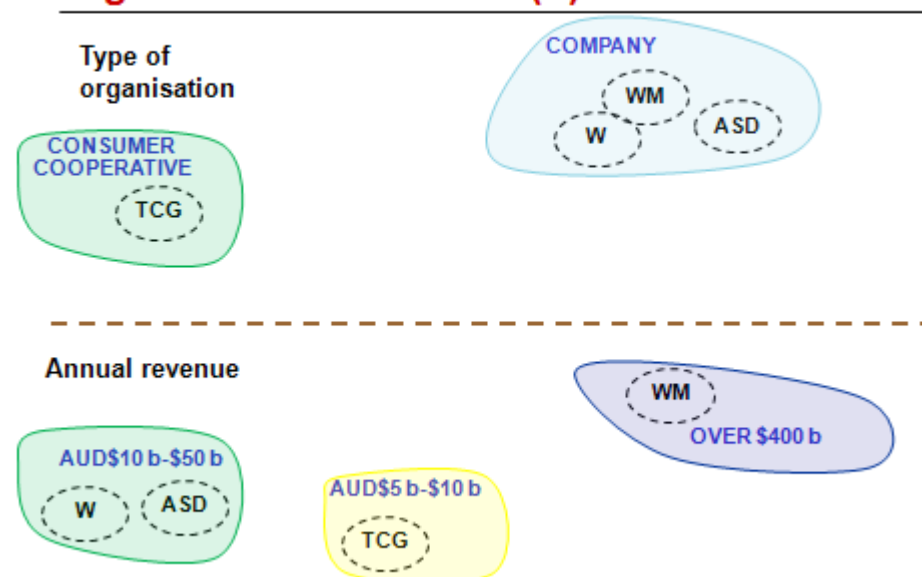
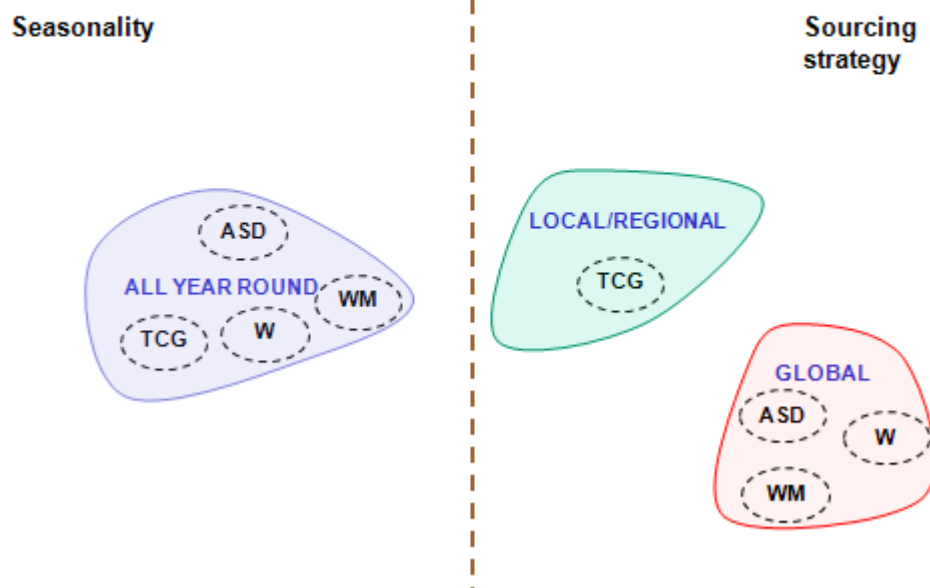


Figure 4.1. Categorisation of retail-led initiatives, depending on their organisational characteristics: (a) country and scale; (b) type of organisation and revenue.

Supply chain structure (a)



Supply chain structure (b)

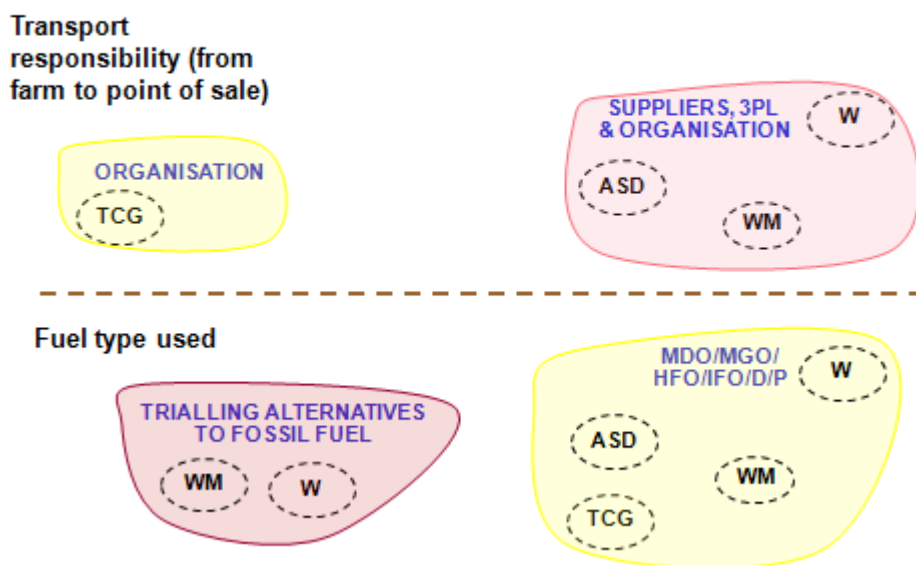


Figure 4.2. Categorisation of retail-led initiatives, depending on their supply chain characteristics: (a) seasonality and sourcing strategy; (b) transport responsibility (from farm to point of sale) and fuel type used.

Mission

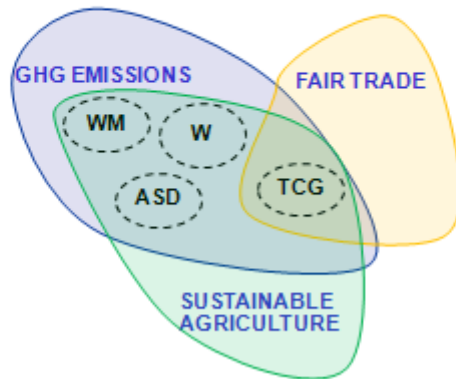


Figure 4.3. Categorisation of retail-led initiatives, depending on their type of mission.

b) Climate change and the impact on food chains. As Creese and Marks (2009) pointed out, climate change is becoming a risk management issue for retailers and they are investing accordingly.

The effects of drought and severe weather events on the supply and price of foods are a threat to Woolworths' suppliers and therefore, a threat to their own sustainability. As a Woolworths spokesman stated:

"For Woolworths to manage the physical impacts of climate change, significant investment in infrastructure will be required" (PricewaterhouseCoopers, 2009).

Woolworths is investing in sustainable farming practices to increase productivity and efficiency in primary production, through a sustainable farming fund (in partnership with Landcare Australia) and the Fresh Food Grants. Through this fund, Houston Farms and Horticulture Australia are developing a carbon footprint tool for salad processors, which includes distribution as part of the activities assessed (Mardirossian, 2009).

The potential impact of climate change on retailers may be one of the reasons why many of them have continued their sustainability plans, in despite of the global financial crisis. For instance, Tesco plans to spend over US\$159 million with British green technology companies over 2010, as it steps up its drive to halve carbon emissions by 2020 ⁵⁴.

c) Consumer confidence and company's reputation. A recent report examined the responses to climate change by Government, consumers and retail value chains (Creese and Marks, 2009). The authors concluded that retail chains invest in climate change strategies to differentiate themselves from competitors.

David North, consumer and government director at Tesco, has stated that there is a strong commercial reason to develop sustainable supply chains:

⁵⁴ <http://smallbusiness.uk.reuters.com/2010/02/03/tesco-to-spend-100-mln-on-green-technologies/>

"The supply chain is the big prize. We think that in the future many of our customers are going to care about this: we think this will be an area of competitive advantage." (Tieman, 2010).

Woolworths' research suggests that there are gaps between consumer attitudes and behaviour. As the company states in its website:

*"Compared with the UK and US, a greater proportion of Australian consumers say that they are willing to take more challenging steps. [...]. Woolworths' sales data reflects the gap between consumer attitudes and behaviour. Consumers make purchasing choices based on a number of factors such as utility, quality, value and health, and not just environmental attributes, so more information on environmental characteristics does not necessarily translate to buying behaviour change."*⁵⁵

While supermarkets may be skeptical about how far environmental aspects drive actual consumer purchases, they are also aware of the growing public and media awareness of climate change and its potential long-term effects on the planet and food supplies⁵⁶.

d) Impact of a possible future carbon price. Given that agriculture is excluded from a future Australian ETS, that the introduction of a CPRS has been delayed until 2013 and that supermarkets are not permit liable under the proposed CPRS scheme (Mardirossian, 2009), the regulatory pressure has momentarily lost some importance as a driver of change.

The lack of regulation for voluntary carbon markets has also caused concerns about whether they can or will have any real impact on carbon reductions. Examples of this position include Neil Sachdev, commercial director of J Sainsbury, who stated that carbon offsets passes the problem to a third party: *"It makes more sense to focus on energy efficiency, where there are clear economic and environmental savings."* Sainsbury did offset the emissions linked to the construction of a new building three years ago, but *"It only reinforced our belief that energy reduction is a more efficient way to spend our money"*⁵⁷.

Retailers in general support clear carbon reduction goals. For example, Tesco's Chief Executive Terry Leahy stated that *"It would have been better if there had been clear binding targets (set by governments) against which all businesses could set their own targets"*⁵⁸.

In Australia, political/regulatory aspects triggered Woolworths to develop aggressive plans to tackle their emissions in 2007. As Michael Luscombe, Woolworths CEO, explained when he unveiled his plans to decrease 40% emissions by 2015:

"The Government and Opposition are each working towards carbon reduction targets, and our business may be significantly affected by any decision." (Luscombe, 2007).

Woolworths essentially supported the introduction of an ETS instrument. The organisation states in their website:

⁵⁵ http://crreport08.woolworthslimited.com.au/climate_change.php

⁵⁶ http://woolworthscrr09.reportonline.com.au/summary_of_performance.php

⁵⁷ <http://www.timesonline.co.uk/tol/news/environment/article6078141.ece>

⁵⁸ <http://smallbusiness.uk.reuters.com/2010/02/03/tesco-to-spend-100-mln-on-green-technologies/>

"Woolworths is supportive of well balanced and compatible emissions trading schemes for Australia and New Zealand and recognises that emissions reporting regulations such as the NGER are essential for an emissions trading scheme."⁵⁹

Interestingly, Australian food manufacturers do not share this view, as discussed later in Chapter 5. This may be due to the same issues observed with Wal-Marts footprint: according to the latest Carbon project Disclosure report, Woolworths' carbon footprint (scope 1 and 2 emissions) amount to 3.1 Mt CO₂-e per year. However, Scope 3 emissions⁶⁰ are calculated to be 85.3 Mt CO₂-e. Therefore, 96.5% of the annual emissions as a result of Woolworths' activities are created by their suppliers.

There will be CPRS-derived cost impacts in the form of energy and gas increases, refrigerant gas, waste disposal and cost increase for all food supply chain (Mardirossian, 2009). Given that effective strategies that decrease these costs and distribution emissions require collaborative retailer –supplier approaches, tensions between these two players can be a barrier for the implementation of these strategies.

CASE STUDY: WAL-MART STORES INC

Walmart has 8,446 retail units under 55 different banners in 15 countries. In the fiscal year 2010, Wal-Mart had sales of \$405 billion. Wal-mart employs more than 2.1 million people worldwide.

Wal-Mart is the largest retail group in the world. Their direct and indirect emissions (or Scope 1 and Scope 2 emissions, respectively) account for 21 million tonnes CO₂-e per year, globally. However, Wal-Mart estimates that 90% of the total retailer's footprint lies on the activities of Wal-Mart's suppliers (Scope 3 emissions). Scope 3 activities would represent 189 MtCO₂-e, bringing the total carbon footprint of Wal-Mart and suppliers to 210 Mt CO₂-e (PricewaterhouseCoopers, 2009). To place some context around this figure, this represents more than a third of Australia's entire carbon footprint (583 Mt CO₂-e).

In 2009, the retailer introduced a supplier sustainability assessment which includes disclosure of GHG emissions measured in the past financial year.

Fleet improvements

In the US, the Logistics Division plans to double the efficiency of the fleet by 2015. A mechanism to achieve this is the reduction of distances driven and loading trailers more effectively. This measure improved the fleet efficiency by 60 % in 2009, compared to the 2005 baseline. Including all carriers, 77 million more cases were delivered in 2009 than the previous year, while eliminating more than 100 million miles and 145,000 t CO₂-e. Other improvements include the installation of fuel saving devices in trucks, improving engine calibration, installing auxiliary power units (APUs), the use of aerodynamic truck designs and the use of alternatively fuels.

In particular, APUs have been helpful to decrease the number of hours that the truck remains idle: the driver can control the cabin's air conditioning system as a separate action

⁵⁹ http://crreport08.woolworthslimited.com.au/climate_change.php

⁶⁰ See glossary in Page 6 for definition.



to the truck's engine. In traditional trucks, air-conditioning is linked to the main truck's engine.

In Arizona, Wal-Mart is testing 15 hybrid trucks retrofitted to run on reclaimed brown waste cooking grease. The waste grease is being collected from Walmart stores.

Wal-Mart also plans to test a diesel-electric hybrid system around Detroit. This dual-mode diesel hybrid is believed to be the first

of its kind. It has both a mechanical and electrical propulsion system. The electric motor is used mostly for low speeds with high demands, such as accelerating after stopping. Once moving, the mechanical propulsion begins working with the electric motor until reaching highway-like speeds, at which point diesel is used as the main source of energy. Similarly to other hybrid trucks, the brake-energy is captured and stored in a battery. This energy is later used to assist the diesel engine.

Another interesting technology is the adoption of nitrogen gas to fill the truck's tyres. Constant air pressure in the tyres is important to achieve maximum fuel efficiency when the truck is on the road.

In Japan, Seiyu (a Wal-Mart's store) is set to reduce the amount of fuel required to carry one tonne of goods one kilometer by 25 % by 2012. Between 2006 and 2009, they achieved this by transporting 29 % more goods over the same amount of distance through more efficient routing and loading techniques for trucks, and by consolidating distribution centers and deliveries.

Source: <http://walmartstores.com/Sustainability/7951.aspx>

4.2 Innovative aspects and opportunities for retail-led initiatives

There are several areas where retailer-led initiatives have developed innovative strategies to decrease the impact of food distribution. We have categorised these as supply chain strategies, waste handling, packaging development and carbon footprinting/labeling.

a) Catalytic force for change in food chains. Supermarket chains are formed by alliances of growers, manufacturers, logistics providers and retailers. In Australia it has been argued that the balance of power in this chain is tilted toward supermarkets and that this can lead to decreased innovation⁶¹. However, it has also been argued that environmental supply chain dynamics take place if there is a channel leader with sufficient channel power over their suppliers, technical competencies, and specific environmental pressure is exerted (Hall, 2000).

Given these facts and that supermarkets are the "last frontier" between the commercial food chain and the consumer, it would be fitting that retailers adopt the role of environmental

⁶¹ <http://www.theaustralian.com.au/business/industry-sectors/woolies-supermarket-power-proves-hard-to-wear/story-e6frg9h6-1225767235943>

innovators in the industry. Initiatives where this model has worked in Europe and in the US include changes in packaging (see Appendix 3), working with third party transport companies and carbon footprinting (also discussed in this section).

An example of this approach is the Wal-Mart's recent announcement on their goal to eliminate 20 million metric tons of greenhouse gas (GHG) emissions from its global supply chain by the end of 2015. The fact that Wal-Mart has more than 100,000 suppliers and works in 15 countries gives it tremendous influence among makers of all kinds of products (D'Innocenzio, 2010).

Further, retail businesses go beyond supermarkets to encompass a range of other services, including financial services, restaurants, liquor and petrol stores. In terms of the impact on the later, Tesco presents a good example because they are the UK market leader in the sale of biofuels to customers. Tesco offers a 5% bioethanol mix at 185 petrol stations at the same prices as standard unleaded. About 181 of their filling stations in England have been converted to biodiesel and there are plans to increase this number to over 300 in the next year.

Direct investment of retailers into primary production is another mechanism of supplier engagement on environmental initiatives. Examples include the recently unveiled Sustainable Agriculture Programme of Marks & Spencer, which will engage 10,000 farmers⁶². M&S will also engage all its food suppliers with a balanced scorecard that includes social, environmental and lean manufacturing requirements.

b) Cold chain innovation. Supply chain strategies include the use of refrigerated warehouses and transport for the distribution of perishable foods. Woolworths is the largest operator of refrigeration in Australia –both in stores and in their supply chain (Luscombe, 2007). Woolworths produces about 3.2 million CO₂ –e in refrigeration and air conditioning, or about 8% of the total GHG emissions from the Australian refrigeration and air conditioning sector (Estrada-Flores, 2008). Woolworths is targeting a reduction in refrigeration energy consumption through the use of co-generation and the installation of cascade systems using carbon dioxide as refrigerant. Woolworth's is also consolidating ambient and temperature-controlled product in the same trucks.

Some Coles stores have also switched to natural refrigerant systems and incorporate twin air screens and manual night blinds in the refrigeration cases for energy savings. A store at Flemington in Victoria makes use of rainwater capture from the roof for landscaping, roof and wall insulation to reduce reliance on air-conditioning⁶³.

Wal-Mart is using secondary-loop systems and the use of glass doors on refrigerated cabinets to decrease their refrigeration energy consumption.

c) Transport innovation. Transport fuels account for 14.5% of Woolworths' total emissions⁶⁴ and the supermarket is targeting a reduction of 25% in this footprint by 2015. To achieve this, Woolworths is establishing a number of measures. For example, in the

⁶² <http://plana.marksandspencer.com/we-are-doing/climate-change/stories/84/>

⁶³ <http://www.coles.com.au/About-Coles/Community/Community-Sustainability-Report/Report.aspx>

⁶⁴ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Woolworths_Limited_8440_Corporate_GHG_Emissions_Response_CDP7_2009.asp

second half of 2009 Woolworths contracted a 3PL which operates a fleet run on 20% biodiesel, made from reclaimed waste tallow. Biodiesels, liquified natural gas and compressed natural gas are also being tested in Woolworths-owned trucks ⁶⁵.

On average, Woolworths is responsible for 100,000 truck movements every month, and the movement of 80 million boxes. However, Woolworths is developing a more accurate baseline data for their vehicles and those provided by 3PLs. Other measures include the reduction of kilometres travelled, improved vehicle aerodynamic design, and use of alternative fuels (*e.g.* biodiesel). Woolworths has also reviewed their recyclable crate sizes to maximize pallet loads. The company expects to increase the use of these crates to 3 billion in their supply chain pool in the next years.

The redesign of the Tesco distribution network (UK), which aims to reduce 50% emissions per case by 2012 is another example of innovation in distribution. Tesco holds over 76,000 SKU's and 95% of volumes delivered via centralised distribution. Its current supply chain infrastructure includes 29 warehouses and over 2,000 vehicles travelling 659 million km across the primary and secondary transport operations.

In Shrewsbury, a town with a population of 67,000, Tesco is running a trial to do all home deliveries using fully electric vans only. This is expected to deliver a saving of 100 tonnes of CO₂ –e per year, on top of the 6,000 customer car journeys that each delivery van already saves each year. Tesco is also investing in double-deck trailers, which carry up to 80% more products per load⁶⁶.

Tesco is also switching to rail for transporting goods from their Daventry depot to Scotland. They are urging the Government to build on their commitment to rail as an alternative to road for moving goods around the country.

In terms of carbon footprints, Tesco is measuring the carbon footprint of three of its major food categories (tomatoes, potatoes and orange juice).

ASDA is using vehicle telematics to collect information on engine and driver style performance ⁶⁷. From 2007 to 2008, the improvement through telematics and retraining of drivers to become aware of diesel use led to a 6% decrease in miles driven per gallon.

The Co-operative Group decided not to actively pursue biofuel as an alternative to fossil fuel for their distribution operations, in recognition of the adverse environmental impacts that certain biofuel feedstocks can have, and the uncertainty in the biofuels supply chain, which makes selection of feedstocks that meet sustainability criteria very difficult. Further, TCG argues against any unmerited focus on the mode of transport (particularly airfreight) or food miles, given the wider impacts of product lifecycle (including cultivation and processing) and the ethical impacts of limiting food imports to the UK for developing exporting countries. Instead, TCG is focusing on reducing road distribution mileage by better networks and trip planning, plus improving their carbon accounting systems for transport activities (The Cooperative Group, 2009).

⁶⁵ http://woolworthscrr09.reportonline.com.au/climate_change.php

⁶⁶ <http://www.tesco.com/climatechange/speech.asp>

⁶⁷ <http://www.igd.com/index.asp?id=1&fid=5&sid=43&tid=59&foid=52&cid=1154>

d) Local sourcing.⁶⁸ The appeal of local food can translate into an increase in the consumer's market share for food retailers. The "Von hier" (transl. *from here*) private label brand from the German retailer Feneberg is an example⁶⁹. The project is a joint initiative of the retailer, growers/farmers and social organisations from Brandenburg and Berlin. Mostly organic products are sourced within a radius of 100 kilometres from the retailer's headquarters. Approximately 300 organic farmers and 15 producers form part of the "Von hier" project that guarantees clients that beef, eggs, vegetables and fruit are of local origin. The market share of these regional products in the Feneberg supermarkets is about 20%, which is significant (Whitelegg, 2006).

Another retailer responding to consumer demand for 'local' food is ASDA, which currently has over 6,500 local lines on its shelves across the UK and has recently invested over £80,000 in researching its customers' views on local food⁷⁰. Local foods are credited with increasing overall sales in ASDA's UK operations, with many lines outselling ASDA own label products⁷¹. ASDA has 9 hubs working in 14 regions around the UK, working with local suppliers to guide them through the ASDA accreditation process. The hubs act as a single distribution point and ASA estimates they save on average 3 million food miles a year through this model.

Tesco stocks approximately 3,000 local lines and work with over 480 local and national suppliers. In 2008, local produce accounted for £624 million or 2.2% of UK sales, compared with 1.7% the previous year. This is a 30% increase in sales compared to 2007⁷². Tesco classes a product as local if it has been produced in that county or a neighbouring one. Tesco sources Scottish, Welsh and Northern Irish local products from within those areas. These criteria mean that some local products may only be available in one or two stores. Products may be famous, iconic lines or simply produced in that area to be considered local. Local products can be branded or unbranded.

Woolworths has also shown interest in the 'local' and organic market, by acquiring Macro Wholefoods, now running under the brand Thomas Dux. Right now Thomas Dux's stores are a modest component of Woolworths stores (there are 11 stores in Sydney and Melbourne), but there are plans to expand the brand's presence (Woolworths Ltd, 2009a).

Thomas Dux is a specialized retail business that sources its fruit and vegetables from the Sydney and Melbourne Markets in a daily basis. Although there are some statements in their website that indicate that they are working to some extent with local growers in some seasons, some of their specialty goods and ingredients are sourced globally. Thomas Dux is therefore not a true 'local food' business, although it has the potential to be marketed as such.

Coles is also working toward achieving local credentials, through sourcing some products from the same regions where stores are located. For example, a range of locally grown tomatoes from Cooyinda Park can be found at the Coles Belmont stores on High Street as

⁶⁸ As discussed earlier, 'local' can and is used to represent very different geographic scales within different projects.

⁶⁹ <http://www.feneberg.de/index.php?id=92>

⁷⁰ <http://www.talkingretail.com/news/industry-news/12432-local-food-sales-boost-for-asda.html>

⁷¹ <http://www.farma.org.uk/news/37-news/122-supermarkets-asda-local-food-sales-up-41>

⁷² http://www.tescopl.com/plc/corporate_responsibility_09/suppliers_ethical_trading/local_sourcing/

well as at Coles stores in Waurin Ponds, Corio Village, Geelong Bay City and Geelong West. Similarly, Coles stores in Toowoomba now buy avocados from locally-based supplier Balmoral Orchard, while Rugby Farms is now supplying vegetables including broccoli, iceberg lettuce and cauliflower to Toowoomba and Coles Gattin⁷³. While the exact logistics of these products is not known, it is assumed that the products bypass the normal distribution system where all products go to a distribution centre before being transferred to particular stores. In addition, Coles catalogues now display the 'locally grown' Australian-made logo.

There are innovation areas that have an indirect relationship with food distribution strategies. These are discussed in Appendix 4.

4.3 Obstacles and challenges for retail-led initiatives

a) Financial payback of low carbon transport technologies. In 2008-09 Woolworths trialled hybrid trucks for home deliveries, but concluded that the use of hybrid trucks and the fuel savings at that stage could not justify the higher cost of investment required to purchase the trucks (Woolworths Ltd, 2009b). This decision was taken despite the fact that the crisis has not substantially affected Woolworths' growth plans and continues to open stores, in line with their strategy⁷⁴.

b) Inconsistent approaches to carbon reduction targets and mismatch on the support of chain partners to a Carbon Pollution Reduction Scheme. The failure of the Copenhagen Climate summit in developing clear targets and ways to achieve a reduction of global emissions was one major reason given by the Australian Government to introduce a 3-year delay in the implementation of the CPRS⁷⁵. This has increased uncertainty for parties working towards the development of low carbon solutions for food distribution.

It is not clear what is the level of support of global food manufacturers to an ETS or any other instrument of emissions reduction. For example, in the UK the Food and Drink Federation (FDF) stated that the industry had been looking to Copenhagen for a legally binding agreement that would encourage the development of new low carbon technologies⁷⁶.

However, the AFGC (which represents local and global food manufacturers in Australia) is not supportive of the proposed CPRS. Given these differences between manufacturers and retailers, tensions could arise if a CPRS is introduced in the future.

c) Consumer attitudes. As discussed earlier, consumer awareness in climate change does not necessarily translate into environmentally friendly purchases (Creese and Marks, 2009). Some indicators suggest that the decrease of food carbon emissions does not seem to be as important as food safety, obesity, or the use of genetically modified foods⁷⁷. Given that supermarkets will direct their efforts to those areas relevant to consumers, the level of

⁷³ <http://www.coles.com.au/LinkClick.aspx?fileticket=Ihr3xTBe9Ns%3D&tabid=101>

⁷⁴ http://woolworthscrr09.reportonline.com.au/public_interest.php

⁷⁵ <http://theland.farmonline.com.au/news/nationalrural/agribusiness-and-general/political/climate-chief-defends-copenhagen/1841826.aspx>

⁷⁶ <http://www.confectionerynews.com/The-Big-Picture/Food-industry-attacks-weak-Copenhagen-climate-change-deal>

⁷⁷ <http://blog.hunterpr.com/post/2009/12/22/Survey-Reveals-Top-Food-Stories-of-2009-and-the-Decade.aspx>

consumer awareness and concern on the impacts of food distribution on the environment is a key factor of change in the food industry.

Coles acknowledges that their interest in local foods is a response to consumer sentiment: *"We have increased local sourcing of produce where this is consistent with consumer preferences"*⁷⁸. Similar comments were made in response to the claims that the quality standards for bananas channeled through supermarkets had led Australian growers to discard a third of the crops harvested. A Woolworths spokesperson stated: *"As with everything we sell it's our customers who make the final decision and it's their buying decisions over many years that inform our banana specifications"*⁷⁹.

d) Lean thinking and just-in-time strategies do not always lead to lower transport carbon footprints. Lean thinking is a systematic approach to developing business processes with the aim of doing more with less while coming as close as possible to providing customers exactly what they want, when and where they want it (Venkat and Wakeland, 2006). Just-in-time (JIT) is the backbone of lean manufacturing systems⁸⁰.

Although it is reasonable to expect that lean processes (which aim to eliminate wasteful activities) should align by definition with a lower carbon footprint, this is not always the case. In principle, Lean supply chains should lead to lower emissions due to reduced inventory levels and the elimination of inefficiencies in distribution (Christopher, 2005). However, they also require frequent replenishment at every point in the supply chain. If a lean supply chain is located entirely within a small region, then it would have low levels of inventory and short shipping distances. As distances increase along the supply chain, the extra energy needed for transporting more partial loads may be less than that associated with stockpiling products in cold storage for greater durations, making lean operations less attractive (Cholette and Venkat, 2009). This issue needs to be further explored in the case of Australia, where long transport distances are the rule rather than the exception.

e) Level of trust and transparency in the retail supply chain. It has been suggested that one of the potential mechanisms to increase environmental initiatives in food supply chains is the use of supermarket influences to drive those changes⁸¹. However, the balance of market power between food suppliers, manufacturers and retailers works against this idea. This aspect was discussed in Section 3.1, where we stated that the ACCC report did not appease concerns of grocery suppliers and the overall sentiment of a lack of transparency in the Australian grocery chain and the dominance of retailers remains (West, 2008). Creating the required level of communication, trust, commitment and interdependence required for environmental change calls for significant political and organisational efforts, which may be better handled by a third party (*e.g.* an association or a governmental body).

⁷⁸ <http://www.coles.com.au/About-Coles/Community/Community-Sustainability-Report/Report.aspx>

⁷⁹ <http://www.brisbanetimes.com.au/business/banana-size-shouldnt-matter-minister-20100120-m1g6.html>

⁸⁰ http://www.leanmanufacturingconcepts.com/LeanTool_JIT.htm

⁸¹ <http://www.abc.net.au/rural/qld/content/2010/05/s2898633.htm>

4.4 Lessons learned and applicability to future initiatives

The last paragraph highlighted the challenges presented to develop the level of cooperation and integration in food supply chains necessary to achieve a balanced uptake of innovations.

