

Supply chain innovation: New Zealand logistics and innovation August 2012

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Abbreviations and acronyms

3PL	third party logistics
HPMV	high productivity motor vehicle(s)
IT	information technology
NAIT	national animal identification tracing
NZTA	New Zealand Transport Agency
RUC	road user charge
FTL	full truck load

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Executive summary

The purpose of the research was to examine selected supply chains to identify real life examples of innovation and highlight aspects which have proven to be barriers to innovation. The research provides government and the private sector with a range of initiatives that will assist supply chain owners in implementing innovations and overcoming barriers.

Methodology

Our approach to the study included two distinct phases. The first was to undertake a detailed review of other relevant studies, both in New Zealand and internationally. The outcome of this review was to identify key drivers and barriers to innovation in the freight and logistics sector.

The second phase in the research was to select three key export sectors (meat, forestry and wine) to examine in more detail. This was done through desktop research and interviews with selected industry bodies, supply chain owners and transport and logistics service providers.

The findings from both phases were used to develop a list of recommendations or initiatives.

Drivers and barriers

Our research showed that organisations achieve innovation by taking active decisions to change the way they operate their businesses.

The requirement to change can be driven by a number of key factors:

- In a price driven market there is a strong incentive to reduce costs to remain competitive.
- If infrastructure capacity is constrained, organisations will seek ways to increase utilisation of existing resources.
- The provision of superior service delivery will increase product differentiation, particularly in a homogeneous market.

Barriers to innovation are factors that stifle or slow activities which create innovative ideas. These can include:

- Businesses are unable or unwilling to consider longer-term productivity improvements due to the cost and risk involved.
- Fragmented supply chains incorporating multiple parties result in added complexities when implementing change.
- Competitive positioning within sectors may reduce information sharing and collaboration.
- Low utilisation of technology typically means data gathering and information sharing is more difficult.
- High barriers to entry may stifle the introduction of new innovative businesses.

Emerging trends

The freight logistics industry operates in a constantly changing landscape, resulting in a number of challenges and pressures to adapt within the market. Key global trends, both within New Zealand and internationally, are as follows:

- Supply chains are becoming longer and more complicated as a result of technological improvements.

- Compliance requirements have increased which demands improved management and monitoring.
- A growing urban population has increased the demand for freight but this has knock-on impacts.
- Government and consumers are increasingly becoming more aware of environmental impacts.

There are also a number of issues that are specifically relevant to the industry within New Zealand:

- The Productivity Commission identified improvements in efficiency particularly with regard to port ownership structures.
- The sector faces issues around information reliability, consistency and completeness regarding landside freight movements.
- There is a need to better understand container movements for a more integrated network approach.
- The reduction in ship travel speeds, or slow steaming, has increased transit times to key markets.
- As a result of the reform process of the road user charges, there has been reluctance by industry participants to invest due in part to uncertainty over new regulations.

Key export sectors

To maximise the objectives of this study, three 'sample' export sectors were selected for detailed analysis – meat, forestry and wine. These sectors were considered to be representative of the broader market as they consist of either significant export volumes and/or have the potential growth. In addition, their supply chains have comprehensive national coverage, often consisting of multiple participants across multiple sectors.

Key findings

The research highlighted a number of innovation themes common across the three sectors:

- Collaboration – to generate economies of scale, purchasing power benefits and improve utilisation of available capacity.
- Information technology – to improve vehicle scheduling (yielding higher utilisation), better monitor consignments and reduce waste.
- Transparency and control – service and price offerings from transport suppliers are being dismantled which means the producer is able to increase control and lower supply chain costs.
- New transport technologies – new investment in improved rail and road equipment means increased payloads, lower operating costs and improving utilisation of equipment.
- Supply chain structuring – to reduce the transport costs, for example by identifying the most suitable location in the supply chain to package product.
- Leveraging relationships – particularly international relationships to exploit economies of scale in production and purchasing power.
- Cluster benefits – the common regional locations of the three sectors have enabled third party operators to provide packaging, storage and transport services at costs not obtainable if small producers undertook the processes themselves.

A number of barriers have hampered innovation such as embedded practices, oversupply of capacity, limited network to enable information technology, dispersal of industries and challenging geography.

Potential initiatives

Based on research findings, we have identified several issues and initiatives.

Table ES.1 Issues and actions

Issue	Possible actions
Long-term trend towards larger vessels on international shipping routes	Encourage dialogue between shipping lines, exporters, port operators and land based freight providers to better understand the key drivers for the shipping lines' actions.
	Exporters could work together to better understand the mix of cargoes to identify opportunities to build cargoes across export sectors for specific destinations.
	As an owner of rail and roads, Government can support the private sector, the ports and developers by ensuring complementary landside infrastructure is available.
	Government can also provide support through land use planning and regulatory arrangements.
Integration and connectivity	<p>Ensure transport and land use planning recognises and facilitates interconnectivity.</p> <p>Encourage investment in intermodal terminals and innovative equipment by ensuring roads and rail lines are operating efficiently.</p>
Infrastructure investment	<p>The provision of efficient freight infrastructure will encourage investment in related assets.</p> <p>Government should continue to investigate ways in which the private sector can invest directly in public infrastructure.</p>
Regulatory environment	Ensure regulatory change is robust and undertaken in a timely manner. Any changes must be cognisant of the needs of and implications for transport providers and cargo owners.
Network resilience	<p>Undertake a system wide approach to freight infrastructure planning.</p> <p>Identify and understand existing and potential bottlenecks in the system.</p> <p>Identify alternatives and develop contingency plans in the case of system outages.</p> <p>Utilise short term regulatory levers to overcome outages.</p> <p>Support continued interoperability capability between modes to improve supply chain resilience.</p>
Economies of scale	<p>Central and local government can facilitate intra-regional and cross industry forums to leverage collaborative actions. Likewise industry peak bodies could facilitate information sharing.</p> <p>Ensure anticompetitive regulations do not inadvertently restrict collaboration opportunities for exporters who are competing on the world market, not within New Zealand.</p> <p>Identify information and encourage research that may assist industry and government agencies to develop a better picture of what is happening across industries and regions.</p>
Higher payloads	<p>Implement recommendations for application process as per September 2011 review of high productivity motor vehicles (HPMVs).</p> <p>Address differences in the treatment of HPMV vehicle infringements versus other heavy vehicle infringements.</p> <p>Identify ways to incentivise local government to approve HPMV applications.</p> <p>Ensure regional and local plans have mechanisms to keep up with the changes in the private sector.</p>
	<p>Investigate the options for private sector investment in rail rolling stock (particularly wagons), intermodal terminals and private sidings.</p> <p>Assess opportunities for alternative contract arrangements to facilitate a lower-risk environment.</p>
Information	<p>Leverage data from electronic of road user charges for road planning.</p> <p>Support the expansion of the Freight Information Gathering System to include all container ports and land based container repositioning.</p> <p>New types of data such as the National Animal Identification Tracing (NAIT) system can be used to monitor livestock movements and identify potential efficiencies in the use of trans regional transport operations. As such, NAIT data should be seen as a valuable source of transport information and be encouraged to make interregional 'flow' statistics publically available.</p>

Abstract

This research was undertaken in New Zealand and Australia during 2012, to identify opportunities for, and barriers to, innovation in the freight and logistics component of selected export supply chains. The research was undertaken in two phases, the first a desktop review of similar studies completed in New Zealand and overseas. Three export sectors were then chosen for more in-depth analysis (namely forestry, meat and wine). The second phase of the research incorporated a number of face-to-face discussions with a sample group of sector participants and industry peak bodies.