Having said this, if these obstacles are surpassed through the establishment of fair targets for each supply chain player and perhaps a watchdog organisation that ensure fair dealings, there is potential for supermarkets to lead change to reduce the environmental impacts of modern food distribution systems.

The influence of supermarkets on the food chain cannot be overestimated: supermarkets sell over 60% of staple foods across several categories (Woolworths Limited, 2008). Further, private labels account for about 34% of the total grocery bill paid by low-income consumers. The increase of the market share of private label in the consumer's food basket is likely to increase in the short term⁸². Given that these products are manufactured under direct specifications of retailers, private label products can be potentially used as a platform for vertical integration of environmental distribution initiatives, from suppliers to retailers. Category management is another platform that could be use in the same way.

An area of largely untapped opportunity in Australia is retail-led home delivery systems, which decrease the need of consumers driving to stores to purchase food. The benefits of internet delivery channels in decreasing consumer carbon footprints have been investigated in the UK (Edwards and McKinnon, 2009), although no studies related to their implementation in Australian cities have been undertaken. The potential growth for online purchases and home delivery is estimated in 20% per annum in several Western economies (World Economic Forum, 2009). Considering that an average household in Australia carries out over 80 annual food shopping trips (Marquez et al., 2010), the potential carbon emissions savings in this segment is considerable. This is a direct retail-led measure that is achievable by retailers and their 3PLs alone.

As with innovations discussed in the other chapters, there is a need for the full costs and benefits of different approaches to be considered. For example, while the increase in private labels may enable supermarkets more control over supply chains and potentially increased efficiencies, there are concerns that they reduce consumer access to information about products and reduce the ability of producers or food businesses to negotiate fair prices. Similarly, while home delivery models may reduce the emissions associated with food transport, for some communities they could contribute to social isolation. When health and community development objectives are being considered, more distributed outlets that enable active transport (walking and cycling) and encourage social interaction may be preferred.

⁸² IBISWorld 2010

Chapter 5: Global manufacturer-led initiatives

!	<i>Global manufacturers are exposed to regulatory risks and costs through mechanisms/policies that affect the entire value chain, including raw material production (e.g. biofuels policies), transportation, product design and use and consumer habits</i>
!	<i>The GHG emissions of many highly processed food products are concentrated in the production of raw materials or in the consumers' use and disposal of products. These Scope 3 emissions, defined as emissions not directly controlled by manufacturers still need to be accounted for as a direct consequence of the product's manufacture.</i>
!	<i>It is difficult to place an average percentage on the contribution of distribution activities for processed products, because these are highly dependent on the raw materials used.</i>
!	<i>The cumulative GHG emissions of seven major global manufacturers investigated in this Chapter amounts to 24.3 Mt CO₂-e per year.</i>
!	<i>While global food manufacturing companies are actively engaged in collaborative efforts to decrease the impact of distribution, Australian-based companies are lagging in these efforts.</i>
!	<i>The use of ISO 14001 standards in Australia is relatively small, with a total number of certifications of 1,125 in 2008. This modest uptake does not seem to be enough to push the food sector towards environmental stewardship.</i>
📖 ↗	<i>Potential for collaborative freight initiatives between manufacturers and between manufacturers and retailers in Australia.</i>
📖	<i>The reasons of disagreement between statements supporting carbon reduction measures made by the global offices of manufacturers in the Carbon Disclosure Project and the statements made through their AFGC representation.</i>
↗	<i>The global reach of large food manufacturers means that their potential to achieve reductions in GHG emissions is large. For example, a commitment of 20% reduction in GHG emissions by the seven major manufacturers amounts to 4.9 Mt CO₂-e per year.</i>

Table 5.1 summarises some of the distribution strategies adopted by global food manufacturing companies.

Table 5.1. Food distribution initiatives of eight of the largest global food manufacturers.

Company	Sustainable distribution strategies
Nestlé S.A. (NES) <ul style="list-style-type: none"> • 2008 sales were US\$103.9 billion • Employs around 283,000 people • Have factories or operations in almost every country in the world 	<p>Nestlé have initiated a pilot with Schenker, an international logistics company, to evaluate the effect of different types of transport, distances driven and fuel type used. Through internal R&D there was a reduction of 326,300 tonnes of packaging material between 1991 and 2007.</p> <p>In the UK, Nestle is participating in the Sustainable Distribution Group (IGD) to reduce transport impacts. Collaboration with customers (e.g. ASDA) and other food manufacturers (e.g. United Biscuits) has resulted in reductions of the empty running of vehicles.</p>
Pepsico (PEP) <ul style="list-style-type: none"> • One of the world's largest food and beverage companies • 2008 annual revenues of more than US\$43 billion • Products are sold in approximately 200 countries • More than 300 bottling operations worldwide • More than 4,300 operations 	<p>Pepsico is currently assessing the impact of its distribution operations. For example, Tropicana (a Pepsico orange juice manufacturer) and The Carbon Trust estimate that 79% of their carbon footprint comes from growing and juicing (57%), and cross- Atlantic shipping (22%).</p> <p>Pepsico is a member of the SmartwaySM Transport Partnership in the US. The combined efficiency and fuel conservation projects have driven reductions in fuel use of nearly 56.8 million litres of diesel, eliminating 154,200 tonnes of CO₂ emissions.</p> <p>Another strategy is the optimisation of their combined transport network. For example, Quaker Oats (Pepsico's cereal company)</p>

(plants, distribution centres, warehouses and Offices) worldwide	has its milling site in Fifer, Scotland. Walkers trucks (Pepsico's brand for crisps in the UK) delivering product to Fife pick up Quaker products and go back to the main DC full, thus avoiding empty runs. Future plans include using the byproduct (husks) of the Fife plant for electricity production. This means that the oat husks will no longer have to be transported away from the site. This will reduce the number of truck miles by over 172,000, further reducing their carbon emissions by 600,000 kg annually ⁸³ . Quaker will also switch road transport to electric rail to transport porridge oats from its factory in Scotland to its storage depot in Lutterworth, Leicestershire ⁸⁴ .
Kraft Foods Inc. (KF) <ul style="list-style-type: none"> • World's second-largest food company • Approximately \$50 billion in revenues • Sales in approximately 160 countries • 25%+ of global revenue from emerging markets 	<p>In the US, Kraft recently purchased ten all-electric transport refrigeration vehicles⁸⁵. The UK branch is working with key transport providers on a programme focused on five areas: inbound transport of goods to warehouses, outbound transport from warehouses to customers, technology to improve vehicle and fuel efficiency, alternative transport modes (<i>i.e.</i> a move from road to rail) and collaboration with other manufacturers or carriers⁸⁶. Kraft also used transportation management software from Oracle to cut empty miles from its private fleet trips last year.</p> <p>Overall, Kraft Foods took 50 million truck miles out of its global distribution operations through a broad effort to overhaul shipping strategies and make its supply chain more efficient (Anon., 2009a).</p>
Unilever N.V. (UNL) <ul style="list-style-type: none"> • Turnover in 2008: €40.5 billion • 174 000 people employed in around 100 countries worldwide • Global market leader in Savoury and Dressings, Spreads, Weight Management, Tea, and Ice Cream. • 270 manufacturing sites across six continents 	<p>Unilever's own assessment in 2007 showed that their transport and distribution emissions is around 4 million tonnes of CO₂ –e per year. In 2008, Unilever and Tesco co-chaired the haulage element of the Sustainable Distribution Group (IGD) to reduce transport impacts.</p> <p>Unilever owns over 2 million point-of-sale ice cream cabinets worldwide. They have been replacing these with more energy-efficient and climate-friendly alternatives. By early 2009, they had around 400,000 hydrocarbon refrigerant cabinets in use⁸⁷.</p>
The Coca-Cola Co. (CCC) <ul style="list-style-type: none"> • Product sold in over 200 countries • Over 3,00 beverage types • Employs 94,400 people • Turnover of US\$5.8 billion in 2008 	<p>Coca-Cola has made public the carbon footprints for its most popular drinks⁸⁸. Packaging accounts for 30 – 70 % of the carbon emissions. In terms of distribution, Coca-Cola is improving the accuracy of supply and demand, integrating distribution centres, reorganising distribution and transportation routes, adopting low-emission vehicles and promoting eco-driving⁸⁹.</p> <p>Coca-Cola has one of the largest distribution systems in the world, yet they maintain its transportation footprint relatively low</p>

⁸³ <http://www.pepsico.co.uk/purpose/environment/environment-factsheets/quaker-and-the-environment>

⁸⁴ <http://supplychainanalysis.igd.com/index.asp?id=14&cid=&nidp=&retid=0&isid=0&tab=3&nid=1308&ecid=2597&uid=39283>

⁸⁵ <http://www.earthtimes.org/articles/show/aura-completes-10-oasis-all-electric-transport-refrigeration-systems-for-kraft-food,1108742.shtml>

⁸⁶ <http://www.fdf.org.uk/casestudies/transportmiles-kraft.aspx>

⁸⁷ http://www.unilever.com/images/Unilever_Sustainable_Development_Overview2008_v3_tcm13-163522.pdf

⁸⁸ http://presscentre.coca-cola.co.uk/viewnews/coca_cola_announces_the_carbon_footprints_of_some_of_its_best_loved_brands

⁸⁹ http://www.cocacola.co.jp/positively/pdf/2009/eng_additional.pdf

	because their operations are largely local for bottling, production and delivery. To tackle the local footprint, Coca-Cola is implementing hybrid passenger cars for the sales force, diesel-electric hybrid delivery trucks, idle-reduction and biodiesel technologies.
Cadbury plc (recently acquired by Kraft Foods) (CAD) <ul style="list-style-type: none"> • Manufactures confectionery (chocolate, gum and candy) • Revenue of US\$9.4 billion in 2009 • Operates in over 60 countries • Works with around 35,000 direct and indirect suppliers • Employs around 45,000 people 	With the help of Carbon Trust, Cadbury evaluated the carbon footprint of its products in 2009. 60% of the emissions are a result of the dairy farming process, which is much larger than transportation and packaging. Shipping of raw materials and transportation of the finished products accounts for 10% ⁹⁰ . Cadbury is a signatory of the Food and Drink Federation's programme "Fewer and friendlier transport miles". In this programme, Cadbury UK has decreased its number of warehouses from 15 to 3 warehouses. Further, from a transport fleet consisting in over 60 company-owned vehicles and 63 third-party hauliers (3PL), they now use only five 3PL to cover all their freight movements (Food and Drink Federation, 2007).
Kellogg Co (KC) <ul style="list-style-type: none"> • Manufacturing sites in 18 countries • Marketed in more than 180 countries around the world • 2009 sales of nearly \$13 billion 	<p>In 2006 Kellogg Co. joined EPA Climate Leaders, a voluntary government-industry partnership designed to measure and reduce greenhouse gas emissions. Kellogg's primary sources of GHG emissions are from the use of energy for manufacturing and fuel used by the transportation fleet. A global energy management program to promote conservation, manage energy use and investigate energy savings opportunities (including alternative fuels) has delivered the following.</p> <ul style="list-style-type: none"> -Reduced energy use from lighting by 25 % -Modified the steam system at its Battle Creek plant to avoid 1,300 tonnes of GHG emission. -Modified its fleet of vehicles to automatically shut down after 5 min of idle time. -585 truck trips have been eliminated by a case-size change for several cereal products⁹¹.
Mars (MAR) <ul style="list-style-type: none"> • Annual revenue of US\$28 billion • 230 sites in 68 countries, including 135 factories. • Employs 65,000 people 	<p>Mars UK has established the goal of reducing transport CO₂ emissions in 30% by 2020 and reducing packaging by 10% by 2010⁹². They plan to achieve this through maximising load fill of delivery trucks, minimising journey distances, and working with 3PLs to implement best environmental practice and using rail rather than road whenever possible.</p> <p>Imports are significant in their pet food business. By shifting production from continental Europe to facilities within the UK, the company reduced its food import food miles by 17% in 2008. Overall, Mars UK expects to save 606,000 food transport miles per year – and over 25,000 tonnes of CO₂ by 2011.</p> <p>Mars Australia is developing lifecycle analyses for their products, in collaboration with CSIRO⁹³.</p>

Figures 5.1 to 5.3 show the classification of these initiatives according to the three characteristics of importance discussed in section 2.1.

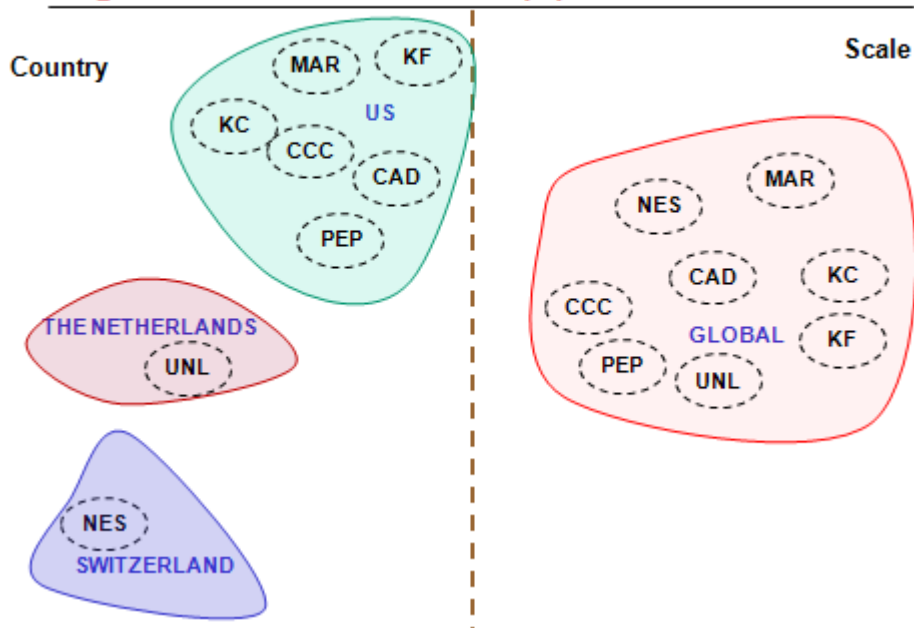
⁹⁰ http://www.wme.com.au/categories/energy/june3_08.php

⁹¹ <http://www.foodprocessing.com/articles/2008/335.html>

⁹² <http://www.mars.co.uk/United+Kingdom/en/Our+commitments/Environment.htm>

⁹³ <http://www.foodproductiondaily.com/Product-Categories/Service-Providers/Looking-at-life-cycle-key-to-product-sustainability-CSIRO>

Organisational structure (a)



Organisational structure (b)

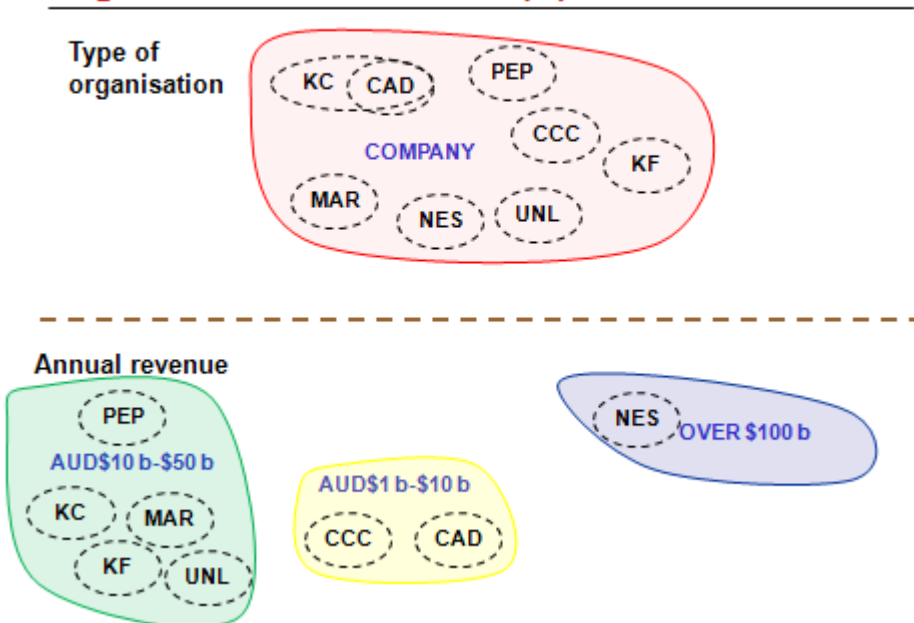
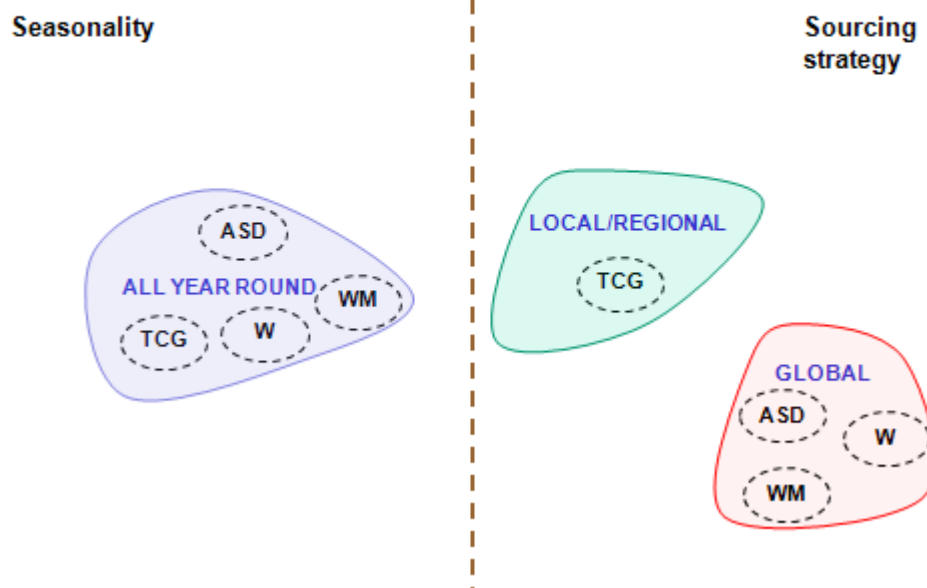


Figure 5.1. Categorisation of manufacturer-led initiatives, depending on their organisational characteristics: (a) country and scale; (b) type of organisation and revenue.

Supply chain structure (a)



Supply chain structure (b)

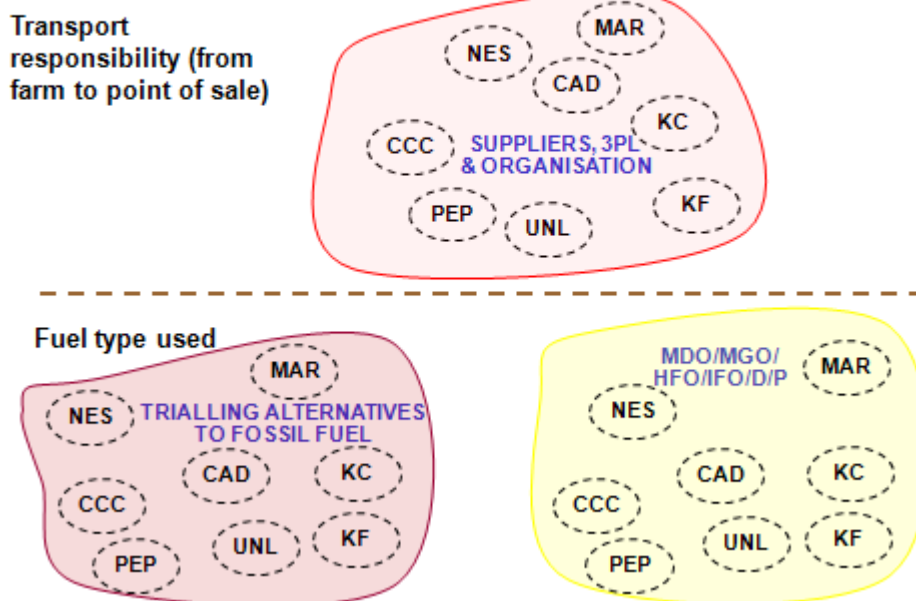


Figure 5.2. Categorisation of manufacturer-led initiatives, depending on their supply chain characteristics: (a) seasonality and sourcing strategy; (b) transport responsibility (from plant to point of sale) and fuel type used.

Mission

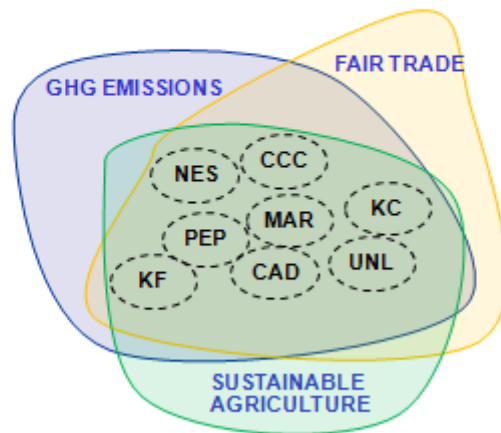


Figure 5.3. Categorisation of manufacturer-led initiatives, depending on their type of mission.

5.1 Drivers and motivations for global manufacturer-led initiatives

There are significant drivers for food manufacturing companies in decreasing food transportation impacts:

a) Financial drivers. The “bottom line” is the driving factor for efficiency improvements resulting in lower carbon emissions (Southworth, 2009).

The Carbon Trust, a leading organisation dedicated to decrease the carbon footprint of corporations in the UK, established in its manifesto that “Reducing carbon emissions nearly always means reducing energy consumption and many energy efficiency measures can be executed at zero or even negative cost” (The Carbon Trust, 2009). With energy costs on the rise and worldwide energy demand projected to double by 2030, efficiency options are a clear example of action that corporations have been willing to take because it saves money over the life cycle of the product. For example, Cadbury has reduced the movement of goods by truck from 142,000 in 2002 to 65,000 in 2008. This has led to cost savings of 15% on haulage costs and an avoidance of 4.7 million road miles (Food and Drink Federation, 2007).

b) Regulatory drivers. Global manufacturers are exposed to regulatory risks and costs through mechanisms/policies that affect the entire value chain, including raw material production (*e.g.* biofuels policies), transportation, product design and use (*e.g.* EU Sustainable Consumption Action Plan) and consumer habits (*e.g.* carbon labelling).

However, the actual exposure of food manufacturers to carbon trading schemes is highly variable. Unilever, for example, estimates that less than 10% of their manufacturing sites in Europe are covered by the EU ETS. Of those sites participating in the EU ETS, most have a surplus of allowances.

The GHG emissions of many highly processed food products are concentrated in the production of raw materials or in the consumers' use and disposal of products. These emissions are within Scope 3, defined as emissions not directly controlled by manufacturers. Companies still need to account these impacts as a direct consequence of their products. This is a driver for change in manufacturers and their suppliers.

c) The impact of climate change on the production of raw materials. Agricultural crops make up about two-thirds of the raw materials used by food manufacturers⁹⁴. Security of supply is therefore a core issue for manufacturers, especially when agricultural production is under threat from changing weather patterns, water scarcity and unsustainable farming practices. Large manufacturers are linked to a complex global supply network of several smallholder farmers and large agri-businesses. Even though global sourcing mitigates the risks of a reduction in the production of raw materials, climate change may affect several sites at the same time, making supply unreliable.

d) Consumer confidence and company's reputation. Manufacturers and marketing companies follow consumer trends and understand that consumers are choosing products that have been produced, manufactured and transported causing the least damage to the environment. Food companies are willing to invest in a global base to satisfy consumer expectations and safeguard the reputation of iconic food brands. For example, the communication of the carbon footprint of Tropicana Orange Juice and Walker's Crisps products (manufactured by PepsiCo) had a positive reception by consumers⁹⁵.

A significant trend recognized by manufacturers is the emergence of the 'conscious consumers' – people who want to make a positive difference to the world through the brands they choose to buy. From being a minority group of consumers seeking out a small selection of mostly niche brands, this has become a more mainstream movement, with large numbers of people now actively seeking out products with a positive social or environmental benefit or avoiding those that are perceived as having a negative impact⁹¹.

e) Retailer-led initiatives. In Chapter 4, it was established that in retail-led supply chains, most of the emissions are in Scope 3 or those related to suppliers of retailers. The fact that Wal-Mart has highlighted this fact indicates that retailers expect suppliers to support their environmental efforts to drive emissions out of the chain.

⁹⁴ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Unilever_5830_Corporate_GHG_Emissions_Response_CDP7_2009.asp

⁹⁵ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/sdcpublish/PepsiCo_Inc_6977_Corporate_GHG_Emissions_Response_SC09.asp

CASE STUDY: KRAFT FOODS INC

Kraft Foods manufactures a large range of confectionery and snacks in 150 countries. It employs 100,000 people. Some well known brand include Kraft cheeses, dinners and dressings, Maxwell House coffees, Oscar Mayer meats, Oreo, Cadbury and Toblerone chocolates, among others.

Kraft distribution emissions

Kraft's total emissions (covering Scope 1 and 2 activities) are estimated to be 2.6 Mt CO₂-e per year, globally. Their GHG inventory includes: 1) stationary sources: manufacturing, distribution/product warehouses, headquarters and R&D locations; 2) mobile sources: transportation – private fleet, sales fleet, executive fleet, private airplanes. The results of the inventory showed that more than 92% of GHG emissions are due to manufacturing (86%) and transportation (6%). Thus, Kraft's primary focus has been on reducing emissions from manufacturing and the transportation fleet.

Considering both their North American and European operations, Kraft finished goods travel nearly 1 million km, consuming about 370 million liters of diesel per year and producing an estimated 987,840 t CO₂-e. About 90% of this footprint corresponds to the European operations. Kraft Foods uses 3PLs to transport raw materials to manufacturing facilities and deliver finished product from manufacturing facilities to distribution centers, warehouses and customers. Most of the transport fleet improvements are summarized in Table 5.1. Additionally to these measures mentioned, other initiatives include:

- *Hosting common carrier meetings to share fuel best practices with peers
- *Establishing per mile-gallon goals supported by future changes in fuel surcharge reimbursement
- *Joined the Smartway Partnership
- *Co-founding and co-chairing a coalition of over 100 shippers and industry associations in support of legislation (HR 1799), that which will reduce carbon emissions by increasing gross vehicle weight on trucks
- *Implemented a first-of-its-kind hybrid Direct Store Delivery truck with an electric refrigeration unit
- *Reduced the speed limit on its corporate truck fleet from 65 mph to 62 mph
- *Added auxiliary power units (APU), to reduce idle time and fuel consumption. All trucks purchased in 2008 and in the future will have APU's.
- *Kraft Foods' Corporate transportation fleet is inflating tyres with nitrogen to reduce fuel consumption. In 2008, Kraft purchased nitrogen systems for use by all trucks (this project is approx. 80% complete).

In terms of supply chain risks and environmental trends, Kraft Foods recognizes the following:

Regulatory risks

Kraft recognized that governmental activity to impose further limits on GHG emissions could create additional regulatory burdens. As a matter of business risk, increased government regulation of the food industry regarding climate change could result in increased costs to the company related to compliance, increases in energy prices and increases in raw materials due (among others) to the effect of biofuel incentives. Longer-term costs include land use regulation, carbon-related trade measures and the regulation of agricultural emissions (in the context of operations in Europe).

Communication risks

Kraft believes that, while consumer concerns over climate change need to be taken in consideration, the process of measuring, comparing and communicating accurate information to

consumers is difficult. An agreement on what to measure, how to measure it and how to communicate carbon footprints and similar environmental impacts is essential. Kraft Foods has developed a set of internal guidelines on environmental claims in order to guide the business in making the right decisions when considering these types of claims.

Physical risks (vulnerability)

Kraft recognizes that, although climate change-related regulation may create some near-term risks for Kraft Foods and other companies, the lack of such regulation could create significant longer-term risks. Under a global “business-as-usual” scenario, average temperatures could rise several degrees, resulting in sea level rise, increased extreme weather events such as hurricanes and tornadoes, as well as ongoing changes to weather patterns. This could result in disruption of agricultural supply chains, risks to facilities, increased operating costs and impact on consumer disposable income.

Kraft has several programs in place to manage physical risks. For localized episodic extreme weather events such as floods and severe storms, Kraft has protocols such as special situations management and emergency preparedness and response procedures. These allow Kraft to address and mitigate adverse effects of events. The effect of weather conditions on prices paid for raw materials is managed through global supply strategies. Kraft also uses hedging techniques to minimize the impact of price fluctuations in their principal raw materials. With regard to parts of its agricultural supply chain that rise concern over long term supply conditions, Kraft has in place projects, often in partnership with other companies, governmental bodies & civil society, in order to tackle these challenges. For example, through the World Cocoa Foundation, the industry addresses the main concerns over sustainable supply of cocoa (volumes, qualities, origins) through economic and social development and environmental conservation in cocoa growing communities.

Sustainability presents opportunities for Kraft in the way they develop and market their products. Kraft experienced how sustainability can drive growth in their coffee business in Europe. The beans for a number of brands are grown sustainably as part of their partnership with Rainforest Alliance. In the future, Kraft will examine the benefits of communicating the environmental benefits of certain packaging changes to provide consumers with additional information as they make their purchase decision.

Source: https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Kraft_Foods_5679_Corporate_GHG_Emissions_Response_CDP7_2009.asp

5.2 Innovative aspects of global manufacturer-led initiatives

Corporate commitment to sustainability efforts varies from measuring and disclosing GHG emissions in annual reports, to pledges to reduce their overall carbon footprint. Some companies go beyond this and are investing in innovative technologies, industrial processes, and carbon footprint mappings to pinpoint inefficiencies in the use of resources (Southworth, 2009).

a) Global impact and commitment to sustainability. The global supply chain activities of food manufacturers have a significant carbon footprint, as illustrated in Figure 5.4, which shows the global carbon footprint of seven of the major manufacturers investigated in depth (currently, Mars is not a member of the Carbon Disclosure Project). To place some context

around this figure, the total emissions of the global operation of Wal-Mart are presented. Distribution is at the heart of retail businesses and this can be reflected in the comparison of Figure 5.4.

It is difficult to place an average percentage on the contribution of distribution activities for processed products, because the nature of the raw materials is a factor that influences significantly this contribution. For example, in the case of the 64-ounce Tropicana fruit juice carton and the 34.5-gram Walker potato crisp bag, the distribution of the finished product represents 22% and 10%, respectively⁹⁶.

Other companies choose to report distribution as Scope 3 activities in their Carbon Disclosure Project (CDP) values, arguing that the company does not own or operate transport of finished products. For example, Unilever discloses a value of 2.7 Mt CO₂-e for its Scope 1 and Scope 2 activities, but also indicates that the estimated carbon footprint of transport for finished products is 4 Mt CO₂-e⁹¹. Overall, about 93% of the total number of S&P 500 companies in the CDP choose not to report external distribution and logistics, due to the lack of data made available by the 3PLs contracted to carry out distribution or due to confidentiality (PricewaterhouseCoopers, 2009).

However, the implementation of global sustainable distribution strategies can make a significant contribution to decrease these impacts. For instance, a commitment to a 20% reduction in the total emissions of the seven manufacturers in Figure 5.4 would lead to a decrease of about 5 Mt CO₂-e per year. In Chapter 6 (logistics-led initiatives), the potential initiatives that are likely to have the largest impacts in global distribution are discussed.

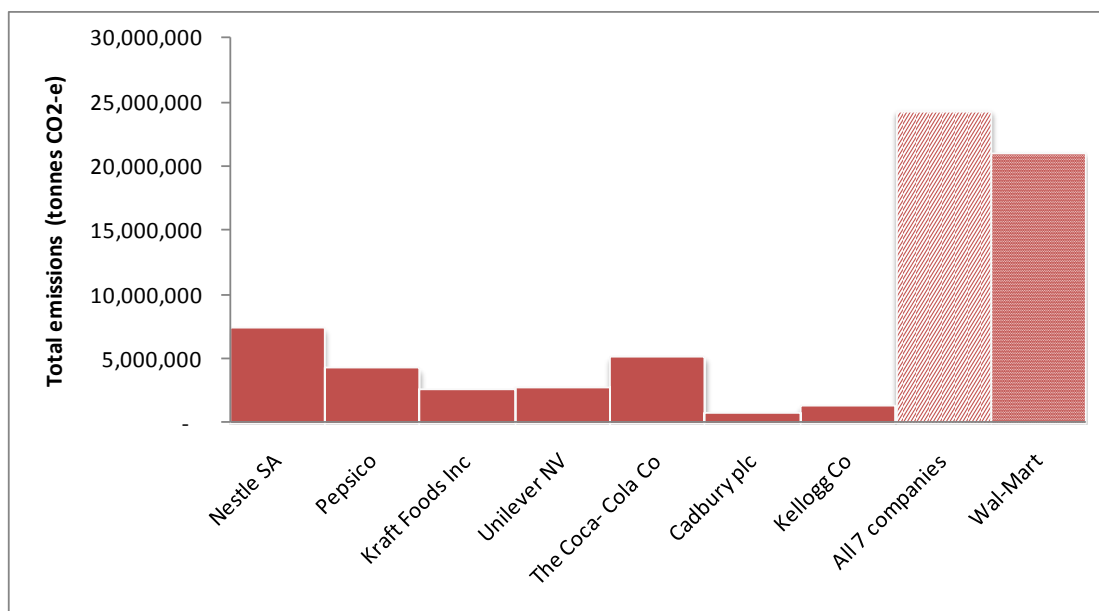


Figure 5.4. Total emissions of seven food manufacturers and one retailer with global operations.

⁹⁶ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/sdcpublish/PepsiCo_Inc_6977_Corporate_GHG_Emissions_Response_SC09.asp

Every global (and local) food manufacturer has an environmental policy, due to regulatory drivers. However, not every manufacturer has specific directives for sustainable distribution.

If sustainable distribution is embedded into the corporate culture, the manufacturers will look for logistics partners than can align to these directives. This in turn drives logistics providers to become aware of their own environmental impacts.

b) Sustainable distribution initiatives with 3PLs and retailers. As discussed in Table 5.1, there are several innovative strategies undertaken in the global distribution of foods. However, these initiatives are being mostly implemented by the carriers providing transport services to manufacturers and by manufacturers joining initiatives such as SmartWay and the EC Sustainable Distribution Group. Therefore, these aspects will be discussed under Chapter 6 (logistics-led initiatives) and Chapter 7 (government-led initiatives).

One point that should be highlighted here is the potential of collaborative freight initiatives between manufacturers and between manufacturers-retailers.

An example of manufacturer-manufacturer collaboration is the Nestlé and United Biscuits case in the UK. In 2007 both companies recognised they had empty running, which was a potential opportunity if they could find a third party with opposite transport flows. As the two parties are direct competitors, the ECR Sustainable Distribution Group (which is further discussed in Chapter 7) coordinated a series of meetings followed to identify and resolve a number of obstacles, such as cultural, brand protection, safeguarding product integrity and the many operational considerations such as risk, insurance, rates and service. In particular, internal stock movements, invoicing and customer deliveries needed to be addressed. As a result of this collaboration, between Oct 2007 and Feb 2009 there was a reduction in empty running of 280,000 truck km, resulting in a fuel reduction of 85,000 litres and the associated 223 tonnes CO₂-e. The collaboration also generated a financial saving split between both businesses⁹⁷.

5.3 Obstacles and challenges for global manufacturer initiatives

a) No price premiums expected on sustainable products. Creese and Marks (2009) concluded that there will be no premium for carbon measured and managed food. Therefore, the measures adopted to decrease carbon footprints need to have a clear understanding of potential benefits of sustainable distribution that encompass a wider range of indicators, other than direct financial gains.

b) Uncertainty in the introduction of a Carbon Pollution Reduction Scheme.

As mentioned for other sectors, the delay in the introduction of the ETS has eased the pressure, for the moment being. However, we can expect a strong debate continuing in regards to the projected effect of a CPRS on food manufacturers. Although modeling done by the Treasury found that the average price impact of the Carbon Pollution Reduction

⁹⁷ <http://www.igd.com/index.asp?id=1&fid=5&sid=43&tid=59&foid=52&cid=1168>

Scheme on food bills would be less than 1 % of household food bills (The Treasury, 2008), The Australian Food and Grocery Council (AFGC), which represents the interests of global and local manufacturers with operations in Australia, has maintained that their confidential data modeling reflects a 5% price increase on household food bills, as a result of increases ranging from 20 to 40% in electricity^{98,99}.

The Climate Institute, a non-partisan, independent research organisation working on climate change solutions in Australia, has stated that the affordability of energy and associated services will in fact improve. Other factors that would decrease the impact on food manufacturers are:

- Many food businesses and primary producers are not covered by the projected CPRS.
- There is a planned support for transport suppliers through fuel tax credits.
- The government has set aside \$150 million to help food manufacturers in the transition.
- Farmers would generate offsetting mechanisms (*e.g.* carbon soil capture).

Most importantly, The Climate Institute has pointed out that the impact of a CPRS is likely to be much less than the impact of weather variability –which is likely to be exacerbated by climate change (The Climate Institute, 2010).

Similarly to the position held by retailers, European food manufacturers have expressed concerns about the lack of governance in carbon credit schemes. For example, Diageo, whose brands include Johnnie Walker and Baileys, considers carbon offsets as a last resort for emissions that cannot be eliminated in any other way such as energy reduction¹⁰⁰. Direct action seems to be the preferred mechanism for carbon reduction.

c) The effect of seasonality and supply chain vulnerability on the transport emissions of global manufacturers. Global manufacturers are less exposed than local manufacturers to limitations on the supply of raw materials, due to their ability to procure supplies from different parts of the world. But this ability comes at the cost of increasing shipping emissions. For instance, the production of orange juice for the Australian domestic market depends on the sourcing of Valencia oranges, which are commonly in season from September through to April. Navel oranges, which are also used, are in season from May through to December. This leaves a 4-month procurement gap between the two crops. To fill this gap, frozen orange juice is imported from Brazil – 14,700 km away –or from China –at a distance of 4,700 km– thus adding the corresponding shipping emissions to the orange juice chain.

Fruit and vegetable processors are particularly exposed to the consequences of extreme weather conditions on crop yield. For example, it is estimated that the industry revenue decreased in 2006-07 by 11.3% as a result of dry weather conditions, which pushed prices

⁹⁸ <http://www.theaustralian.com.au/news/grocery-industry-backs-coalition-on-ets/story-e6frg6n6-1225813999543>

⁹⁹ <http://www.ausfoodnews.com.au/2010/01/28/afgc-urging-coordinated-effort-on-climate-change.html>

¹⁰⁰ <http://www.timesonline.co.uk/tol/news/environment/article6078141.ece>

upwards and caused imports to rise. This in turn led to increased production costs and reduced production volumes in Australia (Riddell, 2009).

It was discussed that global manufacturers are more resilient to these aspects than companies that source from only one location. When price pressures in fruit and vegetables increase, manufacturers close their Australian operations to move offshore, thus continuing their operations. A recent example of this trend is the closure of the McCain Foods plant in Tasmania, which produced frozen vegetables. McCain is opting to use its plant at Hastings (New Zealand) to source and process its vegetables ¹⁰¹.

This strategy clearly comes at a cost when jobs are lost, growers are left without a market for their product and transport emissions are increased for the finished product. In terms of shipping emissions, products manufactured in New Zealand and shipped from Tauranga will need to be transported about 3,000 km to reach Melbourne.

CASE STUDY: PUDDING LANE

Started as a home-based business, the Pudding Lane franchise has grown into the finest producer of the traditional "boiled-in-the-cloth" Christmas pudding.

In terms of markets, some Australian products have found its niche on export. These producers cannot decrease the impact of food transportation in their carbon footprints, but they still have ways to address their production carbon emissions to offset transport emissions.

An example is Pudding Lane, which produces hand-made puddings for Christmas for the export market (mainly UK and USA). The family-run company shipped more than eight tonnes of puddings to the UK in 2008 and sold out before Christmas.

At the production end, Pudding Lane installed measures to use recycled water, doubled the insulation in cooling rooms and uses only energy-efficient lighting. Pudding Lane's packaging is made from 100% recycled material and cloths are hand stitched by a local Australian charity group. The only disposable part of the pudding-making process is a piece of cotton twine used to tie the pudding cloth for cooking. Pudding Lane recycles 100% of any cardboard and paper packaging (*i.e.* flour bags, fruit and egg cartons) created in making the puddings.

Additionally, the company does not use any automated processes: there are no production lines, no electric steam ovens, no plastic basins, plastic bowls or moulds to shape the puddings.

Exports of puddings do not require refrigeration and Pudding Lane uses shipping as their main method. Transportation costs for a pallet of product shipped to San Diego are about AUD\$400. Interestingly, this cost is lower than shipping a pallet of product from Sydney to Perth by road ¹⁰².

The team also supports as many local producers/businesses as it can such as local bakeries (for fresh breadcrumbs) and free range egg suppliers (Lewis, 2009). Pudding Lane is demonstrating how a small food manufacturer can position itself as an environmentally-friendly option for domestic and export sales.

¹⁰¹ <http://www.abc.net.au/news/stories/2009/11/20/2749164.htm>

¹⁰² <http://cosmos.bcst.yahoo.com/up/player/popup/index.php?cl=19868626>

Sources: <http://www.abc.net.au/landline/content/2008/s2426086.htm>
<http://www.puddinglane.com.au/theenvironment.htm>

5.4 Lessons learned and applicability to future initiatives

While global food manufacturing companies are actively engaged in collaborative efforts to decrease the impact of distribution, Australian-based companies seem to be lagging in these efforts. It is interesting that some global companies represented by AFGC have stated in other forums their support for strong carbon abatement measures, yet their Australian operations seem to be aligned with the AFGC view. For example, in its Carbon Disclosure statement, Unilever (an AFGC member) has stated that:

"As an increasing number of nations set up carbon trading schemes, the Copenhagen agreement should also step up efforts to link these schemes together and create a global carbon market. The EU is proposing this as part of [...] a post-Kyoto Climate deal, and Unilever supports this wholeheartedly. This is especially important for companies operating internationally".

The Kellogg Company (also with operations in Australia and represented by AFGC), has indicated that *"Regulatory programs, such as cap and trade for carbon emissions, can provide significant benefits to companies like Kellogg that have invested in activities to reduce their carbon emissions and have plans in place to continue to do so."*¹⁰³

It is therefore puzzling that this global statement does not translate into an overall support and agreement for the Australian CPRS. This may be related to the lack of a coordinated global approach for carbon abatement for the industry. In general, food manufacturers are calling for a coordinated approach and the move towards a single global carbon market, and that includes forestry and agriculture¹⁰⁴.

While the largest savings in carbon footprints for many shelf-stable goods are likely to be achieved elsewhere, distribution activities remain important for several product categories, particularly in highly perishable products. There is potential to develop collaborative industry-led efforts or joint government-industry initiatives in Australia, an aspect that is further discussed in Chapters 8 and 9.

Some food manufacturers have embraced the concept of Environmental Management Systems (EMS) and ISO 14001. Chapter 8 discusses one of these cases. ISO 14001 establishes codes of practice, risk assessments, objectives, responsibilities control of

¹⁰³ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Kellogg_Company_991_Corporate_GHG_Emissions_Response_CDP7_2009.asp

¹⁰⁴ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Unilever_5830_Corporate_GHG_Emissions_Response_CDP7_2009.asp

documentation and other processes for environmental management systems. ISO 14001 standards in particular directly affect various food industry management problems, such as processing wastewater and packaging issues (Arvanitoyannis et al., 2008).

Unfortunately, the penetration of ISO standards in Australian enterprises does not seem to be enough to push the food sector towards environmental stewardship. For instance, the total number of ISO 14001 certifications in Australia in 2008 was 1,125, while the number of ISO 9001 certifications (Quality Management Systems) was 8,773 in the same year (The Nielsen Company, 2008). Further, from 2003 to 2008 the Australian government (through DAFF) facilitated the uptake of EMS in the primary industries and food manufacturing sectors. Some successes were achieved in that period but the uptake of EMS in the primary and secondary food sectors seems to have slowed down since.

Chapter 6: Logistics-led initiatives

!	<i>Reduction in oil dependency can substantially reduce operating expenses in the transport sector, where energy purchases can range from 5 to 35% of the total cost base. In Australia, 30% of the costs during long distance road freight transport are fuel related.</i>
!	<i>Transport emissions will be included in a future Carbon Pollution Reduction Scheme. This inclusion is expected to encourage long-term investment in cleaner technologies, better infrastructure and the right transport mode choices.</i>
!	<i>Food supply chain players that outsource transport have a direct influence (through the choice of providers) on the way transport is carried out. Environmental stewardship can be implemented through client-supplier relationships.</i>
!	<i>There are several logistics companies that are establishing environmental credentials, such as UPS, DHL, NYK Line, Lufthansa Cargo, FedEx. Other suppliers related to logistics operations such as CHEP (a pooling pallet company) and Sealed Air (packaging provider) are also investigating ways to minimize their environmental impacts.</i>
!	<i>In Australia, Linfox has launched a new greenhouse gas reduction target, consisting on a 50% reduction by 2015, using the company's 2007 emissions as a baseline. To achieve this, Linfox looking to introduce innovations in vehicle and engine design and fuels in their fleet. Given that Linfox provides logistics services for large food manufacturers and retailers, their sustainable distribution efforts flow to the entire chain.</i>
!	<i>The combination of carbon abatement measures in transport (e.g. alternative fuels, clean vehicle technology and switching methods of transportation) is more effective than one single measure.</i>
📖	<i>Empty running and loading factors in Australian road freight vehicles per type.</i>
📖	<i>Certification of logistics providers undertaking environmental initiatives.</i>
⚡	<i>Improving the efficiency of road vehicles in their day-to-day operation represents a potential GHG emissions abatement of 157.5 Mt CO₂-e, worldwide.</i>
⚡	<i>Reducing speed in shipping vessels and road freight vehicles are highly effective ways to decrease emissions. This strategy needs to be tempered with the need to transport perishables within certain time windows and JIT strategies, among other factors.</i>
⚡	<i>The wider global supply chain is affected by the impact of different sourcing locations. Although growing all produce in optimal conditions could lead to savings of up to 178 Mt CO₂-e per year, only 10% of agricultural production could actually be shifted from its current location, thus limiting the full potential of this measure.</i>
⚡	<i>Typical network changes include re-designing of distribution hierarchies, changing the nodal structure and optimising planning decisions. Globally, these changes could lead to 124 Mt CO₂-e per year.</i>
⚡	<i>The largest abatement potential arising from changes in mode of transport comes from switching long haul road transportation to rail or waterways. While there are additional benefits from switching out of air freight, the savings may be harder to achieve and are of a much smaller scale.</i>

Logistics outsourcing or third party logistics (3PL) are activities carried out by a logistics service provider on behalf of a shipper, consisting of at least management and execution of transportation and warehousing. Other activities such as inventory management, tracking and tracing, secondary assembly and installation of products, or even supply chain management can be also encompassed (Berglund et al., 1999).

Table 6.1 summarises two of the distribution strategies adopted by logistics companies. Only two approaches were selected because these typify the approaches followed— companies either integrate to groups for carbon monitoring and disclosure projects or companies act independently, with direct measures to decrease transport carbon footprints.

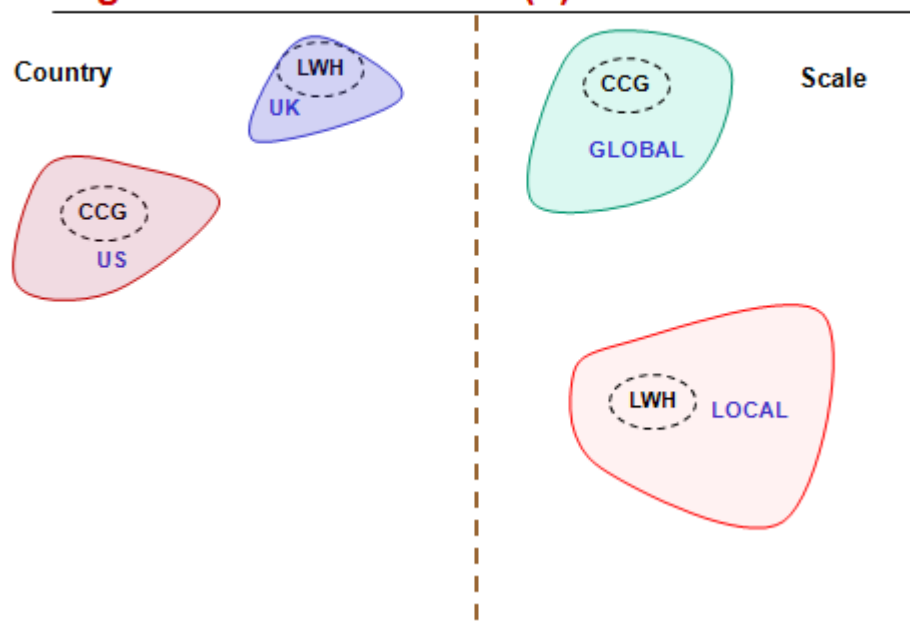
Table 6.1. Logistics distribution initiatives.

Company	Sustainable distribution strategies
Clean Cargo Group (CCG)	<p>The group is a multi-sector, business-to-business collaboration between ocean carriers, freight forwarders and shippers of cargo. There are 28 members in this group, including carriers such as Maersk, Hamburg Süd, Hanjin Shipping, NYK Line and OOCL, among others. Retailers and manufacturers include Wal-Mart, Coca-Cola, Wal-Mart, Chiquita Brands and Starbuck's. The group focuses on environmental performance assessments, sharing of best practices through forums and workshops, application of intermodal emission calculators and CSR performance surveys¹⁰⁵.</p> <p>The organisation that initiated this working group is BSR, a global consultancy company specialized in the CSR area. BSR works with about 250 companies on issues such as the environment, human rights, economic development, and governance and accountability.</p>
LowHub (LWH)	<p>Lowhub provides sustainable, low carbon delivery solutions for London's wholesale markets. The company combines independent journeys into optimised, multi-drop journeys using electric and biodiesel vehicles.</p> <p>The biodiesel is locally sourced from recycled vegetable oil. Lowhub operates from New Covent Garden Fruit and Flower Markets and Borough Market, consolidating deliveries, encouraging collaboration, and ensuring sustainable distribution.</p>

Figures 5.1 to 5.3 show the classification of these initiatives according to the three characteristics of importance discussed in section 2.1.

¹⁰⁵ http://www.bsr.org/consulting/working-groups/BSR_Clean_Cargo_Working_Group.pdf

Organisational structure (a)



Organisational structure (b)

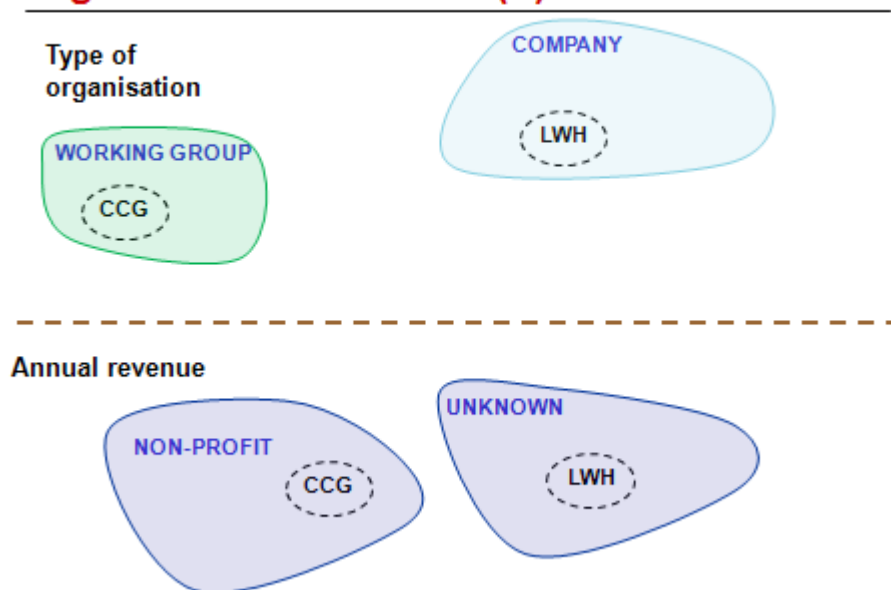
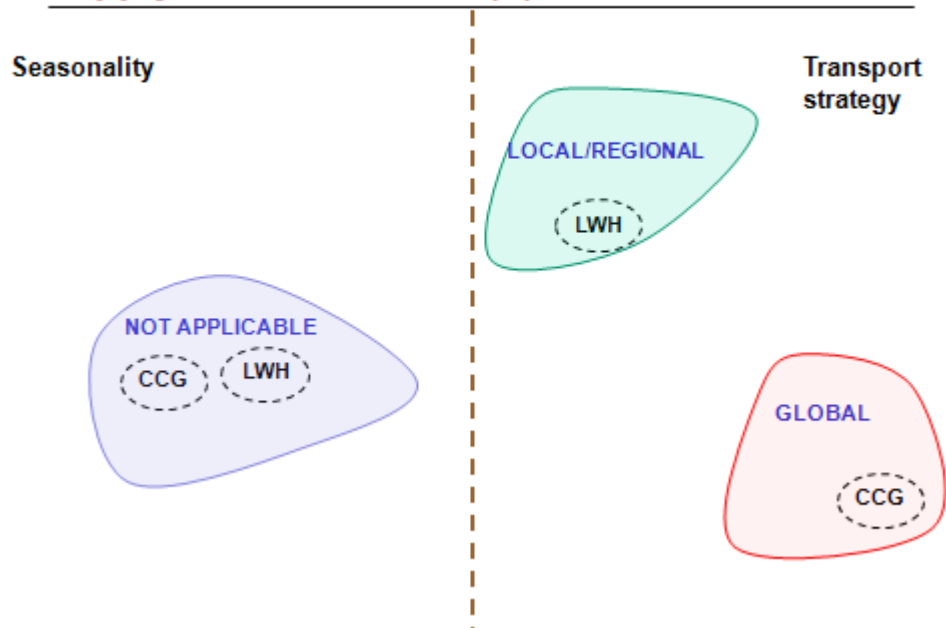


Figure 6.1. Categorisation of logistics-led initiatives, depending on their organisational characteristics: (a) country and scale; (b) type of organisation and revenue.

Supply chain structure (a)



Supply chain structure (b)

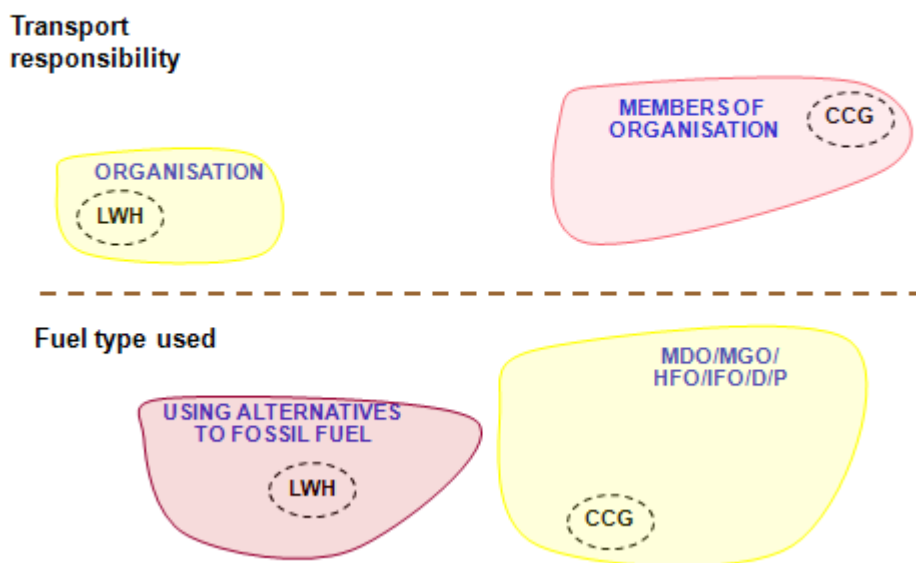


Figure 6.2. Categorisation of logistics -led initiatives, depending on their supply chain characteristics: (a) seasonality and sourcing strategy; (b) transport responsibility and fuel type used.

Mission

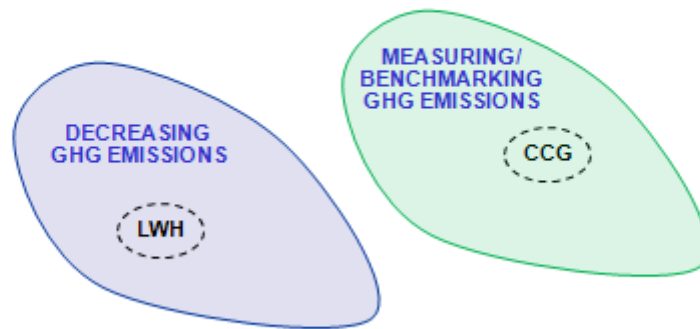


Figure 6.3. Categorisation of logistics -led initiatives, depending on their type of mission.

6.1 Drivers and motivations for logistics-led systems

a) Financial drivers. Reduction in oil dependency can substantially reduce operating expenses in the transport sector, where energy purchases can range from 5 to 35% of the total cost base¹⁰⁶. In Australia, 30% of the costs during long distance road freight transport are fuel related¹⁰⁷.

b) Regulatory drivers. Environmental efforts focused on reducing carbon footprints are also responding to efforts by governments to regulate carbon emissions. For example, in the US, the Waxman-Markey climate bill aims to reduce GHG emissions by 17% from 2005 levels by 2020 and establishes a cap-and-trade system. Given that transport in the US contributes with 30% of GHG emissions, it is expected to be one of the sectors that will need to work towards carbon reductions significantly. Further, "carbon leakage" (*i.e.*, production moves to countries that don't similarly reduce emissions) is expected to be dealt with by imposing tariffs based on the carbon content of imported goods¹⁰⁸, which imposes even more responsibility on the transport sector to decrease its impact on exports and imports of goods.

In Europe, transport accounted for 24 % of total GHG emissions and 28 % of total CO₂ emissions in the EU-27 in 2006. Policy measures include the use of environmental taxes (*i.e.* energy, transport vehicle taxes and pollution and resource taxes), maintenance, development and integration of modal networks and a move to low-carbon transport technologies (European Commission, 2009).

¹⁰⁶ Accenture analysis in the report mentioned.

¹⁰⁷ IBISWorld, 2010.

¹⁰⁸ <http://www.freightpublicpolicy.org/2009/11/how-would-cap-and-trade-affect-transportation/>

In Australia, transport emissions were to be included in the Carbon Pollution Reduction Scheme¹⁰⁹ which would have encouraged long-term investment in cleaner technologies, better infrastructure and the right transport mode choices. In the absence of a CPRS, fuel price volatility is perhaps most likely to drive investment in urban road and rail freight infrastructure, a move to high productivity road vehicles (*e.g.* quad axle semi-trailers and B-doubles, SMART trucks and B-triples) and pricing strategies to drive “whole-of-the-chain” fuel efficiency are being contemplated (National Transport Commission, 2008).