The desktop research and the discussions with industry participants were used to identify a number of key trends in innovation common across all sectors. These included collaboration between industry participants, use of information technology, increased transparency and control of supply chains, new transport technologies, supply chain restructuring to generate cost savings, leveraging international relationships to generate economies of scale and realisation of the benefits of like industries clustered in the same location.

A number of recommendations have been made for further actions to assist in addressing specific issues and/or barriers to innovation.

1 Introduction

1.1 How does this study aim to help New Zealand businesses?

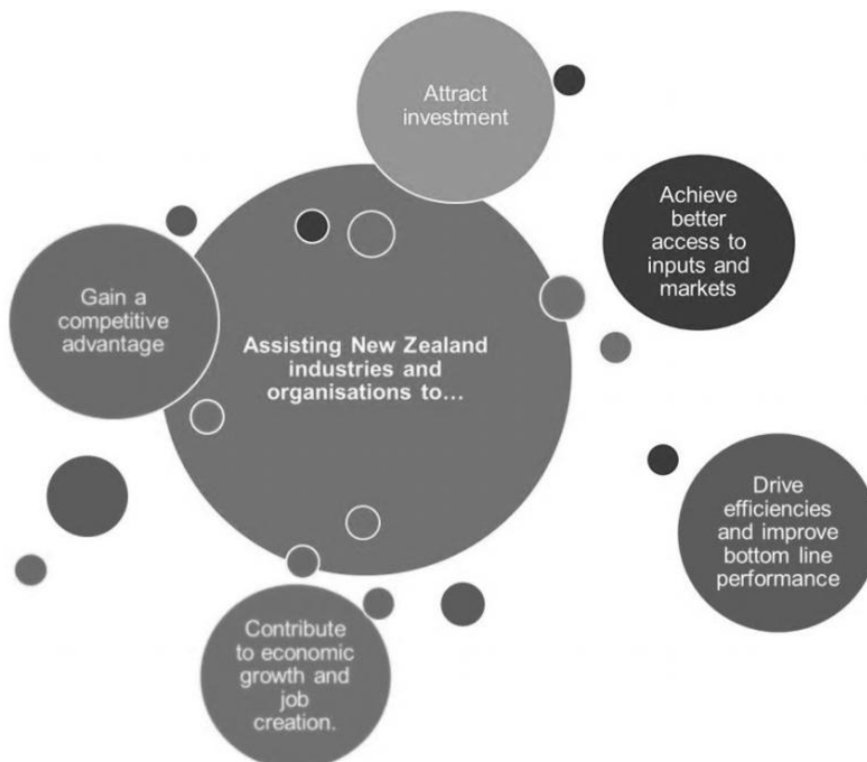
The New Zealand Transport Agency (NZTA) engaged Deloitte to undertake research to identify opportunities for, and barriers to, innovation and productivity gains in New Zealand's freight and logistics industry. The aim of this study was to examine where innovation could be applied within key export sector supply chains specifically in the context of the New Zealand freight and logistics industry. The intention was to provide government with a range of initiatives that would support and improve the efficiency of freight logistics operations and incentivise the adoption of best practices.

Ultimately, this study aimed to identify and illustrate opportunities to assist New Zealand industries and organisations to:

- gain competitive advantage, efficiencies and improve bottom-line performance
- achieve better access to inputs and markets
- attract investment to contribute to economic growth and job creation.

A key focus of the NZTA and this study is to provide meaningful information and solutions that will help the freight and logistics sector improve their operations to support the competitiveness of New Zealand's export sectors.

Figure 1.1 Identifying and illustrating opportunities for businesses



1.1.1 Why the freight and logistics sector?

The New Zealand government has a strong focus on improving freight efficiency to promote economic growth and productivity. Due to New Zealand’s distance from key markets, the management of the flow of goods (which is essentially the broad definition for freight) between a point of origin and a point of destination is important – for both economic success and in order to meet customers’ requirements. As the freight and logistics sector is integral to growing economic performance, identifying opportunities for innovation in freight and logistics is of strategic importance. Ultimately, to be a major and differentiated global competitor, New Zealand must continuously look for new areas of innovation within the freight system to drive down costs and improve services.

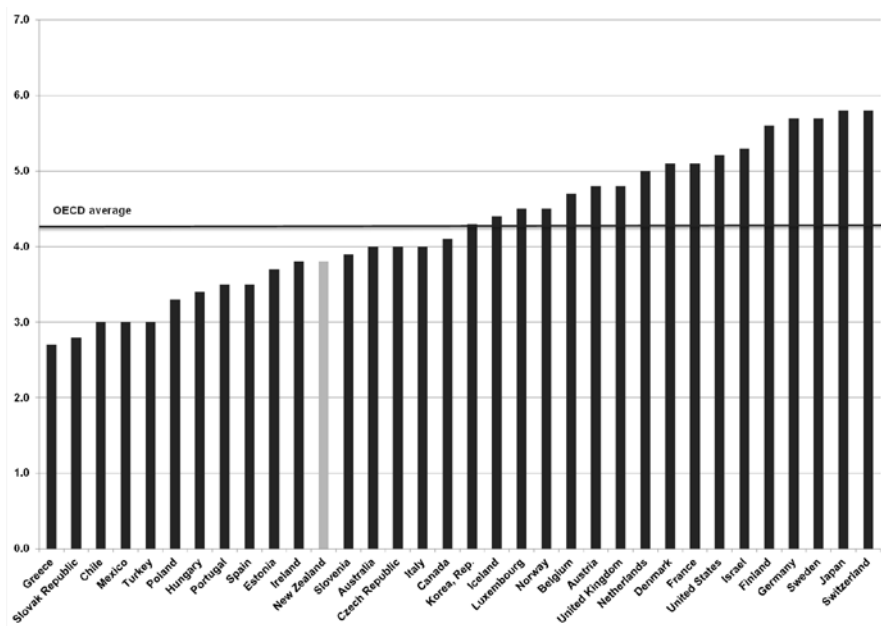
1.2 Why does innovation matter?

Innovation can increase market value or reduce the costs of delivering products and services used domestically or as exports. Higher value or lower costs mean that businesses, and as a consequence countries overall, can earn and sell more. This view is typically held by leaders in both the private and public sectors.

In 2009, Statistics NZ undertook a study of innovation in New Zealand and found that while 46% of businesses reported some form of innovative activity, the innovation levels in New Zealand were slightly lower than those of Australia (The Treasury 2008). According to the World Economic Forum’s annual global competitiveness, New Zealand ranks 23 out of the 34 OECD nations in terms of their capacity to innovate (see figure 1.2). Essentially, New Zealand is considered ‘inventive, but not innovative enough’ (World Economic Forum 2012).