In freight companies that have embedded environmental values in their culture (see next paragraph), sustainable freight becomes a directive and a value-added service for the company’s clients. If marketed correctly, a company’s sustainability efforts can create a competitive advantage (see retailer and manufacturer-led initiatives). In an environmentally-orientated market, no market correction through government intervention would be necessary.

c) Alignment with client’s environmental initiatives. In the past chapters we have discussed initiatives where farmers, entrepreneurs, manufacturers and retailers have a direct influence (through the choice of providers) on the way transport is carried out. In this context, logistics providers align to the core values of the client, whether those values include environmental stewardship or not.

However, carrier companies are starting to adopt environmental measures proactively. For example, Maersk Line is the world’s largest shipping company, with a fleet of 1,077 ships. Maersk has achieved the ISO14001 certification, has joined the BSR Clean Cargo Group and the Network for Transport and Environment. Maersk is also trialing waste heat recovery systems, a voyage planning system and catalytic reduction systems, among other initiatives¹¹⁰. These activities can provide further advantages to sea transportation as one of the most energy efficient distribution modes.

In Australia, Linfox has launched a new greenhouse gas reduction target, consisting on a 50% reduction by 2015, using the company’s 2007 emissions as a baseline¹¹¹. This goal seems achievable, given that between 2007 and 2010, Linfox achieved a 28% reduction, using relatively simple strategies such as eco-driver training, better warehouse design and use of electricity, route planning and better vehicle utilization. Linfox is now looking to introduce innovations in vehicle and engine design and fuels in their fleet. Linfox is one of the major players in the Australian logistics industry, with a 5.7% market share, a fleet of over 4,200 vehicles, more than 500 armoured vehicles, over 250 operation sites in 11 countries, approximately 1,000,000 m² of warehousing space, and ownership of two airports¹¹². Linfox provides logistics services for Cadbury Schweppes, Kraft, National Foods, Simplot, Coles and Woolworths, among other companies operating in the food sector.

¹⁰⁹ <http://www.climatechange.gov.au/government/initiatives/cprs/who-affected/directly-affected.aspx>

¹¹⁰ http://www.maerskline.com/link/?page=brochure&path=/about_us/environment/reducing_gas_emissions

¹¹¹ <http://www.tandlnews.com.au/2010/03/04/article/Linfox-ups-the-ante-on-greenhouse-gas-reduction-target/ABELRIFQGU.html>

¹¹² IBISWorld, 2010.

There are several other logistics companies that have established environmental credentials, such as UPS, DHL, NYK Line, Lufthansa Cargo, FedEx. Suppliers to logistics such as CHEP (a pooling pallet company) and Sealed Air (packaging provider) are also investigating ways to minimize environmental impacts of logistics operations ¹¹³.

CASE STUDY: THE LOWHUB EXPERIENCE (UK)

Lowhub is a Private Limited company that provides sustainable, low carbon delivery solutions for London's wholesale markets. They combine independent journeys into optimised, multi-drop journeys using electric and biodiesel vehicles. The biodiesel is locally sourced from recycled vegetable oil. Lowhub operates from New Covent Garden Fruit and Flower Markets and Borough Market, consolidating deliveries, encouraging collaboration, and ensuring sustainable distribution.

Lowhub was awarded the Traffic Reduction and Transport Management Award¹¹⁴ as well as the Sustain Magazine Award for Leadership in Sustainability in 2009.

Kevin Tullett, the Managing Director of Lowhub, shares the company's experiences on establishing a low carbon transport company.

What was your major motivation to establish Lowhub?

Before establishing Lowhub, I was working with Chi (London), a consultancy specialising in carbon reduction techniques across various industries in the UK. They further specialised in reducing carbon output in agriculture, and designed a low-carbon concept orchard alongside a sustainable agricultural strategy for an estate in the UK [more info can be found on <http://www.383ppm.com/page4/page4.html>]

A natural step after completion of this project was to look at the entire supply chain, from seed to consumer, and we discovered certain sectors of the UK supply chain were neglected from the point of view sustainability.

The final miles from wholesaler & producer to consumer (restaurant/hotel/retailer) were both inefficient, and bereft of care in terms of carbon output. We discovered that there was enough demand from the UK consumer to reduce these inefficiencies, and there existed enough demand from suppliers to reduce their carbon footprint.

Lowhub was established in order to make the 'system' of wholesale food distribution more efficient. This is performed in 2 distinct ways:

- a) Low carbon vehicles (Electric and Bio-diesel)
- b) Efficient 'multi-drop' delivery methods, and creation of geographically concentrated networks of buyers and sellers

Lowhub's aim is to prevent/ reduce the multitude of vehicles delivering produce to the 'final destination' in an inefficient way, and to streamline the entire system of ordering, so that buyer's behaviour is more efficient and therefore make the system more sustainable.



¹¹³ <http://www.inboundlogistics.com/digital/green25partners.pdf>

¹¹⁴ Awarded by the City of London.

Another Lowhub aim is to generate a model for sustainable transport in London that can be replicated in any major city. We have a model for re-cycling organic matter, and using low-carbon fuels in freight that we hope to replicate within any major urban area.

What obstacles have you faced?

The Lowhub emphasis on sustainability has made us focus on customers and partners that share our *ethos*. However, recent economic factors have forced companies to focus more on economic factors than on the environment. Increasingly, the Lowhub unique selling proposition has become secondary to price.

We collect used cooking oil from restaurants and convert this into biodiesel to run our vehicles, creating a sustainable life-cycle for an otherwise wasted product. Setting up this process was lengthy, and maintaining this cycle is a challenge.

The biggest obstacle we faced from a strategic point of view was that of technology, support infrastructure, and the danger of obsolescence. Government policy (in our early days) was focused on hydrogen technology, but after a change of Mayoralty, this shifted towards electricity. There are now plans to build an infrastructure in London to support electric vehicles. However, during this period of uncertainty, the Lowhub choice of sustainable vehicle was put on hold.

Inertia of existing systems and behaviour is another obstacle. The green economy is taking business forward by generating new efficiencies in the existing corporate landscape, but change in any form is met with resistance by some.

What lessons can you share in regards to establishing a company that encourages sustainable food freight?

The most important lesson learnt is that, by taking responsibility, the Lowhub model of sustainable transport has created a 'network' of buyers and sellers that share a common goal of increased sustainability. These networks show that the green economy has a place in mainstream food transport activity.

Lowhub has learnt that any sustainable activity must be able to compete with 'regular' businesses on price and viability. It is a hard truth, but it must be accepted.

Specifically related to sustainable transport, Lowhub has learnt that it is not merely the MODE of transport that must be adapted (electric/ hydrogen/ biomethane gas/ bio-diesel etc) but also the METHOD of transportation that needs to adapt. By emphasising this combination, buyers will happily change their ordering process so that the entire supply chain becomes more sustainable & efficient.

The willingness of London buyers to change their behaviour to enable a more sustainable supply chain shows that there is a desire to promote sustainable food and procurement techniques. This desire shows that the green economy is no longer separate from reality.

Downstream factors also played a role in shaping our strategy. The British public has become increasingly aware of provenance and locality of food. This has brought about a shift in behaviour and new concerns surrounding what is eaten, and how/where it is consumed. This 'new paradigm' is helping create a landscape in which sustainability surrounds all aspects of food and consumption. This virtuous cycle is something Lowhub is harnessing and trying to take further.

6.2 Innovative aspects of logistics-led systems

The World Economic Forum suggested 13 opportunities for emissions abatement that are cost-effective and attainable in global distribution. These are summarized in Table 6.2. Five of these strategies are particularly relevant to distribution and we summarise these below.

Several of the measures in Table 6.2 relate to reducing fossil fuel consumption in supply chains, which has been recognised as the single most important lever to cut carbon emissions (World Economic Forum, 2009) .

Table 6.2. Opportunities for decarbonisation in global supply chains, potential abatement at a global scale and feasibility index (World Economic Forum, 2009). The potential abatement only takes into account international trade.

Decarbonization Opportunity	Description	Potential Abatement Mt CO ₂ e	Assessed Index of Feasibility
Clean Vehicle Technologies	Introduce clean and environmentally efficient technologies	175	0.8
Despeeding the Supply Chain	Decrease transport speed and increase load fill	171	0.8
Enabling Low Carbon Sourcing: Agriculture	Optimise the location of agriculture	178	0.6
Optimised Networks	Improve network planning through transformation projects	124	0.8
Energy Efficient Buildings	Minimise emissions from operating activities	93	0.9
Packaging Design Initiatives	Reduce weight and volume of packaging	132	0.7
Enabling Low Carbon Sourcing: Manufacturing	Optimise manufacturing location	152	0.6
Training and Communication	Provide training to road transport contractors and building operators	117	0.8
Modal Switches	Transfer freight from air and long-haul road freight to ocean, road and rail freight	115	0.7
Reverse Logistics / Recycling	Improve percentage of total supply chain waste which is recycled	84	0.6
Nearshoring	Transfer long-haul air and ocean freight to road and rail freight	5	0.7
Increased Home Delivery	Rely on alternate transport services to deliver goods home	17	0.5
Reducing Congestion	Introduce traffic management techniques	26	0.3

a) Clean vehicle technologies. Increasing attention has been focused on clean vehicle technology, through i) improving the efficiency of vehicles in their day-to-day operation; and ii) switching to alternative or hybrid fuel technology sources. While adoption rates have been low for both bio-fuelled and battery powered vehicles, these technologies are becoming increasingly viable, mostly in urban operations. Less visible technologies such as cruise control and automatic engine shut down also have a role. The WEF study found that increasing road vehicle efficiency represented about 90% of the total abatement potential, which amounts to 175 Mt CO₂-e for these measures. Increased adoption rates of alternative fuels, particularly next generation biofuels, could make a further contribution.

b) De-speeding the supply chain. The high speed of response needed in many supply chain activities means that consumer demand is met effectively, but at a price of increased GHG emissions. Speed in the supply chain is driven by factors such as lead times, deadlines and booking windows. To gain speed, switches to less efficient modes of transport may be needed, as well as increases in the number of expedited orders (with potential use of less-than-full loads) and increased vehicle and trip speeds.

The largest opportunity found by the WEF study was to reduce the speed at which shipping vessels travel, as a result of the squared relationship between speed and emissions. Reducing road vehicle speeds (which can be as modest as a decrease in 5 km/h) is also a highly effective way to reduce carbon emissions, while having only a small impact on operations. The magnitude of emissions reductions through loading improvement is smaller, partly because emissions rise slightly with the associated increase in vehicle weight.

c) Low carbon production. Raw materials from primary production represent a large part of the lifecycle carbon footprint of virtually all manufactured products. This is supported by studies made by Cranfield University, which examined the impact of different sourcing locations for roses (Willimans, 2007), and studies by Lincoln University on the carbon footprint of lamb and other New Zealand exports (Saunders et al., 2006). Key contributors to emissions density are the intensity of agricultural systems and the efficiency of production. This suggests that there is potential to reduce emissions through changing sourcing locations. There is also potential for savings in agricultural sourcing and savings in inputs consumption (particularly energy) associated with primary production. The WEF study analysed past studies on the topic, and then reapplied the estimated savings to calculate an overall potential for savings in agricultural and energy emissions. These were factored down to consider only the portion of production which is traded internationally – *i.e.* that which could be enabled by the global logistics and transport sector. Finally, the result was adjusted to assess only the amount of trade which may be able to shift sourcing location.

WEF found that, in individual situations, the savings in agriculture derived from decreasing inputs consumption and raw materials can reach up to 61% of emissions from the current baseline. However, only about 40% of the primary production output is traded globally. Further, WEF estimated that only approximately 10% of agricultural production could be shifted. Overall, this ranks the feasibility of low carbon production measures lower than the previous two categories.

d) Network optimization. In network logistics, optimising the network's nodal points, hierarchy and inter-related transport flows can bring significant reductions in both cost and carbon. Many networks have unexploited potential for optimization, as a result of both inertia to change and lack of durability in supply chain strategy decisions. Accenture (a consultancy company) has found that restructuring supply chain networks can lead to savings in transport emissions of up to 10%.

Typical network changes include re-designing of distribution hierarchies, changing the nodal structure and optimising planning decisions. These changes could lead to large reduction in Europe, where 24% of goods vehicle- kilometres in the EU are running empty and vehicles are typically loaded at 57% of their maximum capacity. Overall, the total abatement potential across the sector globally could be 124 Mt CO₂-e per year.

Optimisation for efficiency may have implications for vulnerability of supply chains. Balancing these requirements is likely to become an increasing challenge for logistics providers.

e) Modal switch. There are significant differences in GHG emissions between different freight transport modes when expressed in terms of emissions per tonne-km shipped (see

Figure 1.3 in Chapter 1). Shipping emissions are in the region of 1% to 2% of those of airfreight per tonne-km, when comparing long haul air to ocean freight container vessels (AEA, 2008; Department for Environment Food and Rural Affairs, 2007). Where absolute emissions from the less efficient modes are significant, switching small volumes of freight to another mode can have a significant impact on emissions.

The WEF analysis suggested that three mode switches were worth detailed investigation: i) Intercontinental air to ocean freight; ii) Short haul air to road transport; iii) Long distance road freight to rail or waterways.

Other mode switches were deemed less practical or with lower abatement potential. For each switch, WEF used a variety of WTO, Eurostat and USA Department of Transportation data to calculate:

- o Total (as-is) emissions from the existing modal split.
- o "Switchable" emissions which could realistically be moved to a different mode.
- o Maximum abatement potential.

WEF found that the largest abatement potential comes from switching long haul road transportation to rail or waterways. While there are additional benefits from switching out of air freight, the savings may be harder to achieve and are of a much smaller scale. Key strategies are therefore to improve the competitiveness of the modal alternatives to road freight – for example by adding rail spurs, or decongesting long haul rail flows.

f) Development of industry self- regulations. The Clean Cargo Group is an example of how self-regulation can become an effective measure for raising the bar of the logistics industry. Other examples of these type of initiatives include

f_i) The Network for Transport and Environment (NTM), a non-profit organisation based in Sweden, initiated in 1993 and working at establishing a common base of values on how to calculate the environmental performance for various modes of transport. NTM's membership mostly comprises Swedish companies such as DHL (Sweden), Frigoscandia Distribution AB, Cargo Net AB, GreenCargo and Maersk , among others.

f_{ii}) *The Logistics Carbon Reduction Scheme (LCRS)*, an industry-led approach organised by the UK Freight Transport Association (FTA). Members and non members can join the scheme, which will record and report reductions in carbon dioxide emissions from freight transport and logistics operations. Implementation of the LCRS is based on measurement of fuel usage, converted into carbon dioxide emissions using Government-approved conversion factors. The results will be aggregated and reported periodically to track improvements in carbon emissions and fuel efficiency over time. FTA members operate over 200,000 lorries and around one million light vans; they consign over 90 % of the freight moved by rail; and they are responsible for over 70 % of UK visible exports by sea and air ¹¹⁵.

¹¹⁵ <http://www.fta.co.uk/about/fta-roots/>

6.3 Obstacles and challenges of logistics-led initiatives

The road transport sector is expected to transport 65.3% of Australia's non-bulk freight task in 2009-10. Shipments by rail are expected to account for 24.8% and the remaining proportion is attributed to coastal sea freight ¹¹⁶. All sectors have their own obstacles and challenges. In this section we emphasize road transport.

Similarly to retailer-led initiatives, logistics-led efforts to reduce environmental impacts of food distribution face the following challenges:

a) The Global Financial Crisis. As established in the LowHub example, manufacturers and retailers cut back on expenses to compete on price in the past couple of years and logistics suppliers faced a contraction of freight volumes, with industry profits plummeting. Companies pulled trucks off the road and slashed staff to maintain viability but many operators were simply forced to shut their businesses¹¹⁷. In the years ahead, this situation should improve and measures to improve environmental performance should gain momentum as the Government's plans for the introduction of an ETS advance.

After two years of low prices, the cost of fuel is expected to increase again (Marquez et al., 2010). This will add further pressure to reach better fuel efficiencies and uptake technology for the use of alternative fuels. However, only large companies are likely to be able to introduce new vehicle technology. The freight transport market is very fragmented and 87% of the companies working in this space are relatively small, hence the industry as a whole is likely to face difficulties upgrading vehicles and systems.

Transport and agricultural output are also connected: the transport of agricultural stock contributes 11% of the transport industry revenue. A decrease on (or unreliability of) agricultural production (particularly of grains) due to drought and other factors will reduce the demand for road freight.

b) Supply chain vulnerability to climate changes. Climate change is already impacting the operations of global shippers such as Maersk ¹¹⁸. For companies engaging in road transport, insurance/premiums are likely to rise¹¹⁹, as a consequence of climate-change related damage to road infrastructure and the general deterioration of driving conditions during extreme weather events (Marquez et.al, 2009).

c) Uncertainty in the introduction of a Carbon Pollution Reduction Scheme.

Similarly to manufacturers, the transport sector expected a global, standardized way forwards from the Copenhagen Climate summit. In lieu of these outcomes, some global

¹¹⁶ IBISWorld, 2010.

¹¹⁷ IBISWorld 2010.

¹¹⁸ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/AP_Moller__Maersk_2962_Corporate_GHG_Emissions_Response_CDP7_2009.asp

¹¹⁹ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Lion_Nathan_Ltd_3063_Corporate_GHG_Emissions_Response_CDP7_2009.asp

shipping companies (*e.g.* Maersk) are actively engaging in the political debate and acting to reduce their transportation emissions.

d) Lack of disclosure. Companies answering the CDP questionnaire have an option of stating if information is public or non-public. While the CDP strongly encourage companies to make their responses public –which means that the response will be made publicly available from the CDP website– companies can choose not to make the information available. This information can still be used in anonymous statistics in CDP reports or when Supply Chain/Public Procurement members request this information¹²⁰.

This confidentiality prerogative has been used by the organisations working in logistics in Australia and New Zealand (*e.g.* Toll Holdings, Mainfreight, Freightways) and disclosing information to CDP. This lack of *public* disclosure obstructs attempts to accurately analyse the emissions contribution of the logistics sector. If the CDP is not a mechanism for disclosure that Australian logistics companies feel comfortable with, new options for disclosure that target specifically the Australian logistics sector and that aggregates the responses (so that companies remain anonymous) could improve this lack of information.

e) Lack of certification. One issue with establishing the veracity of “green” credentials in Australia is the lack of certification processes for logistics operators.

There is a need to provide third-party standards and certification, to avoid ‘green washing’. Options to develop standards through government intervention are further discussed in the Chapter 9, although it has been suggested elsewhere that the Australian Transport Council could coordinate carbon reduction efforts in freight transport (National Transport Commission and Rare Consulting, 2008).

6.4 Lessons learned and applicability to future initiatives

The WEF report and the interview provided by Kevin Tullet (LowHub) provided significant insights on key strategies to develop logistics businesses with strong environmental values. Namely:

- The development of food distribution networks that share a common goal of increased environmental sustainability.
- The understanding of value pricing mechanisms in the transport industry. While logistics enterprises that are more environmentally friendly than regular competitors may not be able to attract a premium for their services, their base of clients can increase because of their environmental credentials.
- The understanding that different measures are needed to decrease the impacts of transportation. For example, the combination of transport modes, fuels and methods of transportation is more effective than one single measure. By communicating why

¹²⁰

http://www.google.com.au/url?q=https://cdproject.net/CDP%2520Questionnaire%2520Documents/CDP_Investor_2010.pdf&sa=X&ei=ep8ETJu3O8_JcZGtnPQE&ved=0CBgQzgQoATAA&usg=AFQjCNEmtcaafgrqvTte9cDbvQ-NeiSI_g

logistics processes need to work in certain ways, clients will be flexible in their ordering process so that the entire supply chain becomes more sustainable and efficient.

- The understanding of downstream factors, particularly in the consumer side: the awareness in the UK about food provenance and locality has led to a shift in behaviour and new concerns surrounding what is eaten, and how/where it is consumed.

Chapter 7: Government-led initiatives

!	<i>Food distribution has social, environmental and economic impacts. It is a cross-cutting issue that needs a holistic approach to be properly dealt with, and "triple bottom line" indicators.</i>
!	<i>Transport is expected to represent 14% of Australia's GHG emissions by 2020. Therefore, sustainable transport is a key challenge facing Australia in the near future.</i>
!	<i>An underperforming food distribution system can have consequences on the health of a country/region. For instance, research has shown a substantial correlation between fruit and vegetables intake and decreased risk of major chronic diseases. A system that fails in delivering these products to all the population faces increasing pressures in the health system.</i>
!	<i>There are a growing number of council-led policies that address issues such as food security, environmental impacts of food production and health and nutrition. In this report we have detected seven (see Appendix 6).</i>
✎	<i>Collaborative efforts with the industry can contribute to deliver policies that align better to the realities of commercial enterprises. The Waste & Resources Action Program (WRAP) is an example of Government-industry collaboration in the area of food waste management in supply chains.</i>
✎	<i>Governments can directly encourage sustainable food distribution systems through their procurement systems. Schools, hospitals, defense, institutes and many other institutions can directly purchase foods grown and distributed in sustainable ways. This is an untapped and potentially large driver of carbon abatement in Australian food chains.</i>
✎	<i>The Department of Agriculture, Fisheries and Forestry could have a program to improve food and agricultural product distribution through farmers markets and local food initiatives.</i>
✎	<i>Three principles for designing sustainable Government-led initiatives for food distribution are:</i> <i>(a) A consultative, open-minded, information seeking approach. This requires communication with traders, transporters, investors, legislators and central government.</i> <i>(b) Government-led initiatives should promote competition. This may require reducing the influence of particular large traders on city authorities.</i> <i>(c) Policy should not be dominated by strong "modernisation" or "preserving tradition" approaches. The best approach may well be a mix of systems that combine the modern and traditional. For example, larger firms bring market stability, can reduce costs in bulk operations and can also reduce carbon footprints in a larger scale than smaller operators. However, small operators can increase competition, variety and consumer access.</i>
<i>The goal of a food distribution policy is to optimize these extremes.</i>	

Table 7.1 summarises some food distribution strategies initiated by Governments.

Table 7.1. Government-led food distribution initiatives .

Initiative	Sustainable distribution strategies
BioStadt (BS)	Umbrella project developed by the Munich city council that supports organic, fair and regional food sourcing. Policy implementation is through government procurement, bio certification (catering) and trade fairs.
ECR Sustainable Distribution Group (ECR)	This group was an initiative of the Department for Environment Food and Rural Affairs (DEFRA), and IGD, a charity formed in 1909 that provides information and training on retail aspects such as supply chains, nutrition and sustainability, among others ¹²¹ . DEFRA's participation has been in the context of the Food Industry Sustainability Strategy (FISS), mainly as an IGD collaborator in identifying synergies between DEFRA and ECR initiatives.

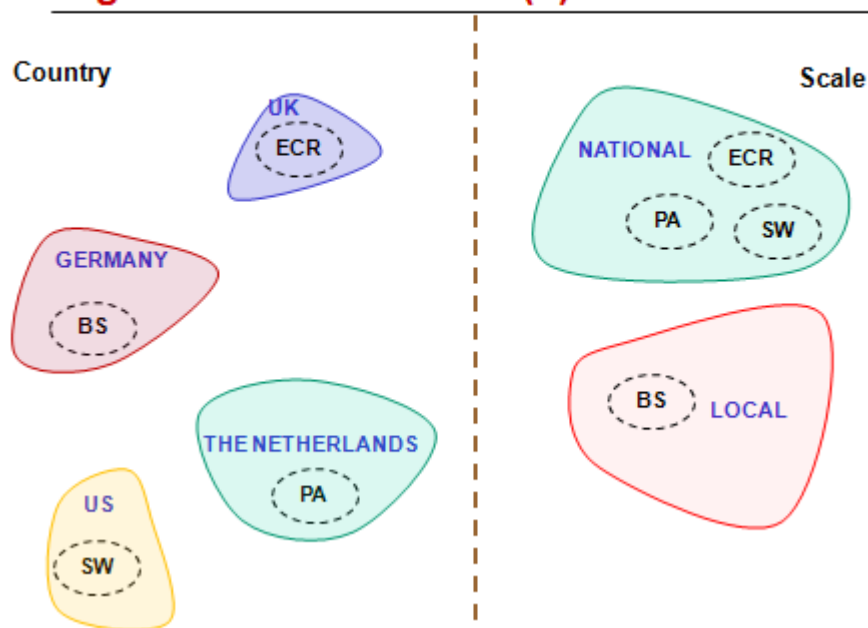
¹²¹ www.igd.com

	<p>The SDG initiative is working on three areas that aim to decrease food & grocery industry mileage: (a) Improvements in transport networks; (b) supply chain consolidation; and (c) measuring industry performance.</p> <p>Members of this group include several large manufacturers (<i>e.g.</i> Nestle, Procter & Gamble, H J Heinz) and supermarket chains (Tesco, Sainsbury's, ASDA). IGD acts as a manager of SDG and organises workshops, forums and tools that match organisations with similar need in their supply chain to develop collaborative measures such as transport and DC sharing. Practical issues addressed include the use of technology for vehicle routing and scheduling, tracking and asset management, improvement of vehicle fill, network design, information sharing and performance measurement.</p> <p>The ECR IGD group is also part of the Sustainable Transport initiative of ECR Europe, a joint trade and industry body.</p>
Platform Agrologistics (PA)	<p>A consortia of agricultural entrepreneurs, logistics companies and knowledge providers, such as universities and research institutes. The Platform challenges the different players in the field – including farmers, the food processing industry, retailers and logistics suppliers – to come up with innovative solutions to improve logistics efficiency.</p>
SmartWay (SW)	<p>Developed by EPA (USA) and the freight sector. One of the key elements of this initiative is the SmartWay Transport Partnership, which is open to companies that provide or hire freight delivery and logistics services. The program helps companies to calculate their environmental performance, set improvement goals, and calculate cost savings through those improvements.</p> <p>Smartway also identifies products and services that reduce transportation emissions, including fuel, vehicles, and tractors and trailers. For example, EPA has detected that idle reduction, aerodynamic designs, low rolling resistance tires and retrofitting technologies (<i>e.g.</i> diesel oxidation catalysts and filters) provide fuel saving and/or emission reducing benefits. Within each of these categories, EPA verifies specific products and a SmartWay certification is awarded to those technologies that test successfully.</p> <p>SmartWay also provides financing for companies to invest in technologies that reduce energy consumption and GHG emissions, in the form of grants. In addition to this, SmartWay hosts a clearinghouse web site with access to private lenders who help carriers obtain a loan for SmartWay certified tractors, trailers or fuel savings and emissions reducing technologies.</p>

These examples are generally facilitated groups of companies across a sector that are working together on carbon monitoring and disclosure projects, or through direct measures to decrease transport carbon footprints.

Figures 7.1 to 7.3 show the classification of these initiatives according to the three characteristics of importance discussed in section 2.1.

Organisational structure (a)



Organisational structure (b)

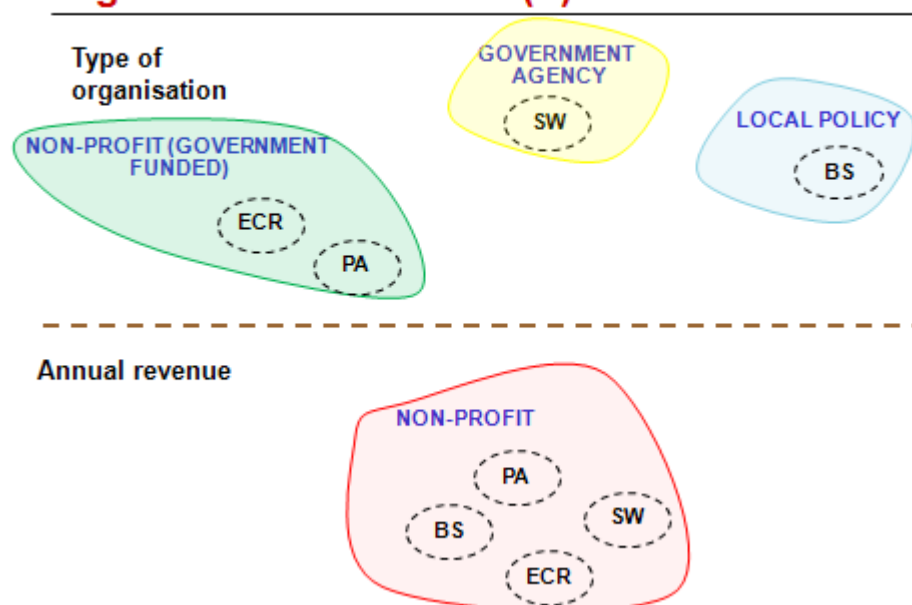
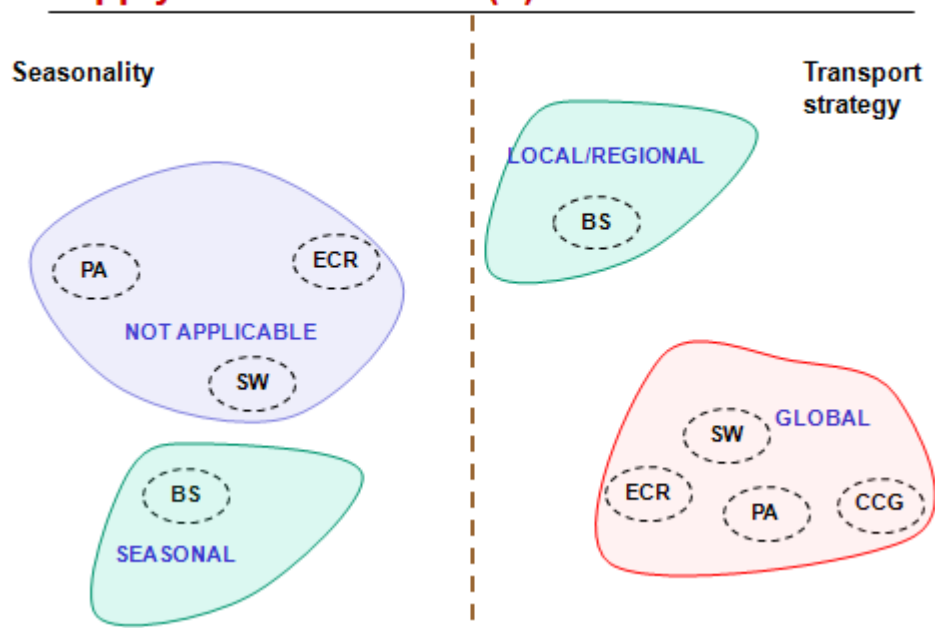


Figure 7.1. Categorisation of Government-led initiatives, depending on their organisational characteristics: (a) country and scale; (b) type of organisation and revenue.

Supply chain structure (a)



Supply chain structure (b)

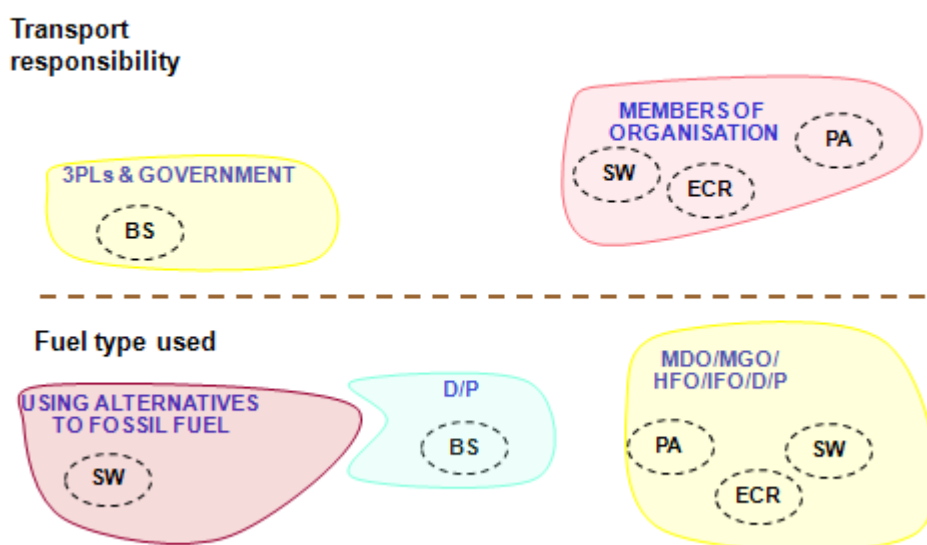


Figure 7.2. Categorisation of Government-led initiatives, depending on their supply chain characteristics: (a) seasonality and sourcing strategy; (b) transport responsibility (from farm to point of sale) and fuel type used.

Mission

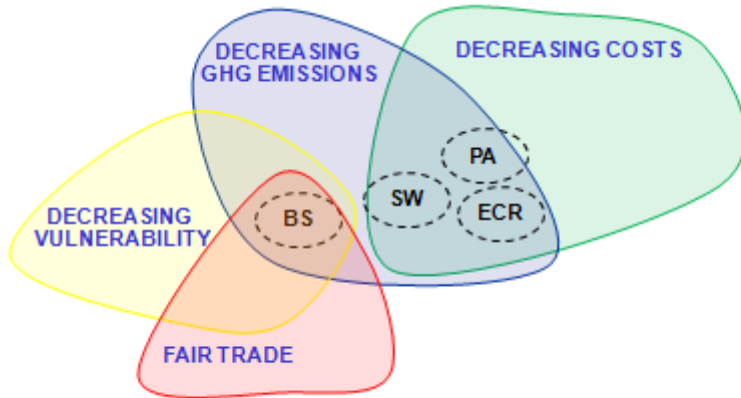


Figure 7.3. Categorisation of Government-led initiatives, depending on their type of mission.

7.1 Drivers and motivations of government-led initiatives

a) Environmental leadership. In the previous chapters, we described the effect that regulatory uncertainty has on practically all the supply chain players.

Further, growing public awareness is generating higher expectations for leadership on social and environmental standards and for more systematic solutions from governments, industry and other stakeholders (Moffat and Auer, 2006).

Food distribution has social, environmental and economic impacts. It is a cross-cutting issue that needs a holistic approach to be properly dealt with, and “triple bottom line” indicators need to be applied to measure the effectiveness of any measures in this regard.

Government-led efforts can both decrease the industry’s uncertainty and can also present a wider and more integrated strategy encompassing the triple bottom line indicators discussed, which are often ignored by the business sector.

b) The Government’s role in decreasing the country’s carbon footprint. In accordance with the Kyoto Protocol and a yet-to be-agreed target on emissions reductions, Australia will be bounded to a percentage decrease in the most significant emitting sectors. Transport is one of such sectors, which is expected to represent 14% of Australia’s GHG emissions by 2020. Therefore, the sustainable use of energy in the transport sector is a key challenge facing Australia in the near future.

c) Strong social and business case. Governments have to bear the costs of poorly functioning food supply and distribution and lack of enterprise opportunities. Such costs include increased congestion, waste, and poverty.

However, an underperforming food distribution system also has consequences on the health of a country/region. For example, a study that underpinned the development of a National Intervention Portfolio to promote fruit and vegetable consumption found a substantial correlation between fruit and vegetables intake and decreased risk of major chronic diseases (e.g. coronary heart disease, hypertension, stroke, diabetes and many forms of cancer) (Baghurst et al., 1999). The body of evidence in this regard has only increased in recent years (Food Standards Australia New Zealand, 2008; Morgan, 2008). A system that fails in delivering nutritional products to the population faces increasing pressures in the health system.

The social, environmental and financial costs described above may explain the numerous council-led campaigns around food, waste recycling and efficient lifestyles, which have a long-standing place in society (Andrews, 2008). Several of these initiatives were discussed in the farmer and consumer-led initiatives. However, renewed awareness of the need to balance food consumption and sustainability has been reflected in the growing number of council-led policies that address issues such as food security, environmental impacts of food production and health and nutrition. Appendix 6 presents a non-exhaustive list of some council initiatives in relation to food distribution.

d) Collaborative investment in food distribution systems. Recent government spending cuts have reduced local investment budgets and other sources of finance need to be found to replace and improve urban infrastructure. Collaborative investments with private companies to improve infrastructure supporting food distribution, particularly for power, water and highways, can lead to significant improvements in infrastructure.

CASE STUDY: THE VON HIER EXPERIENCE (GE)

Von hier is a community initiative that encompasses producers, food retailers and consumers and farmers associations from Brandenburg and Berlin to promote the trade of environmentally friendly local food and encourage job creations in those regions. (Note that there is also a Von hier brand owned by the German retailer Feneberg that holds no relationship with the Von hier brand in Brandenburg and Berlin).



The major strength of the Von hier effort is the brand itself. The initiative received a strong Government support, when the Berlin House of Representatives decided on June 2006, that a third of all food consumed in Berlin should come from the region. There are currently 25 small enterprises that offer over 60 products (of which about 35% are processed foods). Fresh products are all sourced from the Brandenburg-Berlin regions. In the case of manufactured products, at least 70 % of the raw materials are sourced from this region. These products are retailed in the Kaiser and Ullrich supermarkets (two of the largest supermarket chains in Berlin) as well

as in the Holiday Inn hotel chain. The logistics partner is FruchtExpress GmbH, which carries out the transport.

The project is marketed and coordinated through a company specially created for this role (BBM Brandenburg + Berlin GmbH). Ulrike Trellert, project manager, shares her views on the Von hier experiences.

What was your major motivation to establish Von hier?

The creation of a separate regional brand for the entire region was in the foreground. We felt that the marketing of regional products in the Berlin-Brandenburg region should be improved. We used as role model the regional brand from the Munich area, "Our Country".

(www.unserland.info), which is still active.

What obstacles have you faced?

Problems or conflicts in the formation of regional brand, which occurred due to the wide diversity of interests. Also, the involvement of strong partners from the food retailing, logistics, regional farms, and community representatives (both rural and urban) was problematic.

What lessons can you share in regards to establishing a company that favours local food?

Meeting the needs of a society that cares about the marketing of regional products was not a problem. In retrospective, we should have merged at the beginning with a small core of partners who were already united. Then the brand could have developed gradually into a broader partnership.

7.2 Innovative aspects of Government-led initiatives

a) Policy instruments from a whole-of-the-chain approach. The government is in a unique position to approach all the significant actors that play a role in the reduction of food carbon footprints. This is illustrated in Appendix 5, which presents different policy instruments that can be considered by governments to encourage environmental change in food supply chains.

Collaborative efforts with the industry can contribute to deliver policies that align better to the realities of commercial enterprises. The Waste & Resources Action Program (WRAP)¹²² is an example of Government-industry collaboration. It was created by the UK Government in 2000 as a delivery body and as part of the implementation of Waste Strategy 2000 for England and Wales. WRAP is now a UK-wide program supported by Scotland, Wales and Northern Ireland. The major priorities for WRAP can be summarized as reducing waste going to landfill – particularly food and packaging – and increasing the economic impact of these reduction activities. The mechanisms to achieve this are waste prevention, recycling and composting, smarter procurement and smarter processing and manufacturing.

WRAP is funded by a mix of local, federal and EU Government grants and industry funding. WRAP is expected to deliver to all stakeholders and manage potential overlaps with other initiatives at regional and national level. To do so, WRAP tenders projects to universities,

¹²² www.wrap.com

research organisations and private firms that look at innovative ways to achieve its goals of waste reduction and involve the industry.

b) The uptake of Government-led social programs through Councils and F&CL initiatives. The use of Environmental Management Systems (EMS) can support the development of sustainable local food initiatives. Although EMS is viewed by government agencies and farming organisations primarily as a mechanism for verifying 'clean and green' production practices for *international markets*, the Gippsland EMS has been highlighted as an example of how EMS can also support local/regional food networks (Higgins et al., 2008).

The development of the Gippsland EMS included the creation of an eco-label (Enviomeat), which emphasises the product's environmental credentials rather than its regional associations. In doing so, the group has kept open the possibility of expanding the network of suppliers beyond the Gippsland region to supply larger quantities of meat through an extended food chain. However, it will be essential to maintain the environmental credentials of the product by means of sustainable distribution strategies.

Although the association of Government funding or the development of an EMS initiative that enhanced the regional market of Enviomeat may have been incidental, this example illustrates the potential of using the same strategy for other products. Government programs can emphasise the significance of EMS in gaining access to *domestic niche markets*, not only export markets. The results speak for themselves: while Enviomeat was originally sold on a trial basis through a local farmers' market at Phillip Island in 2004, Enviomeat is now sold through specialized butchers and restaurants in Victoria.

c) Institutional procurement. Governments can directly encourage sustainable food distribution systems through their procurement systems. Schools, hospitals, defense, institutes and other publicly-funded organisations can directly purchase foods grown and distributed in sustainable ways. For example, the University of Toronto sources up to 15% of its food from Ontario and there are plans to increase this percentage over time. The City of Toronto is considering a proposal to adopt a local food policy for at least 50% of the food it buys through city-operated day care centres, nursing homes and other venues. The government of Nova Scotia supports local farmers using policies that encourage the purchase of local products in provincial health care and justice institutes. The program currently gets 90% of processed dairy products such as butter and yogurt, 60% of fresh produce and up to 80% of fresh produce from storage, and 60% of beef, chicken and pork from local sources ¹²³.

The potential in Australia for this type of measure is significant, considering these factors:

- The Victorian government alone employs over 200,000 people ¹²⁴.
- The total number of public hospitals is 144 and the annual number of admissions is above 1.2 million patients per year, with an average stay of 6.6 days ¹²⁵.

¹²³ http://www.ccednet-rcdec.ca/files/ccednet/ves_in_Canada_Brief_Final_-_June_18_2008__3_.pdf

¹²⁴

<http://www.careers.vic.gov.au/CA256D160006CABE/0/AC11A37CC7220206CA25705900201A40?OpenDocument>

- In 2005 Victoria had 1,613 public schools with an enrolment of 537,000 students per year.
- It is estimated that the number of Defense personnel in Victoria is over 13,800 staff.
- The outsourcing of food catering by businesses, governments and educational, aged care and medical or health institutions has particularly been a source of industry revenue growth since the mid-1990s. Businesses, governments and institutions account for over 80% of food catering demand ¹²⁶.

Institutional procurement provides opportunities for government to drive innovation in both production and delivery systems, including support for trials of low-emissions distribution.

7.3 Obstacles and challenges for Government-led initiatives

a) Food freight is not considered sufficiently important in Government strategies.

Australian programs targeting freight transport emissions have been limited to some procurement programmes at state level and limited funding. Examples include:

- The NSW Cleaner Government Fleet program, which encourages the uptake of cleaner vehicles (*e.g.* hybrid vehicles) through purchasing arrangements ¹²⁷.
- The NSW FleetWise Partnership program, which mainly targets passenger and light commercial vehicles. The program offers seminars, information on vehicle procurement and tools with a view to reduce vehicle emissions.
- The QLD Freightsmart initiative, which provided \$720,000 in grants (matched dollar by dollar) to organisations for demonstration projects on the use of innovative technologies and logistics practices to reduce transport GHG emissions. This program targeted in particular movements in the Port of Brisbane.

b) The environment for private investment in food distribution is often discouraging. Current agricultural marketing reforms are making food supply and distribution increasingly dependent on the private sector. However, the lack of development on market facilities, roads, regulations, taxes and property rights does not encourage private investment (Hubbard and Onumah, 2001) .

c) Government focus on food exports. In their Trade and Market Access Program, the Department of Agriculture, Fisheries and Forestry (DAFF) tackles the development of export markets. However, DAFF does not have a program for the development of domestic market

¹²⁵

[http://www.health.gov.au/internet/main/publishing.nsf/Content/40841CBD493A5BCBCA25739A007EB824/\\$File/facts%20VIC.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/40841CBD493A5BCBCA25739A007EB824/$File/facts%20VIC.pdf)

¹²⁶ IBISWorld, 2010.

¹²⁷

<http://www.statefleet.ogp.commerce.nsw.gov.au/Greening+the+Government+Fleet/Hybrid+Vehicles+in+the+Government+Fleet.htm>

strategies¹²⁸. This is in contrast with other similar agencies abroad. For example, the United States Department of Agriculture, through their Agricultural Marketing Service, has a mission to improve food and agricultural product distribution through farmers markets and local food initiatives¹²⁹. The USDA itself maintains a farmers' market in Washington, showing a commitment to develop effective direct marketing strategies for farmers. This support for local initiatives in the USA is thought to be a significant factor on the relatively high density of farmers markets with respect to Australia, as discussed in Chapter 3.

d) Food distribution is a low priority in urban development. While the agenda of urban authorities gives emphasis to education, housing, environment, sanitation and traffic control issues, most urban authorities give low priority to food supply and distribution issues. Dealing with urban food distribution requires a cross-cutting approach, yet cross-departmental policy initiatives are uncommon (Hubbard and Onumah, 2001).

e) The complexity of food distribution. It was mentioned before that the Government is in a unique position to provide a holistic approach to food distribution, taking into account triple bottom line indicators. However, holistic approaches are highly elusive in such a complex issue. Measures designed to decrease the environmental impacts of transport systems do not necessarily account for the distribution needs of states and councils. Likewise, council-led policies on food security, nutritional aspects and local foods may consider limitations in regional supply chain infrastructure, but do not have the influence required to improve this aspect. Also, the relationship between social organisations, community values and health in food systems should be considered (Coveney, 2000). These aspects need to be balanced with other drivers such as the economy, modern food supply chain structures and environment.

7.4 Lessons learned and applicability to future initiatives

Hubbard and Onumah (2001) established three fundamental principles to develop sustainable food distribution systems through Government-led initiatives:

- (a) Authorities should adopt a consultative, open-minded, information seeking approach. This requires communication with traders, transporters, investors, legislators and central government.
- (b) Government-led initiatives should promote competition. This may require reducing the influence of particular large traders on city authorities. Council or city-based policy on food distribution should avoid protecting large-scale firms by licensing controls or tax reductions.

¹²⁸ <http://www.daff.gov.au/about/contactus/id>

¹²⁹

<http://www.ams.usda.gov/AMSV1.0/ams.fetchTemplateData.do?template=TemplateA&navID=WholesaleandFarmersMarkets&leftNav=WholesaleandFarmersMarkets&page=WholesaleAndFarmersMarkets&acct=AMSPW>

- (c) Policy should not be dominated by strong “modernisation” or “preserving tradition” approaches. The best approach may well be a combination of systems which combine the modern and traditional. For example, larger firms bring market stability, can reduce costs in bulk operations and can also reduce carbon footprints in a larger scale than smaller operators. However, small operators increase variety and consumer access. The goal of a food distribution policy is to optimize these extremes.

Chapter 8: Final Remarks

Food is undeniably essential to our health and well-being. The food system is also critical to the economy of the nation and its states. While distribution is not the largest component of the carbon footprint of many foods, these systems will need to adapt and move to reduce carbon emissions in the near future.

There are no simple answers as to how Australia will make the emissions reductions that are required across the economy. However, it is likely that substantial reductions can only be achieved through a substantial transformation of all the economic activities that support the country and its population.

Food distribution is a highly complex system. It is both dependent on and a fundamental shaping force of how we produce, transport and consume food. It underpins social as well as economic and environmental outcomes. It is essential to the reliable provision of safe and high quality food, supports diverse livelihoods and contributes economic activity. Our globally interconnected food distribution system can move food from locations of abundance to those of scarcity, potentially enabling surplus in one part of the country or the world to reach those who need it in another.

Food distribution systems are also increasingly vulnerable to a range of climate change consequences as well as to other impacts. Some of these vulnerabilities have been discussed within this report, such as changing and uncertain regulatory environments (particularly relating to greenhouse gas mitigation), and the impacts of the policies that may follow on supply chain participants and consumers. Others have only been briefly touched upon in this report, such as the impacts of extreme weather and oil price fluctuations on viability and reliability of food distribution systems. A more detailed exploration of these factors can be found in the reports from Parts 1 & 2 of this project:

- *Part 1: Victorian Food Freight: Emissions and Vulnerabilities*
- *Part 2: Understanding Victoria's Fruit and Vegetable Freight Emissions*

Efforts to reduce emissions from food distribution systems need to consider this complexity, the diverse outcomes provided by these systems, as well as the increasing vulnerabilities. Manipulating carbon accounting methods or optimising for efficiency or emissions reduction alone can have unintended negative consequences, if:

- Emissions are displaced to elsewhere in the supply chain (*i.e.* some distribution strategies can cause more emissions to be generated in production);
- Health, safety, community well-being or fairness are compromised;
- Other environmental impacts are incurred; or
- The viability and resilience of the system is reduced, *i.e.* the ability of participants in the supply chain to respond and adapt is compromised.

Fortunately, as described in this report, the transformation has begun.

Diverse actors, both within and reliant on the food distribution system, are pursuing reduction in emissions along with other outcomes. While the motivations, reduction targets

and goals of these actors can be different, all of these initiatives have led to an abatement of GHG emissions. Each of the groups studied revealed significant opportunities for reduction of greenhouse gas emissions from food transport.

This report revealed significant areas of untapped potential that can accelerate emissions reduction in Victorian and Australian food distribution systems. These opportunities exist not just within the groups identified, but also in applying lessons and innovations emerging from each group to the experiments and improvements in the others. The case studies have showed numerous examples of this cross-fertilisation – from retailers building on consumer interest in local food to reestablish regional food distribution systems (*e.g.* ASDA, WalMart , Coles), and organisations applying lessons from 3PL providers and supply chain managers to improve the sophistication of their food transport systems (*e.g.* SecondBite and eFarm).

These examples demonstrate the value of diverse approaches, motivations and experiments. This diversity is increasingly important in a context of both accelerating change and increasing vulnerability – it helps to avoid ‘pathway dependence’ or decision lock-in, while increasing the options we have to respond and cope with abrupt or disruptive change.

The exponential development and application of ICT is pervasive and is opening up opportunities for smarter systems through all the groups considered, as well as accelerating our knowledge of, uptake, adaptation and improvement of innovative systems as they arise. The examples mentioned throughout,¹³⁰ are joined daily by others, as open-source innovation, Web 2.0 and personal mobile devices are understood and applied by greater numbers of people – to access information,¹³¹ express preferences in the market place and to organise the food provision they want.^{132, 133, 134}

Strong government action to price or limit greenhouse emissions can drive change in this sector, along with all others. Numerous examples have been cited throughout of the impact of policy uncertainty, even amongst those that may be interested in making improvements. Multi-national food manufacturing companies also offer different levels of support to local and national GHG mitigation policies. The duality in the views expressed by global offices and the position adopted in the company’s representation in different countries adds unnecessary confusion to the implementation of effective carbon abatement instruments. It is systemic change, and not, conservatism, that will improve the viability of our food distribution systems in an inevitably carbon-constrained future.

¹³⁰ SureHarvest (<http://www.sureharvest.com/>); IBM - <http://www.ibm.com/smarterplanet/>; Earthster - <http://www.earthster.org/>; NextLab - <http://nextlab.mit.edu/>; SourceMap - <http://www.sourcemap.org/>; Foodgeeks - <http://www.foodgeeks.com/>

¹³¹ [iphone apps: Food Advisor; Food Additives; LocalHarvest etc](#)

¹³² F&CL coop software - <http://www.localfoodcoop.org/>;

¹³³ Website summarising web 2.0 food apps:
http://www.feedmyapp.com/web_20_food_applications_sites

¹³⁴ As described in Hatfield, Layne et al (2009), *Cultivating the Web: High Tech Tools for the Sustainable Food Movement*, <http://www.eatwellguide.org/i.php?pd=CultivatingTheWeb>

Possible Pathways for Innovation in Victorian Food Distribution

From this work, we have identified some potential opportunities for further development of innovative food distribution systems in Victoria. To implement these ideas, further research to understand the implications and trade-offs of different courses of action will be required. Some opportunities worthy of further consideration and action are outlined below.

Consumers

"As with everything we sell it's our customers who make the final decision" (Woolworths Spokesperson, 2010)

Consumers can support the development of sustainable, low-emissions supply chains by:

- Reflecting their stated environmental and social concerns in purchasing behaviour, including sourcing and purchasing accredited (where possible) foods.
- Being willing to change patterns of behaviour, including greater acceptance of product variability according to season, size and blemishes.
- Providing market signals through demand for action from supply chain players, even in the absence of strong policy / regulatory drivers.
- Working with and/or supporting new pathways for obtaining their food, including directly from producer groups or through businesses with transparent and accountable sourcing and distribution systems.

Farmers / Producers

"While farmers get paid about 3 times what they would receive in traditional supermarket chains, prices that customers pay for FCs produce are about 40% cheaper than their organic equivalents. This means that costs need to be squeezed out of the middle steps to get to the consumer (i.e. the distribution network)." (FoodConnect case study)

A number of the models in this report that were created to provide 'fair trade' alternatives give greater recognition to the location and / or production values of the producer, increasing their ability to claim 'value' in the market place. These models range from direct farmer's markets and community supported agriculture systems, through coordinated distribution for these types of direct sales, to retailers reorganising distribution to meet demand for local food (and reduce 'food miles') and accreditation and marketing on the basis of sustainable practices. The relevance of these opportunities varies according to the size and type of producer in question.

Use of these distribution systems or market pathways does not necessarily mean fewer greenhouse gas emissions from transport. In particular, the use of smaller vehicles or lower loading of those vehicles can significantly increase GHG emissions (Leorey *et al.*, 2010). Similarly, if they result in consumers driving further to access their food, or making additional trips, emissions benefits from the downstream supply chain may be lost. A full-cost emissions comparison of these systems is outside the scope of this project, although some of these components have been analysed in the Report 2, which forms part of this series. The impacts of these distribution systems on food waste would also need to be considered.

For producers of all sizes and types opportunities for preparation to face increasing pressures on the transport system and market positioning include:

- Develop greater understanding and transparency (from farm to fork) about distribution emissions and fuel costs.
- Explore diverse pathways for getting produce to market or directly to consumers and work on improving these systems for greater potential emissions reductions.
- Use of ICT to improve information flows and logistics across regional food transport systems. For example, enabling real-time tracking of vehicles, optimising cargo space, sharing vehicles and storage; or coordinating fronthaul and backhaul trips in the same region.
- Consider opportunities to coordinate regional production, storage and sale to share risk and consolidate transport and contracting opportunities.
- Take advantage of production opportunities that are emerging from increased awareness of distribution costs and resource availability, particularly in urban and peri-urban production.

Retailers

"The supply chain is the big prize. We think that in the future many of our customers are going to care about this: we think this will be an area of competitive advantage." (Tieman 2010 – Tesco, UK).

The influence of the major Australian supermarket chains means that they could drive substantial improvements across food supply chains. An example is Woolworths whose Scope 1, 2 and 3 activities amount to 85.3 Mt CO₂-e per year, or 13% of Australia's direct and indirect emissions. About 96.5% of these emissions are a result of Scope 3 activities, which means that the abatement of this footprint requires a collaborative approach between Woolworths and its suppliers. However, while there are some signs of action, the exploitation of collaborative retailer-manufacturer opportunities and many other possibilities is a long way behind that demonstrated overseas.

Efficiency and cost competitiveness are the key drivers behind many retailer activities to reduce emissions, but there are other impacts that must also be considered, such as fair trade and changing consumer demands. The major retailers hold by far the largest share of the market and may therefore be in the strongest position to drive change towards sustainable production and distribution systems. Some opportunities include:

- Better understanding of the effect of just-in-time systems on emissions and resilience, throughout the supply chain.
- Investing in the infrastructure and systems that enable low-emissions food to be provided to consumers, such as capturing the 'low hanging' fruit in cold chain efficiency. Taking up energy efficiency opportunities now can reduce the impact of future carbon and fuel price increases on food prices, and enable retailers to support strong action on climate change, without reducing their own competitiveness.
- Working collaboratively and transparently throughout supply chains may identify greater emissions reduction opportunities and improve the ability of suppliers to take them up.

- Use the volumes moved by large retailers to lead changes in freight systems. For example, drive development of more effective domestic rail freight systems and infrastructure for biofuel production and use (which could include the use of organic waste to create fuel).¹³⁵
- Experiment with different store or distribution formats, particularly where these may improve producer viability or enable reduced consumer dependence on car travel. Examples include direct sale of produce from the region or stores integrated with public transport or smaller neighbourhood outlets.
- Support consumers to make ethical / fair trade and sustainable choices through information and education. This could include marketing and store layouts that reflect seasonality, production systems and origins of produce.

Retailer leadership is likely to be accelerated by both government and consumer demand for change (see above and below).

Manufacturers / Global

"Kraft recognises that, although climate change-related regulation may create some near-term risks for Kraft Foods and other companies, the lack of such regulation could create significant long-term risks" (Kraft Carbon Disclosure statement, 2009)¹³⁶

"Conviction coupled with enlightened self-interest. No fish, no fish fingers. No water, no tea. It's as simple as that" (Antony Burgmans, Chair of Unilever, 2002)¹³⁷

This report identified that while many global food manufacturing companies are actively engaged in collaborative efforts to decrease the impacts of their distribution systems and supply chains, the Australian-based companies are lagging behind. Even in the absence of a carbon price, there is increasing demand from international supply chains and the need to deal with other pressures (including less reliable supply and fluctuating fuel prices) that mean greater attention to distribution systems is required.

Australian companies focused on export markets cannot escape the impact of distance, but can focus on minimising its impact on competitiveness. It should be noted that, for fruit and vegetables (the major focus of this project), and for some other manufactured foods such as bread and bakery products domestic markets are by far the most significant market share¹³⁸. Opportunities include:

¹³⁵ Migros, the largest food retailer in Switzerland, was also the first Swiss company to extract biogas from its organic waste and use it to run part of its fleet - http://www.migros.ch/DE/Ueber_die_Migros/Nachhaltigkeit/Publikationen/Documents/Migros%20Sustainability%20report%202006.pdf

¹³⁶ https://www.cdproject.net/en-US/Pages/Search-For-The-File+-search.cdproject.net/responses2/public/Kraft_Foods_5679_Corporate_GHG_Emissions_Response_CDP_7_2009.asp

¹³⁷ <http://www.unilever.com/mediacentre/pressreleases/2002/safety.aspx>

¹³⁸ Domestic market makes up 87.9% and 97.0% of fresh fruit and vegetables respectively, and 84.2% of both processed fruits and vegetables (see Part 2 report). Exports of bread and other bakery products represent only 0.5% of the industry's turnover (IBISWorld 2010, *Bread manufacturing in Australia*, Report C2161).

- Applying learning from other food distribution initiatives (*e.g.* F&CL or retailers) to reduce distribution emissions and costs affecting market access.
- Engaging with collaborative international projects focused on reducing the impacts of global food supply chains, to work with and learn from leading projects¹³⁹.
- Develop transparent carbon (and other environmental impact) accounting and reduction strategies, to identify and promote sustainable practices that overcome the emissions generated through long distance transport.
- Work collaboratively to enable reduction of distribution emissions within countries of source and origin. Innovative packaging formats that reduce weight and space requirements is one area where this approach could be useful.
- Investigate and develop methods to reduce emissions and fuel use in long distance transport.
- Use leadership and innovation in domestic low-emissions food manufacturing to open up opportunities for export of knowledge in addition to / instead of actual food product.