For countries, particularly developed nations, to continue to gain competitive advantage in the market and drive economic performance, looking for innovative solutions is a priority. Lifting the innovative capacity and sophistication of New Zealand businesses is a lynchpin for growing New Zealand’s economy and in particular, for distinguishing the country’s capacity to sell into international markets.

Figure 1.2 New Zealand’s capacity for innovation



Source: World Economic Forum (2012)

1.3 Leveraging the knowledge of stakeholders

This study was undertaken through a combination of research, industry engagement and guidance from the NZTA. It leveraged the knowledge and expertise of Deloitte, peak freight groups and government stakeholders.

Our starting point was a detailed literature review exercise to identify research that had already been undertaken in both New Zealand and internationally (see appendix A). This initial research stage provided the starting point to identify innovation drivers, barriers, trends and themes. It also provided the detail to frame our understanding of the key export sectors.

To validate our research from the literature review, we then undertook a number of targeted interviews with industry representatives. Interviews were held both in person and via teleconference and were facilitated by a senior member of the Deloitte project team. The insights gained through the industry engagement process informed many of the findings and case studies presented in this report.

All NZTA research projects require the establishment of a steering group which includes industry representatives who provide useful assistance to researchers and contribute to the uptake of the results. The role of the steering committee is to:

- ensure the project is meeting its objectives as outlined in the research proposal
- provide assistance and advice to the researcher
- ensure the project is making good and timely progress
- give approval, at key milestones, where the requirement for such approval was mandated as a condition of funding
- members of the committee for this project are listed in the table below, and their guidance was invaluable.

Table 1.1 Steering Committee

Name	Organisation	Role
Sandy Fong (Chair)	NZTA	Principal Policy Advisor, Strategy & Performance
Marinus La Rooij	NZTA	Economic Portfolio Manager, Strategy & Performance
Rick Barber	NZTA	Stakeholder Relationship Manager, Access and Use
Mark Batt	NZ MoT	Manager, Maritime and Freight Sector
Aaron Temperton	KiwiRail	General Manager, Operations
Gary Whale	KiwiRail	Business improvement manager
Brian Pritchard	Forest Owners Association	Chair, Transportation Committee
Aaron Chudleigh	Talley's Group Ltd	Logistics Manager
Kerry Arnold	Road Transport Forum NZ	Technical Manager
Jim Fraser	Auckland Council	Principal Transport Planner

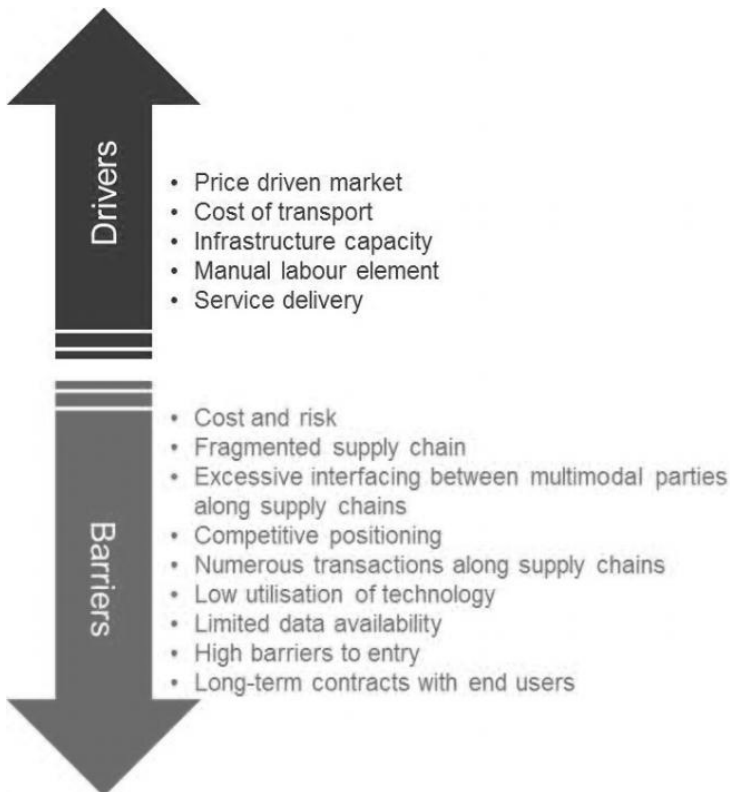
2 How do we identify opportunities for innovation?

2.1 Overview

Organisations achieve innovation by taking active decisions to introduce, change or coordinate their resources and capabilities. The approach for implementing innovative ideas is not always straightforward and is often based on the merits of individual projects. Essentially, businesses tend not to invest in innovation unless there are demonstrable or tangible outcomes. Therefore, understanding the barriers and drivers to innovation is an integral starting point for identifying potential opportunities for innovative actions.

The drivers and barriers discussed in this section reflect research undertaken in the Australian and New Zealand freight and logistics sector in addition to the insights gained through industry engagement.

Figure 2.1 Identifying opportunities through barriers and drivers



2.2 Innovation drivers

Innovation drivers can be broadly categorised as any force that facilitates or encourages innovative change in the sector – these are the incentives for innovation to occur. Five key innovation drivers were identified in the freight and logistics sector (see table 2.1).

A price-driven market provides the incentive for businesses to reduce costs to remain competitive against other players. By providing products and services at a lower cost to end users, a business is able to secure a proportion of the market share in addition to generating economies of scale.¹

For example, where the cost of transport represents a major proportion of a product’s end price, reducing or eliminating costs from freight and logistics is a key driver for businesses as doing so improves the price competitiveness and/or can increase the overall margins.

Similar to the cost of transport, if the cost of labour is high, innovation to reduce labour costs is a key incentive for improving price competitiveness.

Where Infrastructure capacity is limited, participants in a particular supply chain or parallel supply chains may work collaboratively and leverage resources in order to ensure better utilisation of capacity to meet industry’s supply chain needs.

Satisfying customer needs and delivering on their expectations is an integral incentive for most businesses. In this way, exploring innovative ways to maximise the service delivery element of a business is important as it improves the ability for a business to ensure customer loyalty and market share (particularly where the market is homogeneous). This is a particular characteristic of the freight and logistics sectors.

Table 2.1 Maximising innovation drivers

Driver	Description
Price-driven market	<ul style="list-style-type: none"> Provides an incentive to reduce cost in a supply chain. Secures market share and generates economies of scale by producing products to end users at a lower cost.
Cost of transport	<ul style="list-style-type: none"> Increase margins and/or price competitiveness by reducing or eliminating costs from freight logistics. This is particularly important, if transport is regarded as a non-value adding component in the supply chain.
Cost of labour	<ul style="list-style-type: none"> Increase margins and/or price competitiveness by reducing or eliminating manual labour costs.
Infrastructure capacity	<ul style="list-style-type: none"> Increase the ability for supply chain participants to cooperate and ensure industry’s supply chain needs are met. Increase utilisation of existing assets. This is a critical element if capacity constraints exist and/or resources are scarce.
Service delivery	<ul style="list-style-type: none"> Satisfying the customer and delivering or exceeding on their expectations in order to secure customer loyalty and market share which is a strong reason to innovate. This is particularly important in a homogeneous market.

¹ Economies of scale refer to the increase in efficiency as the volume of goods being produced (or size of the operation) grows. Typically, a business that achieves economies of scale lowers the average cost per unit through increased production since fixed costs are shared over an increased volume of goods.

2.3 Innovation barriers

Innovation barriers are factors that stifle or slow activities that create innovative opportunities. It is important to identify barriers to innovation so actions can be taken to reduce or remove them.

A primary barrier to improving productivity or growing a business is cost and risk. Where costs are too high or there is an unacceptable degree of uncertainty, a business is less likely to undertake innovative initiatives, as is often the case with small operators which are common in the freight and logistics sector.

Fragmented supply chains are characterised by multiple parties having input along the supply chain. The objectives of the parties may not always be aligned, multiple processes may exist and information flows can be inconsistent and fragmented. Competition between providers to the supply chain can also inhibit initiatives for change.

Likewise excessive interfacing between multimodal parties along supply chains creates a further barrier to innovation as opportunities for integration and streamlining of procedures and processes are difficult. This situation also increases the extent and complexity of information sharing.

The degree to which freight and logistics operations are competing for cargo further limits the likelihood that information sharing and innovative collaborative approaches will occur across the industry.

If the freight and logistics arrangement of a supply chain is considered a competitive advantage it is unlikely owners will share information and encourage their competitors to adopt similar innovations.

A low utilisation of information technology typically means information cannot be easily shared. As such, achieving innovative initiatives may be challenging as supply chain partners are less able to cooperate and share information.

In a similar way to utilisation of technology, limited data availability also creates a barrier to harnessing and sharing the right level of information to create opportunities to improve efficiency and productivity. For example, availability of industry-wide freight movement data is limited, as freight operators tend to see this information as commercially sensitive.

High barriers to entry may lead to a lack of new ideas and developments entering the supply chain due to limited opportunities for new industry players. This barrier diminishes competition which typically drives cost reduction and improvements in productivity. A subset of high barriers to entry is long-term contracts with end users which impede new players from entering the market and driving change.

Table 2.2 Reducing/eliminating innovation barriers

Driver	Description
Cost and risk	<ul style="list-style-type: none"> Productivity improvements are limited due to high costs and/or an unwilling degree of risk involved.
Fragmented supply chain	<ul style="list-style-type: none"> Multiple parties along supply chains create difficulties in: <ul style="list-style-type: none"> collaborative work on innovative projects price-driven working arrangements short-term focus potential for different processes information flows along multiple competitive supply chains.
Excessive interfacing between multimodal parties	<ul style="list-style-type: none"> Limits opportunities for integration and the streamlining of procedures and processes. Increases the extent and complexity of information sharing.

Driver	Description
Competitive positioning	<ul style="list-style-type: none"> • Less incentive to share information and highly protective of any innovative processes developed. • Particularly if freight logistics operation is viewed as a competitive advantage.
Numerous transactions along supply chains	<ul style="list-style-type: none"> • Increases the chances of duplication and errors, particularly if transactions are manual. • Process can be time consuming leading to innovation being more complex and costly.
Low utilisation of technology	<ul style="list-style-type: none"> • Challenge for supply chain partners to cooperate and improve on information flows where information cannot be easily shared.
Limited data availability	<ul style="list-style-type: none"> • Limits the opportunities for analysis to make improvements along supply chains.
High barriers to entry	<ul style="list-style-type: none"> • Limited opportunities for new industry players may lead to a lack of new ideas and developments entering the supply chain. • Diminishes competition which drives cost reduction and improvements in productivity.
Long-term contracts with end users	<ul style="list-style-type: none"> • A subset of high barriers to entry, impedes new players entering the market and driving change.

3 An integrated freight and logistics system: supporting New Zealand’s export sector

3.1 The freight and logistics industry in New Zealand

The freight and logistics industry in New Zealand is characterised by a system of different transport modes and organisations involved in delivering infrastructure and services to end users. The industry comprises four main transportation modes – road, rail, coastal shipping and air. Each of these components has a role to play in the overall freight sector. Although there is some degree of competition, freight owners and operators ultimately make decisions and select transport modes that best meet the needs of their businesses.

Transport users need to be able to access services across all modes to optimise their decision making. In a similar way, private sector participants in the freight and logistics industry are continually seeking improvements while ensuring arrangements maximise service delivery.

Figure 3.1 Type of freight typically suited to each mode type

Mode	Coastal shipping	Rail	Road	Airfreight
Type of Freight	<ul style="list-style-type: none"> • Large consignments • Bulk commodities • Low value • Non-time sensitive intermodal container 	<ul style="list-style-type: none"> • Large bulk, exports • Interregional • Intermodal container traffic • FCL / FWL 	<ul style="list-style-type: none"> • Time sensitive • Perishable • FTL / LTL • Specialist equipment 	<ul style="list-style-type: none"> • High value • Small consignment sizes • Time sensitive

3.1.1 Road

Road is the dominant freight mode in New Zealand – the road network is responsible for moving 70% of freight tonne-kilometres within New Zealand (Ministry of Transport 2012a). Road transportation is best suited where freight is time sensitive. By leveraging the network, road transportation can provide door-to-door and ‘overnight’ delivery to most destinations within each island (or two days when delivery is inter-island). However, road freight is limited by the size of the vehicle and restrictions on the carrying capacity of local roads and state highways.

There are a large number of operators in the road sector, many of whom specialise in a particular region and or type of freight. A number of major companies are dominant in the sector (including Mainfreight, Toll and Linfox). At the margin there are low barriers to market entry as the cost of purchasing or leasing a truck and obtaining an operating licence is not significant. The challenge is to build a sustainable business by generating a critical mass of customers.

3.1.2 Rail and coastal shipping

The remainder of freight is typically moved by rail and coastal shipping. As an overarching principle, rail is better suited to moving large volumes of bulk and containerised freight over long distances. While compared with road transportation, more freight can be moved via rail, there are a number of practical reasons why this is not the case – for example, short distances or inter-regional movements between an origin and destination not serviced by rail. Rail freight can also be less reliable and less flexible,

particularly when intermodal exchanges are required to connect an origin and destination. KiwiRail is the sole rail freight operator in New Zealand.

Coastal shipping is considered more efficient than rail in moving large volumes, particularly bulk movements over long distances. Freight is moved from 16 of New Zealand's ports², catering for various cargoes including bulk products such as cement and petroleum products, break bulk and containerised product. However, coastal shipping is slower than either road or rail and requires intermodal facilities to transfer freight between modes for pick-up and delivery.

3.1.3 Air freight

A small percentage of total tonnage of freight is moved using air. Air freight suits time-critical and high-value freight.

3.2 Emerging trends

There are a number of global and country-specific trends that influence the freight and logistics industry in New Zealand. These are described in the sections below.

3.2.1 Global trends

The freight logistics industry operates in a constantly changing landscape of international trade, resulting in all kinds of challenges and pressures to adapt within the market. While some of these challenges result from changes in the global climate, others have been the result of innovation by players forcing other members and players within the supply chain to respond.

With continued globalisation and technological improvements, supply chains are becoming longer. The larger distances involved and the number of links create issues for collecting and translating information and sharing it with other members along the supply chain. As a result, freight logistics tasks, across procurement, production and distribution, have become more complicated and harder to manage. This is compounded by increasing customer demands to shorten delivery lead times, provide value-added services, reduce costs and improve productivity.