Logistics Operators

"A 'network' of buyers and sellers that share a common goal of increased sustainability show the green economy has a place in mainstream food transport activity [...] it is not merely the MODE of transport that must be adapted (electric / hydrogen / biomethane gas / biodiesel etc), but also the METHOD. By emphasising this combination, buyers will happily change their ordering process so that the entire supply chain becomes more sustainable and efficient" (Kevin Tullet, LowHub 2010).

The transport and logistics system is the 'mycelium' of the food system – it is a vast, dynamic, penetrating network of entities, continuously creating pathways to move nutrients between producers and consumers. Logistics operators are the key to utilising the infinite possibilities in the network in the most effective way and their decisions require real-time flexibility and response, as sources and demands for this movement of food change. Just like mycelium, and many other patterns in biology, its activities move between main arteries and ever smaller and more diffuse pathways to consumption destinations. As described in this report, innovations in logistics operations are occurring within the main arteries (major global shipping routes and intermodal terminals) as well as throughout the small but numerous tributaries of local distribution and the 'last mile' – which tends to rely on small LCVs in dense urban areas¹⁴⁰ or consumer trips to retail outlets performed in a wide spectrum of transportation options.

Opportunities within logistics operations are closely tied with the demands of their customers, the producers, manufacturers, retailers and consumers of food. Therefore, there is some cross-over with the opportunities identified in those sections. Logistics providers could consider:

¹³⁹ For example, members of the US-based Sustainable Food Lab include: Unilever (Netherlands); Heinz, Sodexo and Starbucks (among many others) from the US; and various companies from Italy, South America, Kenya. No Australian companies or organisations are listed.

¹⁴⁰ See Part 2 report for discussion of the emissions challenge in relation to LCVs

- Clear and transparent reporting of the emissions and fuel costs of logistics operations, including the implications of different delivery time and responsiveness requirements.
- Collaboration with major supply chain players (and government) to co-invest in infrastructure to support adoption of new vehicles and fuels, particularly where this helps overcome early mover or supply network disadvantages.
- Develop collaborative partnerships for network optimisation, both within and between organisations.
- Innovative uses of existing infrastructure, including where it is underutilised (*e.g.* coastal and harbour shipping), has fallen into disuse (*e.g.* rural rail delivery) or where new models are emerging but have not yet been applied in Australia (*e.g.* cargo trams)¹⁴¹.
- Sharing and application of knowledge, particularly regarding network optimisation, to support development of diverse food distribution models that contribute to overall emissions reduction. A point in case is the pro-bono support to Secondbite from major transport companies CEVA and Linfox. The support involves the provision of logistical expertise in both warehousing and transport, and covers areas such as OH&S, vehicle procurement, warehouse design and insurance. Discussions are being held in relation to 'backloading' transport vehicles from food source areas to recipient agency destinations, and on other methods of streamlining the transport of bulk surplus food¹⁴².

Government

Governments have an important role in ensuring a fair and competitive playing field for producers, food businesses, retail and other outlets, and consumers. As these diverse actors engage in activities to improve food distribution systems, their preferred outcomes will not necessarily be aligned.

For example, while the increase in private labels may enable supermarkets more control over supply chains and potentially increased efficiencies, there are concerns about reduced transparency of product information and similarly reduced ability of producers or food businesses to negotiate fair prices. Similarly, while home delivery models may reduce the emissions associated with food transport, for some communities they could exacerbate social isolation. When health and community development objectives are being considered, more distributed outlets that enable active transport (walking and cycling) and encourage social interaction may be preferred.

Policies, schemes and incentives that encourage both consumers and enterprises to move towards low carbon food supply chains need to follow a coordinated approach, with consideration also given to improved supply chain resilience, regional economic development and improved health and well-being.

Key opportunity areas for government (which may apply differently at different levels of government) are:

- Support research into the synergies and trade-offs between emissions and other environmental impacts, health and well-being, and regional development.

¹⁴¹ <http://en.wikipedia.org/wiki/CarGoTram>; http://en.wikipedia.org/wiki/Tram#Cargo_trams

¹⁴² Russel Shields, Secondbite program manager, personal communication. 15 June 2010.

- Facilitate councils, businesses, industry associations, collaborative efforts and farmers and consumers organisations that are showing leadership in emissions reduction to develop clusters of shared knowledge, information exchange and foster development of new partnerships.
- Encourage diversity and experimentation through small grants for innovative systems, and collect information on emissions and other benefits / costs of these systems to inform further development.
- Support informed decisions by ethically concerned consumers, by:
 - Developing accessible information about food trade-offs on aspects such as transport distances, production and processing practices, water availability, packaging waste and fertiliser application;
 - Enabling transparency on how the final price paid by consumers is distributed through the value chain; and
 - Developing and supporting trustworthy and accessible accreditation schemes.
- Ensure retail-led processes such as private label and category management do not become anti-competitive or unfairly disadvantage some producers / consumer groups. Government (in collaboration with industry) could potentially set up a watchdog organisation to ensure fair targets for each supply chain partner and prevent emissions or costs being unfairly distributed along supply chains.
- Use government food procurement to driving uptake of existing accreditation systems and / or support development of new and innovative models for producing and distributing food.
- Identify and remove unnecessary regulatory barriers to development and uptake of innovations.

References

- AEA, 2008. 2008 Guidelines to Defra's GHG Conversion Factors: Methodology Paper for Transport Emission Factors. Department for Environment Food and Rural Affairs, pp. 1-35.
- Alexander, C., Smaje, C., 2008. Surplus retail food redistribution: An analysis of a third sector model. *Resources, Conservation and Recycling* 52, 1290-1298.
- Andrews, G., 2008. *The Slow Food story: politics and pleasure*. Mc Gill-Queen's University Press.
- Anon., 2009a. Kraft Foods Cuts 50 Million Truck Miles, *Journal of Commerce*, New York, p. 1.
- Anon., 2009b. Supermarket waste used for power, *Canadian Grocer*, p. 21.
- Arvanitoyannis, I.S., Ioannis, S.A., Dr, Ph.D, 2008. ISO 14000: A Promising New System for Environmental Management or Just Another Illusion?, *Waste Management for the Food Industries*. Academic Press, Amsterdam, pp. 39-96.
- ATC, 2008. Improving urban congestion information for decision-making, Report to COAG from the Australian Transport Council, Canberra ACT, pp. 1-19.
- Audsley, E., Brander, M., Chatterton, J., Murphy-Bokern, D., Webster, C., Williams, A., 2009. How low can we go? An assessment of greenhouse gas emissions from the UK food system and the scope to reduce them by 2050. *WWF-UK*, pp. 1-84.
- Australian Bureau of Statistics, 2008a. 9208.0 Survey of Motor Vehicle Use, pp. 1-48.
- Australian Bureau of Statistics, 2008b. 71210DO006_200708 Agricultural Commodities, Australia, 2007-08, Table.
- Australian Competition and Consumer Commission, 2008. Report of the ACCC inquiry into the competitiveness of retail prices for standard groceries. Commonwealth of Australia, pp. 1-457.
- Baghurst, P., Beaumont-Smith, N., Baghurst, K., Cox, D., 1999. The relationship between the consumption of fruits and vegetables and health status, Report to the Department of Health and Aged Care and the Strategic Intergovernmental Nutrition Alliance, pp. 1-85.
- Berglund, M., van Laarhoven, P., Sharman, G., Wandel, S., 1999. Third party logistics: is there a future? *The International Journal of Logistics Management* 10, 59-70.
- Berruto, R., Busato, P., Wojciech, J.F., Robert, L.S., Bernhard, B., Stanley, E.P., 2009. *Logistics and Postharvest Handling of Locally Grown Produce, Postharvest Handling (Second Edition)*. Academic Press, San Diego, pp. 283-331.
- Blanco, E.E., Craig, A.J., 2009. The value of detailed logistics information in carbon footprints. *MIT Center for Transportation and Logistics*, pp. 1-7.
- Bowne, M., Rizet, C., Leonardi, J., Allen, J., 2008. Analysing energy use in supply chains: the case of fruits and vegetables and furniture., *Proceedings of the Logistics Research Network Conference*, Liverpool, UK, pp. 1-6.
- Business Monitor International, 2009. *Australia Food & Drink Report Q2 2009*, London, UK, pp. 1-81.
- Carlsson-Kanyama, A., 1997. Weighted average source points and distances for consumption origin-tools for environmental impact analysis? *Ecological Economics* 23, 15-23.
- Carlsson-Kanyama, A., 1998a. Climate change and dietary choices - how can emissions of greenhouse gases from food consumption be reduced? *Food Policy* 23, 277-293.
- Carlsson-Kanyama, A., 1998b. Climate change and dietary choices —how can emissions of greenhouse gases from food consumption be reduced? *Food Policy* 23, 277-293.
- Carlsson-Kanyama, A., Pipping Ekstrom, M. and Shanahan, H., 2003. Food and life cycle energy inputs: consequences of diet and ways to increase efficiency. *Ecological Economics* 44, 293-307.
- CDI Pinnacle Management, 2008. Public submission to ACCC Grocery Inquiry by Horticulture Australia Ltd, in: *Australia*, H. (Ed.), p. 110.

- Chamberlain, L., 2007. Skyfarming, *New York Magazine*, pp. 1-3.
- Chang, J.B., Lusk, J.L., 2009. Fairness and food choice. *Food Policy* 34, 483-491.
- Cholette, S., Venkat, K., 2009. The energy and carbon intensity of wine distribution: A study of logistical options for delivering wine to consumers. *Journal of Cleaner Production* 17, 1401-1413.
- Christopher, M., 2005. *Logistics and supply chain management: creating value-adding networks*, 3rd ed. ed. Pearson Education.
- CIES-Consumer Goods Forum, 2010. The Consumer Goods Forum Top of Mind Survey Press release., Paris, France, pp. 1-2.
- Cleland, D.J., 2010. Towards a sustainable cold chain, 1st IIR International Cold Chain Conference,, Cambridge UK, pp. 1-8.
- Coley, D., Howard, M., Winter, M., 2009. Local food, food miles and carbon emissions: A comparison of farm shop and mass distribution approaches. *Food Policy* 34, 150-155.
- Coveney, J., 2000. Food security and sustainability: are we selling ourselves short? *Asia Pacific J Clin Nutr*, S97-S100.
- Creese, J., Marks, N., 2009. Future farming: how will climate change impact market requirements for Victoria's agrifood exports?, in: Angevin-Castro, Y. (Ed.). Department of Primary Industries, Victoria, pp. 1-24.
- CSIRO, 2009. An Analysis of Greenhouse Gas Mitigation and Carbon Sequestration Opportunities from Rural Land Use,, in: Eady, S., Grundy, M., Battaglia, M., Keating, B. (Eds.), pp. 1-172.
- D'Innocenzio, A., 2010. Wal-Mart to push suppliers to cut emissions, *Business News*.
- Department for Environment Food and Rural Affairs, 2003. A snapshot of the sector report of the working group on local food DEFRA, pp. 1-42.
- Department for Environment Food and Rural Affairs, 2007. Food Transport Indicators to 2006 (revised) -Experimental Statistics DEFRA, pp. 1-7.
- Department for Environment Food and Rural Affairs, 2009a. Basic Horticultural Statistics-summary (tables 1-3). DEFRA.
- Department for Environment Food and Rural Affairs, 2009b. Basic Horticultural Statistics-Vegetable details (tables 11 to 20). DEFRA.
- Department of Climate Change, 2009a. Australian National Greenhouse Accounts:National Inventory by Economic Sector 2007. Commonwealth of Australia, Barton ACT., pp. 1-20.
- Department of Climate Change, 2009b. Australian National Greenhouse Accounts:National Inventory by Economic Sector 2007, Table 6.1: Agriculture sector CO₂-e emissions, 2007. Commonwealth of Australia, Barton ACT., p. 142.
- Deuter, P., 2008a. Defining the impacts of climate change on horticulture in Australia, Garnaut Climate Change Review. Horticulture Australia Ltd,, pp. 1-23.
- Deuter, P., 2008b. Who will use the vegetable carbon tool?, Discussion paper 5.Vegetable Industry Carbon Footprint Scoping Study,. Horticulture Australia Ltd,, pp. 1-17.
- Eden, S., Bear, C., Walker, G., 2008. Mucky carrots and other proxies: Problematising the knowledge-fix for sustainable and ethical consumption. *Geoforum* 39, 1044-1057.
- Edwards-Jones, G., Milà i Canals, L., Hounsome, N., Truninger, M., Koerber, G., Hounsome, B., Cross, P., York, E.H., Hospido, A., Plassmann, K., Harris, I.M., Edwards, R.T., Day, G.A.S., Tomos, A.D., Cowell, S.J., Jones, D.L., 2008. Testing the assertion that 'local food is best': the challenges of an evidence-based approach. *Trends in Food Science & Technology* 19, 265-274.
- Edwards, J.B., McKinnon, A.C., 2009. Shopping trip or home delivery: which has the smaller carbon footprint?, *Logistics and Transport Focus*,. Logistics Research Centre, Heriot-Watt University, pp. 1-5.
- Estrada-Flores, S., 2008. The environmental dimension of food supply chains. Chain of Thought: a newsletter of Food Chain Intelligence 1, 1-18.

- Estrada-Flores, S., 2009a. Method for Estimating the Change in Food Safety Risks Across a Food Transport and Distribution Network: Phase 1. A review on food safety risks in the supply chain of fresh horticultural products. CSIRO and SafeFood Production Queensland, pp. 1-78.
- Estrada-Flores, S., 2009b. Technology Platform 1: Supply Chain and Logistics, Opportunities and challenges faced with emerging technologies in the Australian vegetable industry Horticulture Australia Ltd., pp. 1-82.
- Estrada-Flores, S., 2009c. Technology Platform 2: Adaptation and Mitigation Technologies, Opportunities and challenges faced with emerging technologies in the Australian vegetable industry Horticulture Australia Ltd, pp. 1-109.
- Estrada-Flores, S., 2010a. Achieving temperature control and energy efficiency in the cold chain, 1st IIR International Cold Chain Conference,, Cambridge UK, pp. 1-8.
- Estrada-Flores, S., 2010b. Technology Platform 3: Emerging Technologies for Quality and Safety., Opportunities and challenges faced with emerging technologies in the Australian vegetable industry Horticulture Australia Ltd, pp. 1-90.
- European Commission, 2009. A sustainable future for transport: towards an integrated, technology-led and user -friendly system, pp. 1-32.
- Eurostat, 2006. Road freight transport by type of goods - 2006, pp. 1-8.
- FAO/WHO, 2008. Microbiological hazards in fresh leafy vegetables and herbs: Meeting Report, in: Organization, F.a.A.O.o.t.U.N.W.H. (Ed.). Microbiological Risk Assessment Series No. 14., Rome, pp. 1-151.
- Food and Drink Federation, 2007. Transport efficiency: making a real difference, pp. 1-13.
- Food Standards Australia New Zealand, 2008. Proposal P293 - Nutrition, Health and Related Claims, Final Assessment Report.
- Fruit Growers Victoria Ltd., 2008. Public submission to ACCC Grocery Inquiry by Horticulture Australia Ltd, p. 4.
- Gaballa, S., Abraham, A.B., 2007. Food miles in Australia: a preliminary study of Melbourne, Victoria (updated in 2008). CERES Community Environment Park, pp. 1-60.
- Gaballa, S., Abraham, A.B., 2008. Food miles in Australia: a comparison of emissions from road and rail transport. CERES Community Environment Park, pp. 1-28.
- Garnaut, R., 2008. The Garnaut Climate Change Review. Commonwealth of Australia, Canberra, ACT.
- Garnett, T., 2006. Fruit and vegetables & UK greenhouse gas emissions: exploring the relationship. Food Climate Research Network, Centre for Environmental Strategy, University of Surrey, Uk., pp. 1-134.
- Garnett, T., 2008. Cooking Up a Storm: Food Greenhouse Gas Emissions and Our Changing Climate. Food Climate Research Network, Centre for Environmental Strategy, University of Surrey, Uk., pp. 1-156.
- Gregoire, M.B., Strohbehn, C., 2002. Benefits and obstacles to purchasing from local growers/producers. , Journal of Child Nutrition and Management
- Guthman, J., 2003. Fast food/organic food: reflexive tastes and the making of 'yuppie chow', . Social and Cultural Geography 4, 45-58.
- Hall, J., 2000. Environmental supply chain dynamics. Journal of Cleaner Production 8, 455-471.
- Hamilton, A., Boland, A., Stevens, D., Paulin, B., Kelly, J., Radcliffe, J., Dillon, P., 2008. Use of reclaimed effluent water in Australian horticulture. Land & Water Australia.
- Hennessy, K., B. Fitzharris, B.C. Bates, N. Harvey, S.M. Howden, L. Hughes, J. Salinger and R. Warrick, 2007. Australia and New. Climate Change 2007: Impacts, Adaptation and Vulnerability. Cambridge University Press, Cambridge, UK, pp. 507-540.
- Hertwich, E.G., Peters, G.P., 2009. Carbon footprints of nations: a global, trade-linked analysis. Environmental Science & Tehcnology 43, 6414-6420.

- Higgins, A.J., Estrada-Flores, S., Singh, G., Ton, T., 2007. The State of Logistics. Food Futures Flagship, CSIRO, pp. 1-131.
- Higgins, V., Dibden, J., Cocklin, C., 2008. Building alternative agri-food networks: Certification, embeddedness and agri-environmental governance. *Journal of Rural Studies* 24, 15-27.
- Hinrichs, C.C., 2000. Embeddedness and local food systems: notes on two types of direct agricultural market. *Journal of Rural Studies* 16, 295-303.
- Hogan, L., Thorpe, S., 2009. Issues in food miles and carbon labelling, ABARE research report,, Canberra ACT,, pp. 1-53.
- Horticulture Australia Limited, 2008. Implementation: Stage 3 Report, Future Focus: The Australian Horticulture Plan, pp. 1-114.
- Hospido, A., Milà I Canals, L., McLaren, S., Truninger, M., Edwards-Jones, G., Clift, R., 2009. The role of seasonality in lettuce consumption: A case study of environmental and social aspects. *International Journal of Life Cycle Assessment* 14, 381-391.
- Hubbard, M., Onumah, G., 2001. Improving urban food supply and distribution in developing countries: the role of city authorities. *Habitat International* 25, 431-446.
- Hume, A., Barber, A., East, A., McLaren, S., 2009. Carbon Footprinting for the Apple Supply Chain - Report on Methodology and Scoping Study, Draft Final Report from Landcare Research to MAF.
- IGD, 2008. Retail and foodservice opportunities for local food. Institute of Grocery Distribution, Watford, UK, pp. 1-48.
- Jarosz, L., 2008. The city in the country: Growing alternative food networks in Metropolitan areas. *Journal of Rural Studies* 24, 231-244.
- Jespersen, P.H., 2004. The transport contents of products. *World Transport Policy and Practice* 10, 28-35.
- Jewell, L., 2008. Peri-urban horticulture and land use planning : literature review & 'tool-kit', in: GHD Hassal (Ed.). Horticulture Australia Ltd.
- Jiang, T., Hanslow, K., Pearce, D., 2009. On-Farm Impacts of an Australian Emissions Trading Scheme. An Economic Analysis, RIRDC Publication No 09/064. Rural Industries Research and Development Corporation, p. 108 p.
- Jolley, A., 2006. Transport Technologies, Climate Change Working Paper No. 5. Centre for Strategic Economic Studies, Victoria University, pp. 1-67.
- Jones, A., 2002. An environmental assessment of food supply chains: a case study on dessert apples. *Environmental Management* 30, 560-576.
- Kendall, H.W., Pimentel, D., 1994. Constraints on the expansion of the global food supply. *Ambio* 23, 198-205.
- Kim, B., Neff, R., 2009. Measurement and communication of greenhouse gas emissions from U.S. food consumption via carbon calculators. *Ecological Economics* 69, 186-196.
- KPMG, 2009. State of the Industry. Australian Food and Grocery Council, , pp. 1-80.
- Larsen, K., Ryan, C., Abraham, A.B., 2008. Sustainable and Secure Food Systems for Victoria: What do we know? What do we need to know? Victorian Eco-Innovation Lab (VEIL), pp. 1-152.
- Lebel, L., Lorek, S., 2008. Enabling sustainable production-consumption systems. *Annual Review of Environmental Resources*, 241-275.
- Lewis, H., 2009. Issues, trends and challenges facing the food and drink industry - forecasts to 2014: Climate change (food miles, carbon footprints, going local), *Just Food*, Bromsgrove, p. 5.
- Lockie, S., Lyons, K., Lawrence, G., Grice, J., 2004. Choosing organics: a path analysis of factors underlying the selection of organic food among Australian consumers. *Appetite* 43, 135-146.
- Luscombe, M., 2007. Speech to the National Press Club.
- Mardirossian, A., 2009. Vic EPA – Carbon Innovators Network. Woolworth's Ltd.

- Marquez, L., Higgins, A., Estrada-Flores, S., 2010. Understanding Victoria's Fruit and Vegetable Freight Movements. Victorian Eco-innovation lab, University of Melbourne, pp. 1-170.
- Maton, T., 2010. Local food gains ground with shoppers, IGD Shopper Trends.
- Meisterling, K., Samaras, C., Schweizer, V., 2009. Decisions to reduce greenhouse gases from agriculture and product transport: LCA case study of organic and conventional wheat. *Journal of Cleaner Production* 17, 222-230.
- Mena, C., Stevens, G., 2010. Delivering performance in food supply chain: an introduction., in: Mena, C., Stevens, G. (Eds.), *Delivering performance in food supply chains*. Woodhead Publishing Ltd, pp. 1-15.
- Mintcheva, V., 2005. Indicators for environmental policy integration in the food supply chain (the case of the tomato ketchup supply chain and the integrated product policy). *Journal of Cleaner Production* 13, 717-731.
- Mithraratne, N., McLaren, S.J., Barber, A., 2008. Carbon Footprinting for the Kiwifruit Supply Chain -Report on Methodology and Scoping Study, Report to MAF (LC0708/156). Landcare Research.
- Moffat, A., Auer, A., 2006. Corporate Environmental Innovation (CEI): a government initiative to support corporate sustainability leadership. *Journal of Cleaner Production* 14, 589-600.
- Morgan, E., 2008. Fruit and vegetable consumption and waste in Australia, in: VicHealth (Ed.), pp. 1-54.
- Munro, G., 2007. 'Green' packaging is concern for growers, *Horticulture Week*, pp. 1-2.
- National Transport Commission, 2008. Freight transport in a carbon constrained economy - Options to cut freight carbon emissions pp. 1-2.
- National Transport Commission and Rare Consulting, 2008. Freight transport in a carbon constrained economy: discussion paper, pp. 1-65.
- Noakes, M., 2010. Dietary choices -nutrition vs sustainability, CSIRO Sustainable Food Manufacturing Forum, Sydney, NSW.
- O'Farrell, K., 2008. Sustainability gains through the recovery of unsold or off-specification food, Sustainability Fund Project. Hyder Consulting, pp. 1-20.
- O'Halloran, N., Fisher, P., Rab, A., 2008a. Options for mitigating greenhouse gas emissions for the Australian vegetable industry, Discussion Paper 6. Vegetable Industry Carbon Footprint Scoping Study. Horticulture Australia Ltd, pp. 1-31.
- O'Halloran, N., Fisher, P., Rab, A., 2008b. Preliminary estimation of the carbon footprint of the Australian vegetable industry, Discussion paper 4. Vegetable Industry Carbon Footprint Scoping Study. Horticulture Australia Ltd, pp. 1-39.
- Ossés de Eicker, M., Hischier, R., Hurni, H., Zah, R., 2010. Using non-local databases for the environmental assessment of industrial activities: The case of Latin America. *Environmental Impact Assessment Review* 30, 145-157.
- Paxton, A., 1994. The Food Miles Report: the dangers of long distance food transport. Safe Alliance, London, .
- Peters, G.M., Rowley, H.V., Wiedemann, S., Tucker, R., Short, M.D., Schultz, M., 2010. Red Meat Production in Australia: Life Cycle Assessment and Comparison with Overseas Studies. *Environ. Sci. Technol.* 44, 1327-1332.
- Pimentel, D., Houser, J., Preiss, E., White, O., Fang, H., Mesnick, L., Barsky, T., Tariche, S., Schreck, J. and Alpert, S., 1997. Water Resources: Agriculture, the Environment, and Society. *Biosciences* 47, 97-106.
- Pirog, R., van Pelt, T., Enshayan, K., Cook, E., 2001. Consumer perceptions of the safety, health, and environmental impact of various scales and geographic origin of food supply chains. The Leopold Center for Sustainable Agriculture, Iowa University, Iowa, US, p. 44.
- PricewaterhouseCoopers, 2009. S&P 500 Report. Carbon Disclosure Project, pp. 1-184.
- Quested, T., Johnson, H., 2009. Household food and drink waste in the UK. WRAP, pp. 1-95.

- Rama, I., Lawrence, P., 2008. Food Miles- A Critical Evaluation. Victorian Department of Primary Industries, pp. 1-8.
- Riddell, A., 2009. Fruit and vegetable processing in Australia, IBISWorld Industry Report C2130, pp. 1-44.
- Royo-Bordonada, M.A., Gorgojo, L., Ortega, H., Martín-Moreno, J.M., Lasunción, M.A., Garcés, C., Gil, A., Rodríguez-Artalejo, F., de Oya, M., the investigators of the Four Provinces, S., 2003. Greater dietary variety is associated with better biochemical nutritional status in Spanish children: The Four Provinces Study. *Nutrition, Metabolism and Cardiovascular Diseases* 13, 357-364.
- Saunders, C., Barber, A., Taylor, G., 2006. Food Miles - Comparative Energy/Emissions performance of New Zealand's Agriculture Industry. Agribusiness and Economics Research Unit (AERU), Lincoln University, pp. 1-103.
- Smith, A., Watkiss, P., Tweddle, G., McKinnon, A., Browne, M., Hunt, A., Treleven, C., Nash, C. and Cross, A., 2005. The validity of Food Miles as an Indicator of Sustainable Development. DEFRA, Oxon, UK, p. 103.
- Smith, G., 2009. Australian Hydroponic and Greenhouse Association. Evidence given to the inquiry into sustainable development of agribusiness in outer suburban Melbourne. Parliament of Victoria,, Melbourne, VIC.
- Smith, S., Paladino, A., 2010. Eating clean and green? Investigating consumer motivations towards the purchase of organic food. *Australasian Marketing Journal (AMJ)* In Press, Corrected Proof.
- Smithers, J., Lamarche, J., Joseph, A.E., 2008. Unpacking the terms of engagement with local food at the Farmers' Market: Insights from Ontario. *Journal of Rural Studies* 24, 337-350.
- Southworth, K., 2009. Corporate voluntary action: a valuable but incomplete solution to climate change and energy security challenges. *Policy and Society* 27, 329-350.
- Speedy, B., 2009. Woolies buys organic food chain Macro Wholefoods, *The Australian*.
- Stadig, M., 1997. Life cycle assessment of apple production – case studies for Sweden, New Zealand and France SIK Report 630 SIK, Gothenburg, Sweden.
- Steedman, P., Falk, T., 2009. From A to B: a snapshot of the UK food distribution system. Food Ethics Council, Brighton, UK, pp. 1-31.
- Stern, N., 2006. Stern Review: The Economics of Climate Change. HM Treasury, London.
- The Carbon Trust, 2009. The Carbon Manifesto, *The Daly Telegraph*, pp. 1-24.
- The Climate Institute, 2010. Food prices and emissions trading-briefing, pp. 1-8.
- The Cooperative Group, 2009. Sustainability Report 2008/09, pp. 1-138.
- The Garnaut Review Secretariat, 2007. Issues Paper 1. Climate Change: Land use- Agriculture and Forestry, Garnaut Climate Change Review
- The Nielsen Company, 2008. The ISO Survey -2008, pp. 1-33.
- The NSW Chamber of Fruit & Vegetable Industries Inc, 2008. Submission to the ACCC Inquiry,, pp. 1-7.
- The Treasury, 2008. 3.4 Impacts on households, Australia's low pollution future: the economics of climate change mitigation.
- Thomsson, O., Wallgren, C., 2005. Global warming and fossil energy use. *Ekologiskt Lantbruk* 41, 71-93.
- Tieman, R., 2010. Plan for the future from fork to farm, *Financial Times*, London, UK, p. 6.
- Transport for London Freight Unit, 2007. London Freight Plan:sustainable freight distribution: a plan for London. Mayor of London, London, pp. 1-108.
- Tukker, A., Bausch-Goldbahr, S., Verheijden, M., de Koning, A., Kleijn, R., Wolf, O., Dominguez, I.P., 2009. Environmental impacts of diet changes in the EU. JRC European Commission.
- Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A., Schiller, A.,

2003. A framework for vulnerability analysis in sustainability science. *Proceedings of The National Academy of Science of the USA* 100, 8074-8079.
- United Nations Press Release, 2010. Number of city dwellers grows amidst continuing disparities in level and pace of urbanization worldwide, in: UN (Ed.), pp. 1-4.
- US Environmental Protection Agency, 2008. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, Washington DC, pp. 1-473.
- van Hauwermeiren, A., Coene, G., Engelen, G., Mathijs, E., 2007. Energy Lifecycle Inputs in Food Systems: A Comparison of Local versus Mainstream Cases. *Journal of Environmental Policy and Planning* 9, 31-51.
- Venkat, K., Wakeland, W., 2006. Is Lean Necessarily Green?, 50th Anniversary Conference of the International Society for the Systems Sciences, Sonoma, CA, p. 16.
- Verbeke, W., Ward, R.W., 2006. Consumer interest in information cues denoting quality, traceability and origin: An application of ordered probit models to beef labels. *Food Quality and Preference* 17, 453-467.
- Wallgren, C., Höjer, M., 2009. Eating energy--Identifying possibilities for reduced energy use in the future food supply system. *Energy Policy* 37, 5803-5813.
- Weatherell, C., Tregear, A., Allinson, J., 2003. In search of the concerned consumer: UK public perceptions of food, farming and buying local. *Journal of Rural Studies* 19, 233-244.
- Webber, C.L., Matthews, H.S., 2008. Food-Miles and the Relative Climate Impacts of Food Choices in the United States. *Environ. Sci. Technol.* 42, 3508-3513.
- Whitelegg, J., 2006. Making sustainable transport happen.
- Wilkins, J., Eames-Sheavly, M., 2001. A primer on community food systems: linking food, nutrition and agriculture. . Cornell University, Ithaca, NY. .
- Williams, A.G., Audsley, E., Sandars, D.L., 2006. Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities, DEFRA Research Project IS0205. Cranfield University, Bedford, pp. 1-97.
- Williams, A.G., Pell, E., Webb, J., Evans, D., Moorhouse, E., Watkiss, P. , 2009. Comparative Life Cycle Assessment of Food Commodities Procured for UK Consumption Through a Diversity of Supply Chains, Final Report for Defra Project FO0103. DEFRA, pp. 1-25.
- Willimans, A., 2007. Comparative Study of Cut Roses for the British Market Produced in Kenya and the Netherlands-Précis Report for World Flowers. Cranfield University, pp. 1-3.
- Wilson, M., 2010. Waste not, want not: How environmental awareness is keeping revenue in order, IBISWorld Industry Report Q9634. Waste Disposal Services in Australia, pp. 1-48.
- Woolworths Limited, 2008. Public submission to ACCC Grocery Inquiry pp. 1-34.
- Woolworths Ltd, 2008. Public submission to ACCC Grocery Inquiry pp. 1-34.
- Woolworths Ltd, 2009a. Annual Report, pp. 1-156.
- Woolworths Ltd, 2009b. Corporate Responsibility Report,, pp. 1-76.
- World Economic Forum, 2009. Supply chain decarbonization: the role of logistics and transport in reducing supply chain carbon emissions, in: Doherty, S., Hoyle, S. (Eds.), pp. 1-41.
- WRAP, 2007. Packaging optimisation: the impact to date.
- Zajfen, V., 2008. Fresh Food Distribution Models for the Greater Los Angeles Region: Barriers and Opportunities to Facilitate and Scale Up the Distribution of Fresh Fruits and Vegetables. Urban & Environmental Policy Institute, Occidental College, pp. 1-23.