Compliance requirements around international trade have also increased substantially, particularly with security measures requiring more information on cargoes, as well as safety/environmental regulation demanding improved management and monitoring.

A growing urban population around major city centres is resulting in an increased demand for freight but is also generating other knock-on impacts such as increased traffic. With more freight movements in urban areas, this adds a layer of complexity due to the contribution to congestion and conflicts with public transport (particularly rail) and with private vehicles in metropolitan areas.

Government and consumers are increasingly becoming more aware of environmental impacts and there has been more pressure in recent years to ensure businesses become environmentally sustainable. This is a major concern for the freight and logistics industry as it is a large contributor to carbon emissions and has a significant impact on local air quality and amenity.

² This is counting Onehunga and Waitemata in Auckland as two separate ports. It also excludes Taharoa, which is of no value for coastal traffic.

The global trend in international shipping is for larger vessels. Currently vessels of a nominal capacity of over 8000 20-foot containers account for 18% of the global fleet capacity. Based on forward orders, this will increase to 60% of the fleet capacity by 2014.

3.2.2 Trends specific to New Zealand

3.2.2.1 An inquiry into New Zealand's freight transport services

Of particular relevance to supply chain innovation, and the freight sector in general, is the New Zealand Productivity Commission's inquiry into international freight transport services for New Zealand. The Commission was tasked with finding ways to improve the performance of the sector in order to support New Zealand's ability to compete effectively within the global economy (New Zealand Productivity Commission 2012).

New Zealand's transport and storage sector experienced considerable productivity improvements during the 1980s and 1990s which were driven by innovation and sustained structural reform. However, there has been virtually no improvement in productivity during the last decade.

The Commission found a number of areas that could result in increased productivity in the import and export chains. These included improvements in efficiency particularly with regard to port ownership structures, the potential conflict between local government objectives and the commercial mandate of the port company. Furthermore, port labour agreements have not kept pace with business objectives and are impeding productivity-enhancing ventures.

With regard to the line haul modes the Commission found that:

- the existing arrangements allowing foreign-owned vessels to provide domestic freight services resulted in lower transport costs to cargo owners
- the PAYGO system for road user charges is recovering capital expenditure on roads during the period it is incurred (contrary to popular belief that road freight transport is subsidised)
- the core obstacle to successful implementation of high-productivity motor vehicles (HPMVs) is the inadequacy of infrastructure (particularly for bridges)
- there needs to be more transparency in decision making around rail infrastructure projects which should undergo the same economic assessment and rigour as major road projects.

3.2.2.2 Freight information gathering

The Ministry of Transport launched the Freight Information Gathering System in 2010 to collect information relating to freight movements into and out of New Zealand. The project aims to improve the reliability and consistency of import-export data.

Quarterly reports will be generated based on data feeding into the system from New Zealand's 10 container ports (the first and current issue of the report only includes port data from Auckland, Tauranga, Taranaki, Napier and Nelson) (Ministry of Transport 2012b). An immediate issue arising from the first report has been around information completeness regarding landside movements and origin-destinations.

During the July-September period, 57% of landside movements to the port and 58% of movements leaving the port were not known in terms of transport mode used. Similarly, the movements of 46% of containers were unknown in terms of origin-destination – the Ports of Auckland accounted for the majority of the data gap.

While these issues are expected to be resolved in future releases, particularly with Auckland, the quarterly report highlights the importance of overcoming such data gaps, as the North Island ports of Auckland and Tauranga account for 85% of containerised international and domestic movements.

Increasing the understanding of container movements, in terms of traffic, volume and mode, will be critical if transport planning is to adopt a more integrated network approach as opposed to the more traditional paradigm of planning around individual transport modes, as highlighted in the forthcoming Upper North Island Freight Strategy.

3.2.2.3 Slow steaming

In addition to increasing ship sizes, international shipping lines have also dropped their steaming speeds by around five knots (from 21–24 to 17–18 knots) since 2009. This has been termed ‘slow steaming’. This was a direct response by the shipping industry to increased fuel prices, and has been enabled by the current over capacity in the international shipping sector. There has been no evidence that the cost benefits of slow steaming have been passed back to the shippers.

Figure 3.2 Impact of slow steaming on the red meat industry



Source: New Zealand Meat Industry Association (2010)

A key feature of New Zealand transport is the high proportion, relative to most international sea trade, of exports that require refrigeration or temperature control. This is particularly relevant to meat exports. As such the advent of slow steaming is of particular importance to New Zealand exports.

To illustrate the degree to which different industries can be affected, the reduction in travel speeds has increased transit times to European markets from approximately 32 days to 40 days. This has a greater effect on certain export industries – for example, increasing their exposure to shorter shelf lives, higher inventory costs and the need to ensure the steady supply of products to larger customers remains unaffected.

There have been discussions for a further reduction in travel speeds to 14 knots, ‘super slow steaming’, which has been acknowledged by New Zealand industry peak bodies (such as the Meat Industry Association) as a major risk that could prove detrimental to the export industries catering to European markets.

3.2.3 Road user charges (RUC)

The new Road User Charges (RUC) Act 2012 came into effect on 1 August 2012. The reform in New Zealand's road user charges system arose from an independent review in 2009 on the country's paper-based system at the time (Ministry of Transport 2009).³

The independent review made a number of recommendations as to how the system could be improved. These related to improvements to the Ministry of Transport's cost allocation model, measures to help reduce evasion, improvements in customer service delivery, reducing compliance costs and integrating technology more into the system.

Subsequent to the review a case was made for new governance arrangements to address an estimated \$30 million in RUC evasion each year. It suggested that as a result of evasion, rates are now higher than would have otherwise been the case to raise the same level of revenue.

Notable reforms in the RUC Act include:

- the removal of operator-nominated weights to avoid weight-based evasion
- more stringent measures around odometer tampering
- transport service operators being required to keep certain records accessible by the NZTA
- extending the responsibilities and scope for the NZTA and Police to investigate and address more serious RUC offences, such as search warrants.

The reform is also expected to simplify administration processes, for both government and operators, by streamlining government agency processes and transferring responsibilities to electronic system providers for electronic RUC (eRUC). The RUC Act also aims to improve the regulatory framework for eRUC providers.

It also aims to provide more transparency and clarity with respect to licences and charges (ie similar heavy vehicles will pay similar charges); and will cater to the use of HPMVs by allocating a special licence to allow HPMVs to operate at the maximum weight limit at all times, or provide the option of purchasing additional licences for specific journeys.

However, as a result of the reform process which began in 2008, there has been reluctance by industry participants to invest due in part to uncertainty over new regulations and also due to the general downturn of the economy.

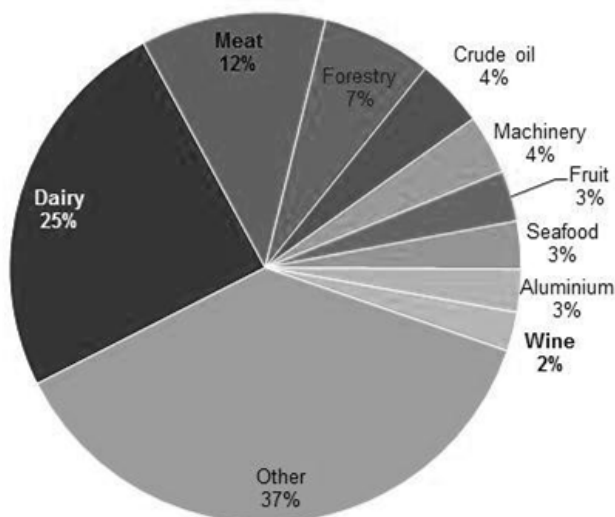
³Since 2010, the system allows operators to use electronic RUC (electronic distance recording and licence display).

4 New Zealand's export sector: capturing a variety of freight activities and transport modes

4.1 New Zealand's distinctive export profile

A unique characteristic of New Zealand's export sector is the high share (by value) of primary industries – that is, parts of the economy making direct use of natural resources such as agriculture, forestry and fishing, mining, and oil and gas.

Figure 4.1 Top New Zealand export commodity share by value in 2011



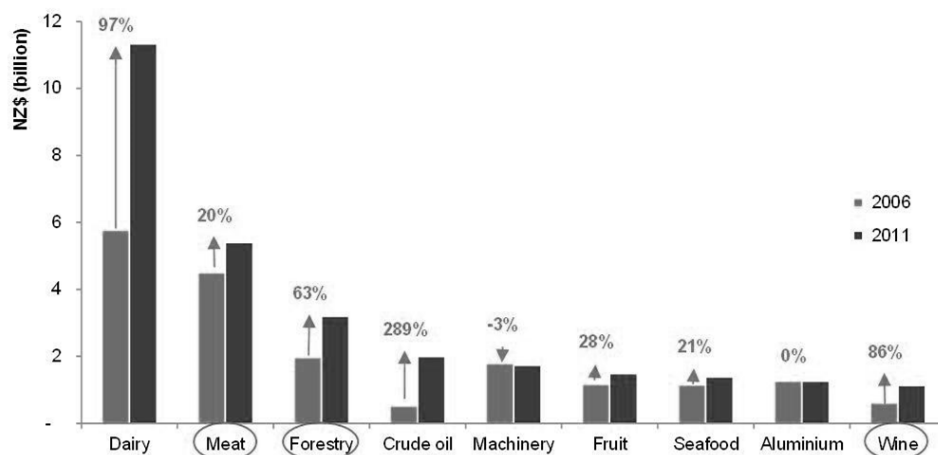
Source: Statistics NZ (2012)

New Zealand's primary industries accounted for well over half of the country's \$46 billion in exports in 2011. In fact, the four most valuable export commodities came from the primary sector.

In 2011, the value of New Zealand's exports totalled NZ\$46 billion – an increase of 42% since 2006. Top export commodities also increased their share of total exports from 58% to 63% in the same period.

As noted earlier, New Zealand's four most valuable sectors now account for nearly half of the country's exports – this share has increased noticeably over the last five years (from 39% to 48%).

Figure 4.2 Change in top New Zealand export commodities by value, 2006–11



Source: Statistics NZ (2012)

Dairy products and crude oil have experienced the largest increases over the last five years. Dairy is New Zealand's largest export and has become more significant to the economy, increasing by 7% to 25% of total exports by value in 2011.

Export meat is the second largest export industry and while it has seen a moderate increase since 2006, its relative export share has declined from 14% to 12%. Forestry saw the third largest increase in value but only a marginal increase from 6% to 7% of total exports.

Dairy, meat and forestry have historically been New Zealand's top exports – however, in recent years, crude oil and wine have seen remarkable growth, nearly doubling for wine and quadrupling for crude oil.

There has been a strong growth in oil production since 2006 – largely driven by renewed exploratory efforts by the private sector. The increase in oil production peaked in 2008 at 21 million barrels, up from 7 million barrels in 2006 (Ministry of Economic Development 2012). As a result, crude oil exports have surged.

While oil production has appeared to taper off since 2008, crude oil exports may see a further decline due to current expansion at New Zealand's Marsden Point oil refinery. The expansion is expected to boost capacity by 15% to meet local oil demands (Refining New Zealand 2011).

The export of wine has also seen growing significance since 2006; New Zealand's reputation for its boutique and high-quality wines has benefited from a trend of increasing demand for a wider variety of wines by geography, quality and type.

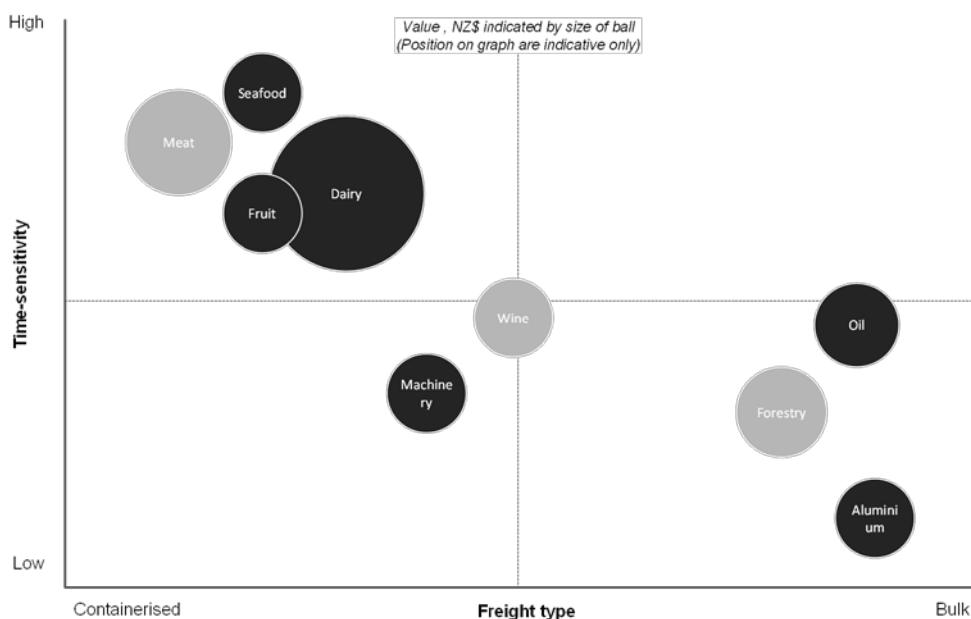
While Australia, the US and UK account for over 80% of exports (of which the Australian market saw the highest growth), emerging economies will likely play a key role in the future, particularly China, which saw a quadrupling in its demand for New Zealand wine between 2006 and 2009 (New Zealand Wine 2009).

4.1.1 Selecting sectors that are indicative of the broader New Zealand export market

Figure 4.3 provides an indicative profile of New Zealand's export sector. Nine major export commodities are plotted based on time sensitivity (eg non-perishable to perishable), freight type (eg how it is transported – unitised or bulk) and value to the economy.