Appendix 1. Food Distribution Initiatives Investigated

Table A1. Food distribution initiatives classified according to category, country, scale, organisational structure, role in the chain and risk structure. See acronyms used in this table at the end of the Appendix.

Food distribution initiative	Category	Country	Scale	Organisational structure	Role in the chain	Risk structure
ASDA	R	UK	Global	Company	Retailer	Risk on suppliers (growers)
Aussie Farmers Direct	F	AUS	National	Company	Marketer	Risk sharing between AFD and growers
BioStadt	GOV	GER	Regional	Local council policy	Policy	Risk shared by suppliers and buyers
CERES	C	AUS	Regional	Non-profit	Urban production/marketer/outlet/education provider	All risk run by CERES (consumers buy on sight in the shop and markets)
Clean Cargo Group	T	USA	Global	Transport association	Transport & logistics	Risks of distribution remain with transport provider
ECR Sustainable Distribution Group	GOV	UK	National	Non-profit	Self-regulation	Risks of distribution remain with transport provider
eFarm	C	IN	Regional	Company	Marketer-supply chain coordinator	Risk sharing among suppliers and marketers
Farm Buyers Club	C	USA	Local	Company	Marketer	All risk run by farmers (money back to consumers if item not available)
Farm to folk (F2F)	F	USA	Local	Farmer cooperative	Marketer	Shared risks of consumers and farmers
Farmers Market Hub	F	USA	National	Farmers association	Producer-marketer	All risk in farmers & association
Farms Reach	C	UK	Local	Company	Marketer/e-auction/information hub	Only responsible for online transaction in electronic portal

Food Routes Network	C	USA	National	Non-profit	Communication, technical support, networking and information resources to organisations nationwide that are working to rebuild local, community-based food systems.	Risk remains with farmers; FRN is not accountable for transactions
Foodconnect	C	AUS	Regional	Non-profit	Marketer	Consumers buy a minimum of 4 week's boxes thus sharing the risk of crop failure
Gruppi di Acquisto Solidale	C	ITA	Local	Non-profit	Buyers (bulk)	All risk in buyers
The Brighton & Hove Food Partnership	C	UK	Local	Non-for-profit	Marketer	Shared risks of consumers and farmers
Homerville wholesale produce auction	F	USA	Regional	Farmer cooperative	Marketer	All risk in farmer
Just Local Food Cooperative	F	USA	Local	Farmer cooperative	Marketer	All risk run by farmers
LocalHarvest	C	USA	National	Company	Marketer-information hub	Risk shared between buyers and suppliers on buyers and suppliers; LH holds no responsibility on the chain
Lowhub	T	UK	Local	Company	Transport & logistics	All transport risk run by Lowhub
Melbourne's community farmers' markets (MCFM)	F	AUS	Regional	Farmer cooperative	Marketer	All risk in farmer
Platform Agrologistics	GOV	NLD	National	Non-profit	Innovator & communicator	Risk remains with farmers; PA is not accountable for transactions

Best Practice Food Distribution Systems

Red Tomato	F	USA	Regional	Farmer cooperative	Marketer, consultants, project implementation	All risk in farmers & marketer (Red Tomato)
Second bite	C	AUS	Regional	Non-profit	Distributor	All transport risk run by second bite
SmartWay	GOV	USA	National	Government agency	Regulator	Risks of distribution remain with transport provider
The Co-operative Group	C	UK	Regional	Consumer cooperative	Retailer	All risk is in the group. Business is vertically integrated in some products, with farm ownership
Von hier	F	GER	Regional	Farmers & processors association	Marketer	Risk sharing between buyers and farmers
Wal-Mart	R	Global	Global	Company	Retailer	Shared risks between retailers and farmers
Woolworth's	R	AUS	Global	Company	Retailer	Shared risks between retailers and farmers
ZESPRI	F	Global	Global	Company	Marketer	Risk shared by growers and marketer
The Intervale Center	C	USA	Local	Non-profit	Entrepreneur incubation/ training/ community programs/ local economic development/ local food system development	Shared risk between consumers and farmers
Nestle SA	M	Switzerland	Global	Company	Manufacturer	Risk on suppliers and company
Pepsico	M	USA	Global	Company	Manufacturer	Risk on suppliers and company
Kraft Foods Inc	M	USA	Global	Company	Manufacturer	Risk on suppliers and company
Unilever NV	M	The Netherlands	Global	Company	Manufacturer	Risk on suppliers and company
The Coca-Cola Co	M	USA	Global	Company	Manufacturer	Risk on suppliers and company

Cadbury plc (acquired by Kraft Foods)	M	USA	Global	Company	Manufacturer	Risk on suppliers and company
Kellogg Co	M	USA	Global	Company	Manufacturer	Risk on suppliers and company
Mars	M	USA	Global	Company	Manufacturer	Risk on suppliers and company

Table A2. Food distribution initiatives classified according to annual revenue (when information was available), seasonality of produce, distribution strategy (indicating the supply chain partner in charge of the transport at each leg), sourcing strategy (*e.g.* national, local), fuel used and commerce platform. See acronyms used in this table at the end of the Appendix.

Food distribution initiative	Annual revenue	Seasonality	Distribution Strategy (party responsible for transport)	Sourcing Strategy	Fuel combinations	Commerce platform
ASDA	\$31.2 billion	All year round	Suppliers & 3PL	N	D/P	Supermarket/ online
Aussie Farmers Direct	?	Seasonal	Suppliers & organisation	N	D/P	Online ordering
BioStadt	NA	Seasonal	Suppliers-Government	L	D/P	NA
CERES	Between AUD\$4 m and \$7 m	Seasonal	Suppliers & organisation	L/R/N	D/P	Transactions over phone, e-mail or face-to-face in market place
Clean Cargo Group	NA	NA	3PL	NA	MDO/MGO/HFO/IFO/ D/P	Online
ECR Sustainable Distribution Group	NA	NA	Suppliers & 3PL	L/R/N	D/P/Elec/Eth/Bio	NA

efarm	?	Seasonal	Suppliers & organisation	L/R	D/P	Online ordering
Farm Buyers Club	?	Seasonal	Suppliers	L	D/P	Online/phone
Farm to folk (F2F)	?	Seasonal	Suppliers	L	D/P	In store
Farmers Market Hub	NA (at proposal level)	All year round	Suppliers	L/R/N	D/P	Transactions over phone/internet or face-to-face in market place
Farms Reach	?	Seasonal	Suppliers	N	D/P	Online buying/selling
Food Routes Network	NA	NA	Suppliers	L/R	D/P	Online
Foodconnect	Estimated AUD\$1,000,000	Seasonal	Suppliers & organisation	L/R	D/P	Online ordering
Gruppi di Acquisto Solidale	NA	Seasonal	Consumers	L	P	Phone/online
The Brighton & Hove Food Partnership	NA	Seasonal	Suppliers	L	D/P	Online hub
Homerville wholesale produce auction	?	Seasonal	Suppliers	L/R	D/P	In auction site
Just Local Food Cooperative	?	Seasonal	Suppliers	L	D/P	In store
LocalHarvest	?	Seasonal	Suppliers	N	D/P	Online ordering
Lowhub	?	NA	3PL	L	Bio/Elec	Online/face-to-face

Melbourne's community farmers' markets (MCFM)	?	Seasonal	Suppliers	L/R	D/P	In auction site
Platform Agrologistics	NA	NA	NA	L/R/N/G	MDO/MGO/HFO/IFO/ D/P	Online
Red Tomato	?	Seasonal	Suppliers & organisation	L/R	D/P	In auction site
Second bite	Less than AUD\$200,000	Seasonal	Suppliers & organisation	L/R	D/P	Transactions with consumers in urban DCs
SmartWay	NA	NA	3PLs	N	D/P/Elec/Eth/Bio	Online
The Co-operative Group	Over US\$ 10 b	All year round	Organisation	L/R	D/P	Transactions over phone/internet or face-to-face in market place
Von hier	?	Seasonal	3PL	L/R	D/P	Online ordering
Wal-Mart	Over US\$400 b	All year round	Suppliers, 3PLs & organisation	L/R/N	D/P/Elec/Eth/Bio	Supermarket/ online
Woolworth's	Over AUD\$40 b	All year round	Suppliers, 3PLs & organisation	L/R/G	MDO/MGO/HFO/IFO/ D/P	Online/ supermarket stores
ZESPRI	NZ\$1 billion+ US\$ 2,154,874/year	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	Complex IT platform
The Intervale Center	US\$103.9 billion in 2008	Seasonal	Suppliers	L	D/P	Face-to-face, phone, internet
Nestle SA	US\$43 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	e-commerce
Pepsico	US\$43 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	e-commerce
Kraft Foods Inc	US\$43 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	e-commerce
Unilever NV	US\$49.8 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	e-commerce
The Coca-Cola Co	US\$6.8 billion in 2009	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/ D/P	e-commerce

Cadbury plc (acquired by Kraft Foods)	US\$9.4 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/D/P	e-commerce
Kellogg Co	US\$13 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/D/P	e-commerce
Mars	US\$13 billion in 2008	All year round	Suppliers, 3PLs & organisation	G	MDO/MGO/HFO/IFO/D/P	e-commerce

Table A3. Greenhouse gas emission and resilience missions and targets for the food distribution initiatives investigated in this report. The website of the company is also presented. See acronyms used in this table at the end of the Appendix.

Food distribution initiative	Sustainable distribution mission/ target?	Resilience mission/ target?	Other mission?	Web site
ASDA	YES/YES	Unknown	Cost efficiency, Fair trading	http://your.asda.com/sustainability-policies
Aussie Farmers Direct	NO/NO	NO/NO	Fair trading	http://www.aussiefarmers.com.au/VIC/index.php?rememberState=1&sid=VIC#
BioStadt	YES/NO	YES/NO	Fair trading	http://www.muenchen.de/biostadt
CERES	YES/NO	YES/NO	Fair trading	http://www.ceres.org.au/sites/default/files/CERES_AR_2008.pdf
Clean Cargo Group	YES/NO	NO/NO	Cost efficiency	http://www.bsr.org/consulting/working-groups/BSR_Clean_Cargo_Working_Group_Overview.pdf
ECR Sustainable Distribution Group	YES/NO	NO/NO	Cost efficiency	http://www.igd.com/index.asp?id=1&fid=6&sid=51
efarm	NO/NO	NO/NO	Fair trading	http://www.matchboxsolutions.in/

			Social justice, fair trade, diet & health, community	http://www.farmbuyersclub.com/
Farm Buyers Club	YES/NO	YES/NO		
Farm to folk (F2F)	YES/NO	NO/NO	Social justice, fair trade, community	http://www.farmtofolk.com/Farm%20to%20Folk%20CSA%20Options.html
Farmers Market Hub	NO/NO	YES/NO	Healthy diets/food security	http://departments.oxy.edu/uepi/publications/TCE_Final_Report.pdf
Farms Reach	YES/NO	NO/NO	Fair trading	https://www.farmsreach.com/welcome/help/index
Food Routes Network	YES/NO	NO/NO	Social justice, fair trade, community, diet & health (GMO)	http://www.foodroutes.org/mission.jsp
Foodconnect	YES/NO	YES/NO	Fair trading	http://www.foodconnect.com.au/
Gruppi di Acquisto Solidale	YES/NO	NO/NO	Fair trading	http://sustainable-everyday.net/cases/?p=42
The Brighton & Hove Food Partnership	NO/NO	NO/NO	Fair trading	http://www.bhfood.org.uk/links.php
Homerville wholesale produce auction	NO/NO	NO/NO	Social justice, fair trade, community	http://agebb.missouri.edu/hort/auction/auctions.pdf
Just Local Food Cooperative	YES/NO	NO/NO	Social justice, fair trade, community	http://justlocalfood.blogspot.com/
LocalHarvest	NO/NO	NO/NO	Fair trading	http://www.localharvest.org/
Lowhub	YES/NO	NO/NO	NA	http://www.lowhub.com/Lowhub/Home.html

Melbourne's community farmers' markets (MCFM)	NO/NO	NO/NO	Social justice, fair trade, community	http://www.mfm.com.au/docs/MCFM%2008.pdf
Platform Agrologistics	YES/NO	NO/NO	Cost efficiencies	http://www.Invaainfo.nl/media/uploads/File/Factsheets/16_Platform_agrologistics.pdf.pdf
Red Tomato	YES/NO	NO/NO	Social justice, fair trade, community	http://www.redtomato.org/
Second bite	NO/NO	NO/NO	Social justice	http://www.secondbite.org/about_us/documents/secondbite_ar08.pdf
SmartWay	YES/NO	NO/NO	Cost efficiency	http://www.epa.gov/smartway/transport/index.htm
The Co-operative Group	YES/YES	NO/NO	Social justice, fair trade, animal welfare, diet & health, community	http://www.co-operative.coop/corporate/Sustainability/
Von hier	NO/NO	NO/NO	Fair trading	http://www.vonhier.com/
Wal-Mart	YES/YES	Unknown	Cost efficiency, Fair trading	http://walmartstores.com/sites/sustainabilityreport/2009/ec_fs.html
Woolworth's	YES/YES	NO/NO	Cost efficiency	http://www.woolworthslimited.com.au/phoenix.zhtml?c=144044&p=homepage
ZESPRI	YES/NO	NO/NO	Cost efficiency	http://www.zespri.com/zespri-story/zespri-sustainability.html
The Intervale Center	YES/NO	YES/NO	Fair trading, sustainable agriculture	
Nestle SA	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.nestle.com/Resource.axd?Id=CA5BDB64-6E13-4CDD-B310-CBF5AB826DA3
Pepsico	YES/YES	YES/NO (but policies on)	Cost efficiency	http://www.pepsico.com/Purpose/Environment/Our-Environmental-Policy.html

		sustainability)		
Kraft Foods Inc	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.kraftfoodscompany.com/Responsibility/sustainability/index.aspx
Unilever NV	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.unilever.com/sustainability/?WT.GNAV=Sustainability
The Coca- Cola Co	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.thecoca-colacompany.com/citizenship/index.html
Cadbury plc (acquired by Kraft Foods)	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.kraftfoodscompany.com/Responsibility/sustainability/index.aspx
Kellogg Co	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.kelloggcompany.com/corporateresponsibility.aspx?id=1517
Mars	YES/YES	YES/NO (but policies on sustainability)	Cost efficiency	http://www.mars.com/global/commitments/sustainability.aspx

Acronyms and definition used in Tables A1 to A3.

	Acronym	Stands for	Definition
CATEGORY	CSA	Community supported agriculture	CSA distribution systems are based on a direct partnership between the farmer and local consumers. CSA is different from other types of direct agricultural markets due to its emphasis on creating and building community around food, land and nature (Hinrichs, 2000).
	T	Transporters -led	2nd or 3rd party logistics taking a leading role on the development of an environmental goal.
	E	Entrepreneur-led	This encompasses social or business entrepreneurs who detect an opportunity to enter the food supply market with a profit or non-profit vision.
	F	Farmer-led	Individual farmer, cooperatives or associations taking a leading role on the food distribution system.
	C	Consumer-led	Consumer organisations taking a leading role on the formation of a food distribution system.
	R	Retailer-led	Retailers leading the food distribution system.
	A	Association-led	An association of farmers, consumers, transport providers or retailers (or a combination of these) developing a food distribution system.
	GOV	Government-led	A local or national policy effort that encourages particular distribution systems.
	P	Processor-led	Retailers leading the food distribution system.
	EC	Electronic commerce portal & information exchange hub for CSA	Centre of information sharing for consumers and food distribution players (<i>e.g.</i> farmers).
	FM	Farmers markets	A site of exchange and a venue for negotiating the sale of local food. In practical terms the FM serves as a site for food producers and consumers to find each other—a physical space in which immediacy and directness can be (re)introduced into transactions around food (Smithers et al., 2008).
	UA	Urban agriculture	The production of food within the boundaries of a city.
Sourcing			
	L	Local	Distance between farmer & consumer is less than 100 miles (160 km).
	R	Regional	Farmer and consumer are in the same state.
	N	National	National products and consumers.
	G	Global	Products are sourced from more than one country.
Fuel			
	D	Diesel	Transport energy source
	P	Petrol	
	MDO	Marine diesel oil	

MGO	Marine gas oil	
HFO/IFO	Intermediate and heavy duty oils	
Elec	Electricity	
Eth	Ethanol	
Bio	Biodiesel	

Appendix 2. STEEP Factors Analysed for F&CL Initiatives

VARIABLE	TRENDS	MOTIVATION & OPPORTUNITY	CHALLENGES
Social	The economic development of some regional areas is strongly connected to horticultural production.	<p>Unequal distribution of costs and benefits in food chains can affect the economic development of entire regions.</p> <p>Opportunity: local governments could promote F&CL initiatives that maintain principles of fair trading.</p>	A sole emphasis upon direct, local marketing strategies can increase self-exploitation—particularly evident in small-scale operations selling primarily to farmers markets and involved with forms of CSA that demand transport to customers based in the city (Jarosz, 2008). F&CL policies and commercial initiatives need to recognize this risk.
	<p>Land use planning processes generally consider peri-urban land, where significant areas of horticulture occur, to be a resource for future urban development.</p> <p>By 2050, about 80% of the human population will live in urban centres¹⁴³.</p> <p>Increase in local and regional sourcing of foods (the rise of the 'locavores')</p>	<p>Integration of horticultural production in urban settings.</p> <p>Opportunity: New supply chains for urban settings (<i>e.g.</i> "vertical farms" and city-based glasshouses under contract with retailers).</p> <p>Opportunity: Green skyscrapers could supply not just food but energy, creating a truly self-sustaining environment.</p> <p>+Direct marketing channels between growers and urban consumers and drive 'local chains' marketing campaigns.</p>	<p>Competition between land for urban uses and for horticultural crops is likely to be won by the former, due to higher prices paid and less risk for land owner involved.</p> <p>Growers in peri-urban areas are unlikely to invest in upgrading knowledge and infrastructure for urban settings.</p> <p>Although some cities may already have the density and infrastructure needed to support vertical farms, this may not be the case in Australian cities.</p>
	Emergence of consumers' concerns on "food miles" and carbon "foodprints"	<p>Proactive response to environmental concerns, with the aim of capturing the "green consumer" to drive the growth of F&CL initiatives.</p> <p>Opportunity: Development of</p>	<p>Competition and fragmentation may make communication and trust-building difficult.</p> <p>Development of marketing campaigns based on "green washing", as opposed to meaningful</p>

¹⁴³ <http://www.verticalfarm.com/>

	cooperative schemes to share transport, cold storage and packing houses among small farms, also increasing the profitability of the operations. Opportunity: Uptake of new transport technologies that minimise environmental impacts (<i>e.g.</i> hybrid vehicles).	change. Lack of consumer awareness on the benefits of F&CL initiatives on the environment. Lack of published information about these benefits.
Emergence of consumers' concerns over food provenance and food safety (Verbeke and Ward, 2006) ¹⁴⁴ .	Proactive response to environmental concerns, with the aim of capturing the "informed consumer" to drive the growth of F&CL initiatives. Opportunity: Development of short supply chains that allow quick trace back to the farm. Opportunity: Development of effective produce identification systems for F&CL initiatives.	The management of local food chains requires superior technical know-how to handle produce in a safe manner, while ensuring that quality is preserved. Traceability can become an issue, as packaging and labelling standards are generally more relaxed in F&CL settings (Berruto et al., 2009). Certification systems for local, sustainable produce is lacking in Australia. There is a similarity with the issues faced by organic production in its early stages.
Technological	The use of biotechnology for developing varieties resistant to pests, climate and for quality and yield improvements has provoked considerable opposition from consumers, due to: <ul style="list-style-type: none"> • potential health and ecological effects • misgivings over the threat of becoming dependent upon biotechnology corporations • doubts over the capacity of public authorities and the science 	Proactive response to environmental concerns, with the aim of capturing the "informed consumer" to drive the growth of F&CL initiatives. Opportunity: Provide information to this consumer segment that describes the advantages of ethical, sustainable and ecological fruit and vegetable production as an alternative to the use of biotechnology for food production. Opportunity: Develop F&CL -oriented infrastructure (<i>e.g.</i> nurseries, seed collections) needed to naturally

¹⁴⁴ <http://blog.hunterpr.com/post/2009/12/22/Survey-Reveals-Top-Food-Stories-of-2009-and-the-Decade.aspx>

community to understand popular concern and effectively regulate risks	replenish and select varieties that withstand climatic changes, to avoid dependence in biotech and chemical firms (<i>i.e.</i> develop a holistic view of the supply chain).	
Use of alternative energy sources (biomass, solar, eolic and geothermal power) is increasing worldwide (<i>e.g.</i> solar power capacity grew 62 %, while wind capacity rose 29 % in 2008 as compared with 2007) ¹⁴⁵ .	<p>Decrease carbon footprints through the uptake of alternative energy sources for irrigation, cold storage and transport.</p> <p>Opportunity: Research on the use of renewable energy for farm applications.</p>	<p>Government policies and grants (<i>e.g.</i> FarmReady) do not encourage uptake of environmental technologies beyond production and do not consider the particular challenges for F&CL initiatives.</p> <p>Producers resistance to change, lack of awareness, lack of capital, lack of skills and knowledge on 'how do we change?'¹⁴⁶</p>
Supply chain technological advances that support environmental initiatives, including energy efficient cold chain equipment, traceability, computerized routing of transport, forecasting of demand and supply and others (Estrada-Flores, 2009b).	<p>Better coordination among small farms and improvement of market opportunities</p> <p>Opportunity: Create a pool of 'green' supply chain technologies and knowledge for F&CL initiatives that can be shared by small farmers, through government support.</p> <p>Opportunity: Involve R&D organisations (<i>e.g.</i> HAL, CSIRO, DPI, universities) to develop tools that specifically address the needs of FC&L enterprises.</p>	<p>The lack of production coordination through SC technologies between small producers could lead to oversupply and shortages within a single growing season, and generate complaints from customers.</p> <p>The concepts of visibility, traceability and consumer confidence do not necessarily overlap. While F&CL initiatives provide visibility (<i>i.e.</i> consumers see the food or the production site and often relies on geographical proximity) , F&CL initiatives do not necessarily provide traceability¹⁴⁷. Consumers may need both things to develop trust (Eden et al., 2008).</p>

¹⁴⁵ <http://www.canada.com/technology/Renewable+energy+outperforms+nuclear/1724258/story.html>

¹⁴⁶ http://www.coffsharbour.nsw.gov.au/resources/documents/LFFA_FORUM_OUTCOMES_10_March_2009.pdf

¹⁴⁷ Traceability has two main components: tracking, or the ability to follow the path of a traceable item through the supply chain as it moves; and tracing, or the ability to identify the origin, attributes, or history of a particular traceable item located within the supply chain by reference to records held.

		<p>Small producers can lack technical knowledge and grading equipment, thus resulting in high variability in the size and maturity of FFVs grown locally.</p> <p>Even if growers and handlers of local FFVs are convinced of the merits of using proper tools or equipment during harvest and in postharvest handling, they will most likely not be able to afford them due to their cost (Berruto et al., 2009) .</p>
<p>The concept of “quality” in fresh produce is established by supermarket standards. For consumers, imperfect/ dirty produce is normally unacceptable (unless the product is purchased in farmers’ markets venues).</p>	<p>The imperfections in produce marketed through F&CL can be a point of difference with respect to supermarket produce.</p> <p>Opportunity: Inform the consumer about the reason for imperfect produce.</p> <p>Opportunity: Establish standards for produce cleaning that does not affect flavour or texture.</p>	<p>FFVs are very susceptible to mechanical injury. Poor handling, unsuitable containers, improper packaging and transportation can easily cause bruising, cutting, breaking and other injuries to the produce.</p> <p>While “dirty” FFV may appeal some consumers, their hygienic conditions are an issue for several reasons:</p> <ul style="list-style-type: none"> • Some fresh produce is often eaten without prior washing. • Some products such as lettuce can harbour pathogens that have internalised in the tissues and cannot be removed by washing. Even if they are washed, pathogens will remain in the product. • In lettuce and similar leafy greens, there is no “kill step” that can eliminate pathogenic microorganisms (Estrada-Flores, 2009a).

	Carbon sequestration and storage strategies may call for changes in land use to favour 'carbon forestry' (CSIRO, 2009).	Horticulture –dedicated land can be combined with 'carbon forestry', thus allowing growers to be integrated into a carbon economy. Opportunity: Develop a secondary source of income through 'carbon forestry' in the F&CL initiatives plans.	Competition for land will increase and horticulture –dedicated land may switch to 'carbon forestry' uses.
Economic	Global financial crises.	Proactive response to environmental concerns, with the aim of capturing the "conscious consumer" to drive the growth of F&CL initiatives. Opportunity: Decrease price through supply chain optimization, cutting the 'middleman' and other infrastructure and overheads that larger corporations can't cut.	Temptation to cut back in necessary expenses (<i>e.g.</i> refrigeration, sanitary procedures, marketing). See technical aspects.
	Some Australian food imports as a share of consumption are significant. For example, seafood (30%), fruit and vegetables (20.4%) and wine (10%) ¹⁴⁸ .		Local, sustainable produce does not necessarily attract a premium. F&CL operations compete with well organised retailers that can temporarily reduce prices in F&V to face competition from alternative networks, or source fresh and processed food from overseas.
	Although agriculture will not be considered in the future emissions trading scheme, the industry will be affected by other supply chain partners which will see an increase in their costs(Jiang et al., 2009) .	Preparations for a future ETS should include the proactive implementation of measures that decrease GHG emissions throughout the chain, including transport. Opportunity: Proactive suppliers that offer services aligned with the environmental goals of buyers have more opportunities of becoming preferred suppliers than those not acting on decreasing environmental impacts.	While field horticulture is likely to have the smallest costs rises from agricultural enterprises (Jiang et al., 2009), glasshouse horticulture may not be equally spared of ETS impacts. Costs of abatement in ETS can lead some growers out of business. Potential for horticultural over production as farmers in energy intensive industry (<i>e.g.</i> livestock) switch to less ETS exposed farming.
	Increasing fuel costs and concerns over peak oil ¹⁴⁹ timing.	Incentive to adopt distribution strategies and technologies that reduce fuel use. Opportunity: Improve resiliency of	Cost of adoption of new transport technologies is likely to be passed on to growers.

¹⁴⁸ <http://www.ibisworld.com.au/pressrelease/pressrelease.aspx?prid=227>

¹⁴⁹ Peak oil is the point in time when the maximum rate of global petroleum extraction is reached, after which the rate of production **at competitive prices** enters terminal decline.