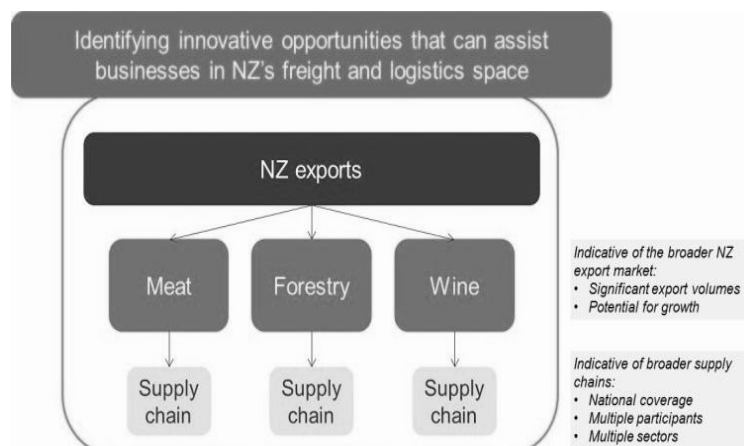
New Zealand's export profile, while skewed towards the primary sector, demonstrates a degree of heterogeneity in terms of how products are moved (eg how much is containerised) and the perishability of goods which makes the transportation of the product time sensitive (eg chilled meat, fresh fruit, seafood). The profile ranges from highly time-sensitive containerised freight to non-perishable bulk freight.

Figure 4.3 New Zealand's export profile



In addition to having different freight characteristics, the meat, forestry and wine sectors are in different stages of their lifecycles – the meat industry has seen a decline in market share, forestry is maturing while the export wine industry has experienced significant growth in recent years. This is discussed in more detail in sections 4.5 to 4.7.

Figure 4.4 Export sectors that are indicative of the broader New Zealand market



4.2 Why has export dairy been excluded?

The dairy industry is undeniably New Zealand's biggest export earner, contributing \$11.3 billion in 2011. Fonterra is New Zealand's largest company and is a world leading exporter of dairy products, responsible for more than a third of international dairy trade. Fonterra accounts for nearly 95% of all dairy produced in the country. The industry has been successful at diversifying both its products and the markets it exports to.

It is notable that the dairy sector has not been selected for inclusion in this research. This is because, in many respects, the New Zealand dairy industry can be regarded as international best practice. Fonterra has a reputation for having established an efficient vertically integrated supply chain making use of intermodal transport modes.

To maximise the objectives of this study, we considered that more value would be generated from focusing our research on export sectors in the economy that are less well understood. This view was supported by members of the Steering Committee.

Box 4.1 Lessons from the dairy industry

There are a number of supply chain lessons from the dairy industry which can be applied to the key export sectors. These include the use of:

- centrally located storage and packaging facilities
- in-house third-party logistics (3PL) to organise all internal transport
- containers higher than ISO standard for local rail transport
- rail for bulk milk
- reverse osmosis to dewater product and save weight in transportation.

4.3 Meat

4.3.1 Overview

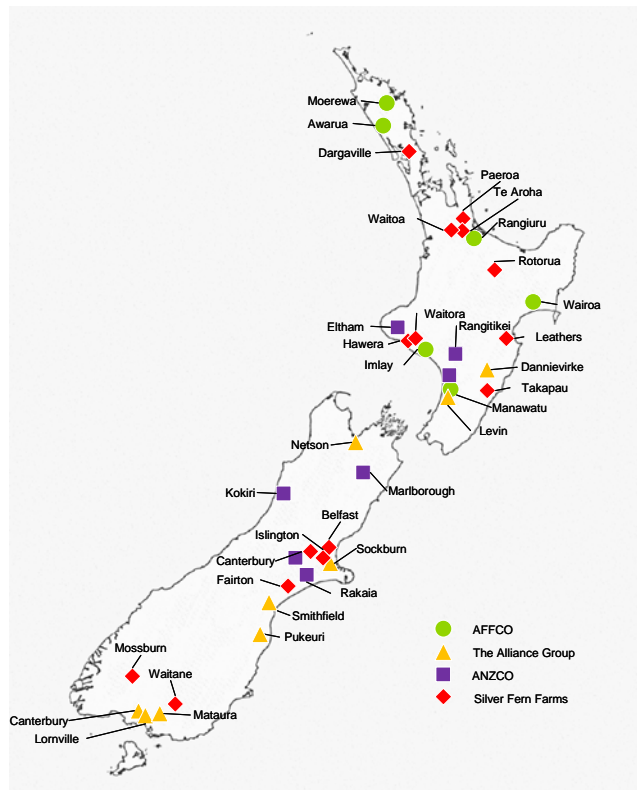
The meat industry is a relatively fragmented partnership between farmers, processors and exporters with more than 14,000 farms and 80 processing plants across the country (New Zealand Meat Industry Association 2009). Two distinct supply chains characterise the sector – the movement of livestock between farms and plants for processing, and the movement of processed meat products from plants to customers (for domestic and export consumption).

Meat's 12% share of New Zealand's exports by value translated to approximately 1.4 million tonnes exported in 2011. Europe, North America and Asia are key destinations for the industry, accounting for nearly three-quarters of the market by value (New Zealand Meat Industry Association 2011b; 2011c). The export meat sector comprises over 80% of New Zealand's meat production (Deloitte 2011).

The sector has experienced increasing competition from other land uses (particularly dairy and forestry) which generate better returns to land owners. This has had the impact of reducing meat's relative export share compared with other industries.

The meat sector has a long history of innovation harking back to the first shipments of frozen meat from New Zealand to the UK in the late nineteenth century. Over the ensuing period this technology has been developed and improved to enhance the quality of export product and improve the efficiency of the transport task, for example, the introduction of refrigerated containers and packaging. A more recent innovation has been the advancement of refrigeration technologies that has enabled a shift from large bulk tonnages of frozen meat to higher value chilled goods (Deloitte 2011).

Figure 4.5 Principal meat processing plants owned by the four largest producers are illustrative of the distribution of meat processing plants across the North and South Islands



However, the move to larger and slower moving sea vessels by international shipping lines poses a potentially large threat to the future wellbeing of the sector. 'Slow steaming' has shortened the shelf life of meat products available to end customers.

4.3.2 Supply chain

Meat processing companies in New Zealand range in size from small, single plant operations to some of New Zealand's largest companies. The four major companies supplying the majority of exported meat products are:

- AFFCO
- Alliance Group
- ANZCO Foods
- Silver Fern Farms.

The industry is characterised by an oversupply of processing facilities which compete for both the purchase of livestock and for the sale of product in export markets (Deloitte 2011).

The key steps in the meat supply chain are illustrated in figure 4.6.