	<p>Domestic food supply chains continue to undergo significant consolidation to take advantage of scale economics.</p> <p>Global and supermarket-orientated FFV supply chains are becoming longer (<i>i.e.</i> more links).</p>	<p>distribution to oil shortages and price increases.</p>	<p>Cost of transport is already a significant proportion of costs for food chains (Higgins et al., 2007). Any technology that increases capital costs without decreasing operational costs is unlikely to be implemented.</p>
Ecological	<p>Prolonged drought conditions in many growing areas.</p>	<p>Incentive to uptake of technologies to improve water efficiency and generation of alternative water sources.</p> <p>Opportunity: Investment on research that increases food chains resiliency to drought.</p>	<p>Investment in developing water efficient crops is still insufficient. Restrictions on water use can disadvantage Australian vegetable exporters with respect to competitors, due to the unreliability of supply.</p>
	<p>Vulnerability of food distribution systems can increase under climate change (Marquez et al., 2010). Recent experiences from Hurricane Larry and the Victorian bush fires demonstrate that both supply and quality of fresh vegetables is disrupted. This makes the Australian industry more vulnerable to lose market share to imported product.</p>	<p>Incentive to increase resilience of food chains.</p> <p>Opportunity: Research into assessing how local and regional distribution models could increase the resilience of Australian food chains is needed.</p> <p>Opportunity: Improve food security at a local level by decreasing oil dependency and by decentralising food production systems.</p>	<p>No assessments on the consequences of disruptions due to extreme weather events and bush fires have been undertaken for F&CL initiatives (either local or with city consumers)</p> <p>Perishable supply chains are likely to become more dependent on cold chain maintenance in a climate challenged future, thus potentially increasing costs and food safety risks in F&CL initiatives.</p> <p>Climate challenges can increase production costs to a point where F&CL initiatives are not financially sustainable.</p>
	<p>The diversity of climatic regions has led to a diverse horticulture industry, ranging from annual to perennial crops through to amenity and urban horticulture.</p>	<p>Australia is capable of producing about 159 different crop varieties, which other competitors in the southern hemisphere can't provide (Horticulture Australia Limited, 2008).</p> <p>Opportunity: Utilise specific crop varieties that can only be found in</p>	<p>Horticulture is spread across most major catchments, with variations in irrigation infrastructure and competing uses between and within these catchments. Niche horticulture will struggle under these conditions.</p>

		<p>Australia as a marketing differentiation for F&CL initiatives.</p> <p>Opportunity: Utilise the flexibility of F&CL structures to accommodate varieties that are not attractive to large retailers.</p>	
Political/ regulatory	<p>Reclaimed water can help polluting industries to comply with EPA standards for outfall discharge (Hamilton et al., 2008).</p>	<p>Opportunity for uptake of recycling technologies in agriculture and urban irrigation.</p> <p>Opportunity: Research on how new technologies (<i>e.g.</i> precision agriculture) can reduce inputs at farm level.</p>	<p>The implementation of reclaimed water schemes for agricultural use carries food safety concerns and potential environmental risks such as rising water tables, salinity and/or water logging.</p> <p>Potential impact on the environment through the emission of GHG during reclaiming processes.</p> <p>Some precision agriculture solutions are perceived as costly.</p> <p>Reclaimed water costs need to be competitive with self supply water costs (<i>e.g.</i> \$0.07–\$0.10 /kL in Western Australia).</p>
	<p>Safety is a top concern for manufacturers, retailers and consumers (CIES-Consumer Goods Forum, 2010)¹⁵⁰.</p> <p>FSANZ is currently developing Primary Production and Processing Standards for seafood, dairy, eggs, poultry and seed sprouts¹⁵¹. It is likely that fruit and vegetables will be also included in the future. These regulations will</p>	<p>Use food safety and knowledge of product origins as marketing points to promote F&CL initiatives.</p> <p>Opportunity: Develop self-regulation, courses and certification programs to ensure that the principles of sustainability, safety, origin, carbon footprints and similar concepts associated to F&CL initiatives are embodied in the practices of their suppliers and marketers.</p>	<p>More red tape for F&CL initiatives.</p> <p>More certification costs, which will decrease the price competitiveness of the F&CL initiatives.</p>

¹⁵⁰ <http://blog.hunterpr.com/post/2009/12/22/Survey-Reveals-Top-Food-Stories-of-2009-and-the-Decade.aspx>

¹⁵¹ <http://www.foodstandards.gov.au/foodstandards/primaryproductionprocessingstandardsaustraliaonly/>

<p>affect farmers supplying to F&CL initiatives. There are no self-regulations for either quality assurance or authenticity to ensure that the product sold through F&CL is sustainable, safe and local.</p>	
<p>Large city markets are requesting the Government to include Farmers' Markets in the application of the Horticulture Code of Conduct.</p>	<p>Compliance with the Code.</p> <p>Opportunity: Recognition of Farmers' Markets as a genuine market force, which would lead to increase farmers leverage in the chain.</p> <p>Red tape. For example, in NSW current Code regulations require that, if a grower wishes to sell one box of lettuce to his/her next door neighbour at the markets, then they would each be required to wade through as many as seven documents. This represents a significant administrative burden to farmers operating in FM (The NSW Chamber of Fruit & Vegetable Industries Inc, 2008). It is not known if these difficulties exist in other states.</p> <p>Regulatory disputes can arise over the size and operation of a F&CL initiative: a successful F&CL will grow to the point where it needed special licenses. Costs for compliance will increase. Also, successful initiatives may not be able to access grants and funds that were available before the size of the operation increased.</p>

Appendix 3. Farmers' Markets in Victoria, Australia

Market	Operator	Address	Date	Contact	Phone	Email
Ararat Seasonal Farmers' Market		Lakeside Gardens, Ararat	2nd Sunday of each seasonal quarter	Kate Kirkpatrick	03 5355 0239	kkirkpatrick@ararat.vic.gov.au
Ballarat Lakeside Farmers' Market	inSeason Markets	Wendouree Parade, Ballarat (opposite the Botanical Gardens)	2nd & last Saturday (except Dec which is on 2nd and 3rd Sat)	Abbie James	03 9569 4767	abbie@inseasonmarkets.com.au
Boroondara Farmers' Market	Boroondara City Council	Patterson Reserve, Auburn Rd, East Hawthorn	3rd Saturday of each month	Elisa Grassa	03 9278 4814	elisa.grassa@boroondara.vic.gov.au
Bundoora Park Farmers' Market	Regional Farmers' Markets	Bundoora Park, Plenty Rd, Bundoora	1st Saturday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
Buninyong Farmers' Market	Ballarat Italian Association	Buninyong Town Hall (May-Dec) De Soza Park (Jan-April)	3rd Saturday of each month	Evie Dichiera	03 5341 3571 or 0438 290 751	market@netconnect.com.au
Cardinia Ranges Farmers' Market	Cardinia Shire Council	Pakenham Racecourse, Racecourse Rd, Pakenham	2nd Saturday of each month	Suzzi Carter Madej	0425 794 941	suzzicm@yahoo.com.au
Caulfield FM	InSeason Markets	Cnr Neerim and Booran Rds, Caulfield, Victoria	2nd Saturday of each month	Abbie James	9569 4767	abbie@inseasonmarkets.com.au
Casey Farmers' Market	Berwick Rotary Club	The Old Cheese Factory, 34 Homestead Rd, Berwick	4th Saturday of each month	Geoff Rankin	03 9769 4459	kayandgeofffrankin@bigpond.com
Castlemaine Farmers' Market	Committee for the Central Victoria Farmers Market	Moyston Street, Castlemaine (next to Market building)	1st Sunday of each month	Sally Kaptein (Coordinator)	03 5470 6340	walmer@castlemaine.net
Yarrawonga FM		Piper Street, Yarrawonga, Victoria	4th Sunday of each month		0422 110 372	info@yarrawongafarmersmarket.com.au
Central Murray Farmers' Market	Central Murray Produce Group	Alton Reserve, High St, Echuca	1st, 3rd & 5th Saturday of each month	Doug Mulley	0437 746 459	-
Churchill Island Farmers'	Regional Farmers' Markets	Visitor Centre, Churchill	4th Saturday, 8am - 1pm	Peter Arnold	03 5664 0096	peter@rfm.net.au

Market		Island via Phillip Island				
Hurstbridge FM	Nillumbik Shire Council	Fergusons Paddock, Hurstbridge - Arthurs Creek Rd , Hurstbridge, Victoria	1st Sunday of every month, excepting January	Hurstbridge Farmers Market Coordinator	0414 703 186	info@hurstbridgefarmersmarket.com.au
Collingwood Children's Farm Farmers' Market	Melbourne Community Farmers' Markets www.mfm.com.au	Collingwood Children's Farm, St Helier Street, Abbotsford	2nd Saturday of each month	Miranda Sharp	03 5657 2337	miranda@mfm.com.au
Croydon Park Farmers' Market	Regional Farmers' Markets	Croydon Park, Hewish Road, Croydon	2nd Saturday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
Daylesford Farmers' Market	Regional Farmers' Markets	Daylesford Primary School, Vincent St, Daylesford	1st Saturday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
East Gippsland Farmers Market	Secondary College Chaplaincy Committee	Secondary College Oval, McKean St, Bairnsdale	1st Saturday of each month	John Butler	03 5156 9342	ajejbutler@wideband.net.au
Gasworks Farmers' Market	Melbourne Community Farmers' Markets www.mfm.com.au	Gasworks Arts Park, 21 Graham St, Albert Park	3rd Saturday of each month	Miranda Sharp	03 5657 2337	miranda@mfm.com.au
Geelong Farmers' Market	Central Geelong Marketing	Little Malop Street - between Moorabool & Yarra St, Geelong	2nd Saturday of each month	Shelley McKiernan	03 5227 0938	smckiernan@geelongcity.vic.gov.au
Golden Plains FM		Cnr High and Milton St , Bannockburn , Victoria	1st Saturday of each month		03 533180 36	rachel@visionaryevents.com.au
Heathmont Farmers' Market	Regional Farmers' Markets	Great Ryrie St Primary School, Great Ryrie St, Heathmont (Melways ref 49 J12)	1st Sunday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
Hume Murray Farmers' Market	Hume Murray Food Bowl	Gateway Island, Lincoln Causeway, Albury, Wodonga	Fortnightly	Gena Cavini	02 6058 2996	cavini@bigpond.com
Inverloch Farmers' Market	Regional Farmers' Markets	The Glade, Inverloch, South Gippsland	3rd Sunday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au

Korumburra Farmers' Market	Regional Farmers' Markets	Railway precinct, off Commercial Rd, Korumburra, South Gippsland	3rd Saturday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
City of Kingston Farmers' Market	Kingston City Council	Sir William Fry Reserve, cnr Nepean H'wy and Bay Rd, Highett (opposite Southland Shopping Centre)	1st Saturday (except January) of each month	Vicky Davison	0407 810 877	vicky.davison@bigpond.com
Lake Boga Farmers' Market		Outside Lake Boga Yacht Club, Murray Valley H'wy, Lake Boga	2nd & 4th Friday of each month	Ken Shipham	(03) 5037 2347	shipham.ken.w@edumail.vic.gov.au
Lancefield District Farmers' Market	Lancefield Neighbourhood House Inc.	Centre Plantation, High Street, Lancefield	4th Saturday (3rd Sat in Dec) of each month	Meggs Hannes	0407 860 320	gingermeggs20@hotmail.com
Metung Farmers' Market	Metung Business & Tourism Association Inc	Village Green, Metung, Gippsland Lakes	2nd Saturday of each month	Damian Waters	03 5664 0096	dswaters@bigpond.com
Mornington Farmers' Market	Regional Farmers' Markets	Mornington Peninsula Lifestyle Centre, Bungower Rd, Mornington, Victoria	2nd Saturday of each month	Peter Arnold	0400 562 283	peter@rfm.net.au
Mulgrave FM	The Wise Foundation	Corner Jacksons & Wellington Rds, Mulgrave, Victoria	Every Sunday		03 856174 75	info@mulgravefarmersmarket.com.au
Moyhu Farmers' Market		Cnr of Wangaratta/Whitfield Rd & Meadow Creek Rd, Moyhu	3rd Saturday of each month	Sarah Heathcote	03 5727 9229	sarheathcote@hotmail.com
Natimuk Farmers Market	TransVision Arts	Natimuk, near Horsham	2nd Sunday of each month	Shiree Pilkinton	03 5387 1456	transvisionarts@hotmail.com
North Melbourne FM	In Season	North Melbourne Primary School, 210 Errol Street, North Melbourne, Victoria	1st Sunday of each month	Abbie James	03 9569 4767	abbie@inseasonmarkets.com.au

Newtown FM		Cnr Shannon Avenue & West Fyans Streets , Newtown, Victoria	4th Saturday of each month	Peter Arnold, Regional Farmers Markets	03 566400 96	peter@rfm.net.au
Pearcedale Farmers' Market	Pearcedale Community Centre	Pearcedale Community Centre, 710 Baxter-Tooradin Road, Pearcedale	3rd Saturday of each month	Jane Varkulevicius	03 5989 0335	janievarx@gmail.com ; suzzicm@yahoo.com.au
Port Fairy Farmers' Market	Port Fairy Show Society	Fiddler's Green, cnr Sackville & Bank St, Port Fairy	3rd Saturday of each month	Pauline Shirrefs (Sec) or Michael Watts (Pres.)	03 5568 2421 or 03 5568 2262	paulineshirrefs@westvic.com.au
Riddell's Creek Farmers Market		Main Road , Riddell's Creek	3rd Sat of each month (except December)		041952 3324	info@riddellfarmersmarket.com.au
Prom Country Farmers' Market	Foster Community Association Inc.	Foster War Memorial Arts Centre (FWMAC), Hall Main Street, FOSTER	3rd Saturday of each month	Peter Fell	03 5682 1345 or 0415 807 017	fct@vic.australis.com.au
Seaford Farmers' Market	Rotary Club of Frankston	Broughton Street Reserve, Station Street, Seaford	3rd Sunday of each month	Peter Cecil	03 9789 6634	pacecil@optusnet.com.au
Slow Food Melbourne Farmers' Market	Slow Food Melbourne www.mfm.com.au	Abbotsford Convent, St Heliers Street, Abbotsford	4th Saturday of each month	Alison Peake	0438 318 319	alison14@iprimus.com.au
South Gippsland Farmers' Market	South Gippsland Farmers' Market Committee	Memorial Park, Koonwarra (10 kms south of Leongatha on South Gippsland Hwy)	1st Saturday of each month	Juliet Klauer	03 5659 8208	julbilly@hotmail.com
Sunraysia Farmers' Market	Sunraysia Farmers' Market Inc	Australian Inland Botanic Gardens, River Rd, Mourquong (approximately 10km from Mildura)	1st & 3rd Saturday of each month	Stacey Edwards	03 5025 2342	farmers.market@bigpond.com

Talbot Farmers' Market	Talbot Farmers' Market working group operating under Talbot Action Inc.	Talbot Historic Precinct, Scandinavian Crescent, Talbot	3rd Sunday of each month	Tiffany Titshall	03 5463 2001	talbotfarmersmarket@bigpond.com
Tallarook Farmers' Market		Main Road , Tallarook, Victoria	1st Sunday of each month	Libby Webster Robert Forrest Tallarook Mechanics Institute	03 579241 25	-
Tatong Farmers' Market		Tatong Tavern Hotel, Tatong	1st Saturday of each month	Jade Kirk	03 5767 2210	jade@tatongtavern.com
Traralgon Farmers' Market		Kay St, Traralgon (opposite Council Chambers)	4th Saturday of each month			-
Trentham FM		Trentham Town Square , Trentham, Victoria	3rd Sunday of each month		03 542411 85	trenthamfarmersmarket@yahoo.com.au
University Hill FM	MAB Corporation	Janefield Drive , Bundoora, Victoria	2nd Sunday of each month		03 868122 96	enorgard@mabcorp.com.au
Veg Out St Kilda Farmers' Market	Melbourne Community Farmers' Markets w www.mfm.com.au	Peanut Farm Oval, between Chaucer & Spenser St, St Kilda	1st Saturday of each month	Miranda Sharp	03 5657 2337	miranda@mfm.com.au
Wellington Farmers' Market		Port Of Sale	3rd Saturday 8am - Noon			trenthamfarmersmarket@yahoo.com.au
Wheeler's Hill Farmers' Market	Regional Farmers' Markets	Jells Park South, Ferntree Gully Rd, Mt Waverley	3rd Saturday, 8am - 1pm	Peter Arnold	03 5664 0096	peter@rfm.net.au
Williamstown FM	Regional Farmers' Markets	Commonwealth Reserve, Nelsons Place , Williamstown , Victoria	2nd Sunday of each month	Peter Arnold	03 5664 0096	peter@rfm.net.au
Whitehorse Farmers' Market	Combined Rotary Clubs of Whitehorse	Whitehorse Civic Centre, 379-397 Whitehorse Rd, Nunawading	2nd Sunday of each month	Michael Kirk	03 9890 5515	mgkirk@tpg.cpm.au
Yarraville Farmers' Market		Corner Hyde & Somerville Road Map	4th Saturday of each month	Eileen Fiederling	0412 910 496	eileen@farmersmarket.net.au

		No. 42 C8, Yarraville Gardens				
Yarra Valley Farmers' Market	Yarra Valley Food Group	Yering Station Vineyard, 38 Melba Hwy, Chateau Yering (Yarra Glen)	3rd Sunday of each month	Kerri Goding	(03) 9513 0677	yarravalleyfood@bigpond.com

Sources: The Victorian farmers' markets association website (<http://www.vicfarmersmarkets.org.au/>), accessed on 4th Jan 2010; and the Australian Farmers' Market Association website (<http://www.farmersmarkets.org.au>), accessed on 4th Jan 2010.

Appendix 4. Retail-led innovations in Areas Related to Food Supply Chains

Food waste into biomass.

Sainsbury's announced it will pioneer a scheme to offset food waste produced in its Scottish stores. Under the initiative, all unsold food (estimated to be 42 tonnes per week) will be sent to a biomass plant to be turned into electricity. Sainsbury's aims to stop sending all U.K. food waste to landfill by the summer, but was fast-tracking the plan at its 28 Scottish stores. Each tonne of food waste diverted from landfill by Sainsbury's will generate enough power for 500 homes and will save three tonnes of carbon dioxide compared to fossil fuels. A single truck will be used to travel to all the Sainsbury's stores in Scotland to collect the waste and deposit it at the site in Motherwell (Glasgow) (Anon., 2009b).

In 2008, Tire and Lube Express (a Wal-Mart car service company in the US) recycled 2.5 million of the tires into rubber mulch, a product sold in Wal-Mart's stores. Apart of the obvious recycling benefit, the closed-loop system reduces the number of trees needed to make traditional mulch ¹⁵².

Tesco is also investing in the application of digestors to convert waste into bioenergy ¹⁵³.

In Australia, the conversion of food waste into biomass is being pursued. For example, there is a joint venture between Veolia Environmental Services and Transpacific Industries Group involving the production of electricity from food waste. SITA is collecting 26,000 tonnes of kerbside food and garden waste in Western Sydney that goes to their BioWaste facility, which manufactures around 11,000 tonnes of compost (Wilson, 2010).

Woolworths in Australia currently sends 164,500 tonnes of waste (including food and packaging) to landfill. They aim to have zero landfill by 2015 through green waste recycling, phasing-out of polystyrene and staff education (Mardirossian, 2009), although there are no details as to how waste will be recycled.

Waste avoidance.

The Courtauld Commitment (UK) is a voluntary agreement aimed at improving resource efficiency and reducing the carbon and wider environmental impact of the grocery retail sector. While the 1st phase of the agreement focused on household food waste, the 2nd phase is looking at reducing supply chain waste through prevention. There is a target of 5% reduction in food waste to be achieved through cumulative measures from farm gate through to manufacturing, distribution and retail of foods. Related to this project, work is under way to map the quantities of food and packaging waste arising at each point in the chain.

¹⁵² <http://walmartstores.com/Sustainability/9176.aspx>

¹⁵³ <http://www.tesco.com/climatechange/speech.asp>

Packaging development.



In the past few years, Wal-Mart has worked with suppliers to reduce packaging, which has translated into more concentrated detergent products and toothpaste that's no longer in a box (D'Innocenzio, 2010). These changes lead to more efficient truck loading and less packaging waste.

Marks & Spencer worked with their suppliers to develop sustainable alternatives, such as the use of polylactic acid - a cornstarch-derived plastic, as a packaging material (Munro, 2007). M&S have also improved packaging seals and moved to thinner films in their private label products. These changes can decrease packaging material in about 25% per year (WRAP, 2007). Most importantly for distribution, thinner packaging translates into less weight and volume, thus leading to higher loading efficiencies.

ASDA and Kanes, a packaging supplier, developed a new polypropylene salad bag with a 5 micron decrease in thickness from a previously used version. This change may sound trivial, but it represents 10-15% less material with a decrease in environmental and financial costs (WRAP, 2007).

WRAP¹⁵⁴ worked with leading brand owners, retailers and the glass container manufacturing industry to develop and trial a range of innovative lightweight glass food and drink containers. Around 2.5 million tonnes of glass are used in packaging in the UK every year, so reducing the average glass container weight by just 10% would generate savings of 250,000 tonnes¹⁵⁵.

In Australia, packaging redesign with a view to increase transport efficiency and decrease packaging waste could have a significant impact. For instance, 30% of the revenue of the plastic films industry in Australia comes from the food and beverage sector. A further 21% of revenue comes from gas permeable applications, of which fresh produce is a significant user¹⁵⁶. Supermarket bags represent 17.4% of their revenue. Retailers have a significant influence in all these sectors, particularly through the manufacturing specifications for their private label products, their specifications for suppliers and their direct influence on shopping bags.

Carbon footprint, disclosure and labeling.

Carbon labelling is the expression of a product's carbon footprint in the form of a label. A carbon label (or eco-label) may have information such as grams of CO₂-e, plus declarations of other GHG produced during the life cycle of the product. Carbon labelling has been adopted for non-perishable and perishable items. For example, Tesco is testing these labels in milk, potatoes, orange juice, detergent and light bulbs.

¹⁵⁴ The Waste & Resource Action Programme, WRAP, is a nonprofit department created in 2000 as part of the UK Government's waste strategies.

¹⁵⁵ http://www.wrap.org.uk/retail/case_studies_research/case_study_5.html

¹⁵⁶ IBIS, 2010

Eco-labelling is now part of the strategy of large supermarket chains, most notably Walmart in USA¹⁵⁷ and Tesco in the UK¹⁵⁸. ASDA is developing and publishing an annual carbon footprint of their own operations¹⁵⁹.

In Australia, an invitation by Planet Ark and the Carbon Trust to develop a carbon label has been extended to companies producing consumer packaged foods. It is expected that the first products bearing the label will hit Australian supermarket shelves in 2010¹⁶⁰.

If Australian supermarkets adopt carbon labelling, suppliers will have to declare their contribution to the total carbon footprint. Growers would then compete not only in price and quality, but also in environmental impact. Those with operations that minimise contributions to a product's carbon footprint could be selected as preferred suppliers over non-compliant/high environmental impact competitors.

Recently, the Food Ethics Council in the UK suggested including in food labels a statement showing the manufacturers' awareness in producing goods using water efficient processes. Rather than providing a specific "water footprint", the goal is to highlight companies engaging in "water stewardship"¹⁶¹. It is debatable whether this scheme would be successful in Australia. After all, farmers are already battling conditions of drought in several parts of the country. Growers that are not currently optimizing their water consumption are likely to be out of business in the near future.

A key aspect about 'green' labels is that the information should be conveyed to consumers in a clear way. Consumers are already reading the labels to check the food's contents, to ensure that products are aligned to the consumers' diet needs (*e.g.* weight loss, diabetic, etc) and to classify packaging waste in their bins ("Is it recyclable?"). There is a limit to the amount of information that can be placed in a label without making it confusing and also a limit to the patience of consumers in reading and digesting information before selecting the next product.

Further, there is still no consensus in Australia about the methodology to follow to carbon footprint products. At this point in time, comparisons between two similar products are difficult because they could have used different carbon footprint methodologies. Planet Ark's proposed carbon label is likely to take on the PAS 2050 methodology, developed by the British Standards Institute (BSI). One key aspect for uptake is the development of low cost approaches to carbon footprint calculation and certification/labelling (Hogan and Thorpe, 2009).

¹⁵⁷ <http://walmartstores.com/FactsNews/NewsRoom/9279.aspx>

¹⁵⁸ <http://www.ausfoodnews.com.au/2009/05/04/tesco-expands-use-of-carbon-label-on-grocery-products.html>

¹⁵⁹ <http://your.asda.com/2010/2/24/asda-s-carbon-footprint>

¹⁶⁰ <http://www.ausfoodnews.com.au/2009/07/07/carbon-reduction-label-for-packaged-goods-launched-in-australia.html>

¹⁶¹ http://www.foodethicscouncil.org/files/waterlabels_0.pdf

Appendix 5. Examples of policy instruments in the supply chain of fruit and vegetables

These measures were encompassed in the IPP framework launched by the European Union in 2000 (Mintcheva, 2005). In this report the original table has been modified to present the specific case of fruit and vegetables.

Policy instruments that address issues detected in fruit and vegetables chains , using life cycle thinking.

	Supply chain phases and issues				
Policy mix	Agriculture (land use)	Processing (resource intensity)	Freight transportation (efficiency)	Consumer phase (energy use)	End-of-life (waste)
A. Information					
Eco-labels			±	±	
Organic farming labels	++	++	±	±	++
Corporate environm. reporting		++	±	±	
Education	--				++
B. Voluntarism					
Voluntary agreements				±	
EMS		++	++		
C. Self-regulation	++		++		
D. Economic instruments					
Taxes and charges			±		
Subsidies	--		±	±	
Deposit refund funds/EPR					++
E. Command and control					
Bans	--				--
Standards	--	--	--	--	--
Policy objectives	1. Increase sustainable production of fruit and vegetables 2. Reduced pesticide levels in food, soil, water	3. Improving resource productivity	4. Improved transport efficiency	5. Improved energy efficiency	6. Waste reduction 7. Increased recovery & recycling of packaging.

Notes: ++=instrument stimulating life cycle thinking in food chains; ±= instrument that could stimulate life cycle thinking in food chains but is covered by other product or service framework (e.g. transport, energy sector); --instrument considered as non-stimulating life cycle thinking in food chains, but that still can have positive impacts on environmental improvements.

Appendix 6. Examples of council-led initiatives

Initiative	Mission	Website
Illawarra Biodiversity and Food Project	The Food component of the grant will explore options for locally produced food, support school and community gardens, encourage people to make more sustainable food choices through education and training, as we prepare for the decline in availability of cheap fossil fuels.	http://www.wollongong.nsw.gov.au/environment/biodiversity.asp
The QPIF Gourmet Food Project	This 2007-2010 project aims to: (a) support and profile Queensland primary producers (small to medium-sized enterprises) who are developing high-value products including organics, Australian native foods, Queensland tropical fruit, seafood and game meats for niche markets; (b) build relationships between producers, the food service sector, niche retailers and food media in Queensland and interstate; (c) partner with state and federal departments and agencies to develop and promote Queensland's agri-food sector.	http://www.dpi.qld.gov.au/cps/rde/dpi/hs.xsl/16_10324_ENA_HTML.htm
The Local Food Network Project (Bega Valley Shire)	The following information will be sort from this project: Can local growers, community gardens and/or CSA plans increase quantities and consistency of supply. If so with which crops? Can demand be cost effectively increased with promotion and to what extent? Can promotion temporarily increase demand for a fresh food product when it is in season? Will providing potential and existing growers with information about demand result in more effective choices of crops and quantities to plant or sow thereby resulting in a better match between supply and demand? Can local produce be supplied with more convenience to customer at acceptable prices? Can existing local transport resources be utilised to distribute product to bring down costs, increase convenience and/or reduce food miles?	http://austcom.org.au/1051.html
The Local Food Futures Alliance (Coffs Harbour)	Mission: promote and support the development of a strong local food economy based on sustainable agricultural practices so that all residents of the Coffs Coast have equitable access to affordable, fresh, healthy food into the future. We will value and utilize local knowledge.	http://www.offsharbour.nsw.gov.au/www/html/4069-overview.asp
Farmers markets (Colac Otway)	Marketing of local farmer markets	http://www.colacotway.vic.gov.au/Page/page.asp?Page_Id=2702&h=1

Northern Rivers Food Links (Ballina Shire, Tweed Shire, Lismore Shire, Kyogle, Richmond Valley, Clarence Valley, Byron Shire)	<p>The project will :</p> <ul style="list-style-type: none"> • assist the local government to build capacity and develop the skills, resources and tools needed to support urban agriculture • increase community education on links between sustainability and buying local • increase links between organic waste recycling and nutrient harvesting for soil health • reduce organic waste and landfill • enhance food literacy and healthy lifestyles • support a reduction of transportation and petrol costs associated with food supply • reduce greenhouse gas emissions associated with the food distribution systems • increase social connectedness and community resilience, and • develop better connections between the region's growers and consumers. 	http://www.kyogle.nsw.gov.au/cmst/kc008/lp.asp?cat=85
Food Security Council (TAS)	<p>A legislative mandate to oversight the planning and delivery of a Food Security Strategy. Programs: (a) a statewide school based food security program; (b) a statewide food preparation program; (c) Tasmania – the community garden state.</p>	http://www.premier.tas.gov.au/hot_topics/social_inclusion_strategy_for_tasmania2
Market Fresh Schools Program	<p>An initiative of the Melbourne Market Authority, promoting the daily consumption of fresh fruits and vegetables to children in schools across Melbourne and Regional Victoria.</p>	http://www.marketfresh.com.au/training/schoolsprogram/spdetail.asp