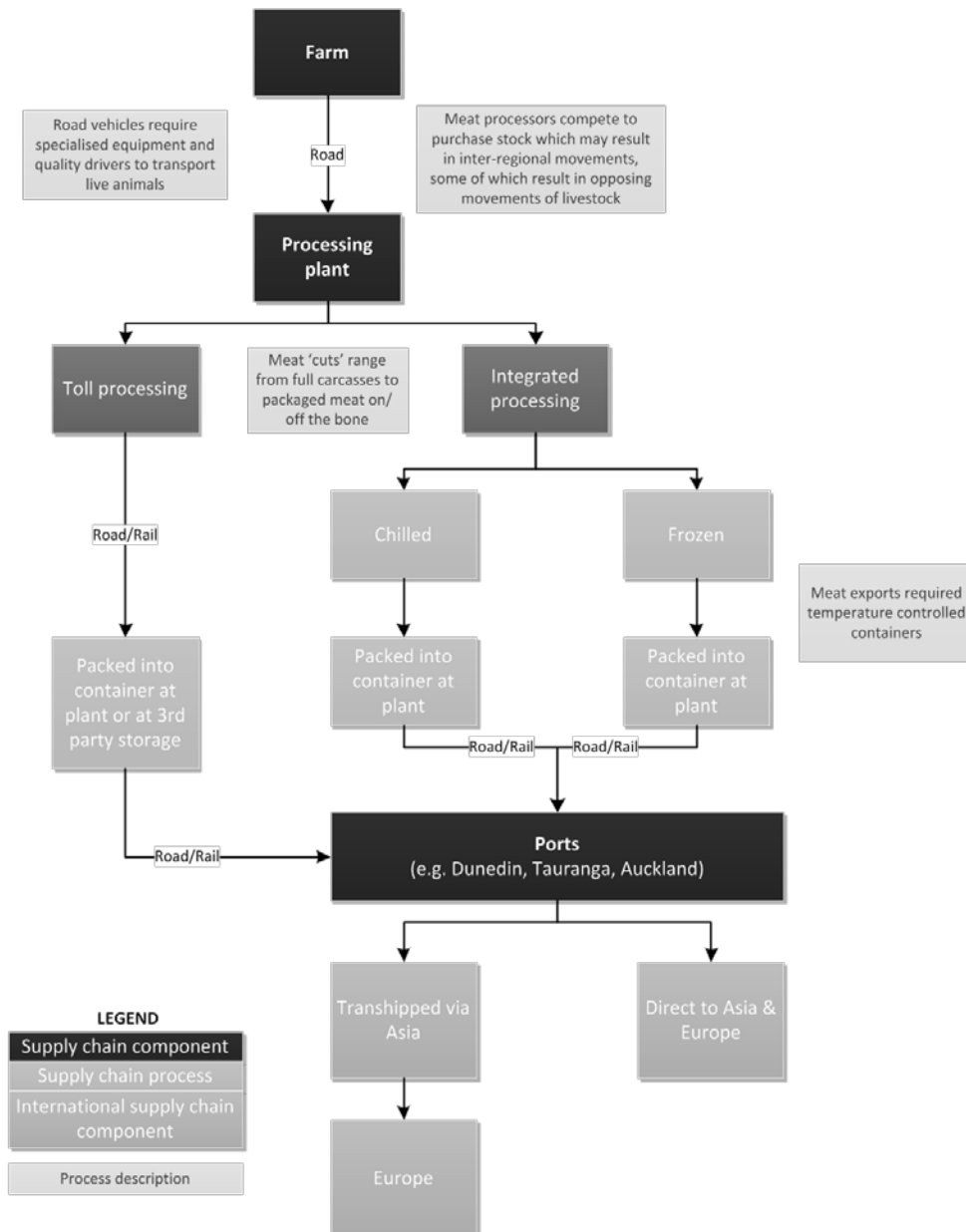
The movement of livestock requires specialised road vehicles and experienced drivers to ensure the quality of live animals transported to processors is maintained.

New Zealand's meat sector requires temperature controlled containers for export. The larger production plants have the capacity to load containers at the processing plant. Smaller operators tend to utilise third-party storage and packing facilities. It is not unusual for various cuts of frozen/chilled meats from

different players either to be consolidated into full container loads or left to third party logistics providers to consolidate less than container load consignments.

A significant challenge faced by meat exporters is the impact on shelf life of products as a result of the long travel distances involved. This is particularly the case for chilled meat which extracts a higher return from customers but is more prone to being damaged. Supply chain owners have attempted to overcome this through improving the technologies utilised in temperature controlled containers and improved packaging systems

Figure 4.6 Export meat supply chain



4.3.3 Key issues affecting the meat sector

4.3.3.1 Relative market share

The relative market share of beef and lamb influences the supply chain options for each. New Zealand is the world's largest sheep meat exporter accounting for 40% of global exports, whereas beef exports account for only 7% of global exports (New Zealand Meat Industry Association 2010). Due to sheep meat's market size the New Zealand industry has greater ability to influence distribution systems in destination markets. This is not the case for beef markets, in which New Zealand product represents a much smaller market share.

4.3.3.2 Seasonal production and demand

The seasonal nature of meat production and demand puts considerable strain on all aspects of the supply chain. As producers seek to maximise the utilisation of their production facilities, stress is placed on the livestock carriers to collect animals. As demand for product increases so too does the demand for shipping containers and line haul services. This increase in demand is compounded by relatively short lead times from order placement to delivery and the requirement to quickly reposition empty containers for loading.

4.3.3.3 Influence of shipping lines

The industry has been highly successful in developing and marketing its chilled meat product. However, this has significantly shortened the shelf life of product (chilled meat has a shelf life of 15–20 days compared with frozen products which can be shelved for many months). The advent of slow steaming by shipping companies, where ships reduce their speed in order to reduce fuel consumption and costs, has increased the steaming time from New Zealand to Europe. This means that the shelf life in Europe for chilled meat has reduced from 15 to 10 days.

Furthermore, the shipping lines traditionally controlled the distribution chain, primarily through a freight rate system applied universally across New Zealand. This system enabled the shipping lines to optimise their shipping schedules. However, the meat producers had no visibility over the unbundled cost to transport their product from production plant to market.

4.3.3.4 Geographic dispersion

Meat processing plants are dispersed over the country, and are situated mostly in regional areas. This not only increases the complexity of transport arrangements (for example multiple port calls, and the extensive requirements to reposition empty containers), it also limits the ability to leverage back load opportunities and realise economies associated with industries being clustered in geographic regions.

4.3.3.5 Container supply and optimised loading

The high-density nature of export meat, particularly boned, in addition to its requirement for temperature controlled equipment, means the industry cannot leverage the benefits of larger (40-foot) generic 'dry' containers. As a result the supply of suitable equipment is more complex. For example, New Zealand's small market and its specialist need (ie refrigeration) are difficult to accommodate by generic ship operators whose trade is mostly lower-density products out of Asia which are predominately serviced in 40-foot containers.

4.4 Forestry

4.4.1 Overview

New Zealand forest industry participants can be separated into four segments – forest management, harvesting, processing and exporters.

With nearly 22.6 million cubic metres of logs harvested in 2009/10, the annual harvest of logs equates to approximately 20 million tonnes. The National Freight Demands Study estimates that approximately 30 million tonnes of forest products are moved around New Zealand each year. From this, 10.5 million tonnes of forestry products are exported, representing almost half of New Zealand’s total exports by volume (New Zealand Forest Owners Association 2011). The top five export destinations for forestry products from New Zealand are China, Australia, Japan, Korea and the USA.

For the year ended March 2010, the total value of all forestry products was \$3.9 billion (New Zealand Forest Owners Association 2011). New Zealand’s forest industry produces a number of different export products including logs, sawn timber, panels, wood pulp and paper and paperboard. Logs represented almost one-third by value of forestry exports, approximately \$1.1 billion in 2010.

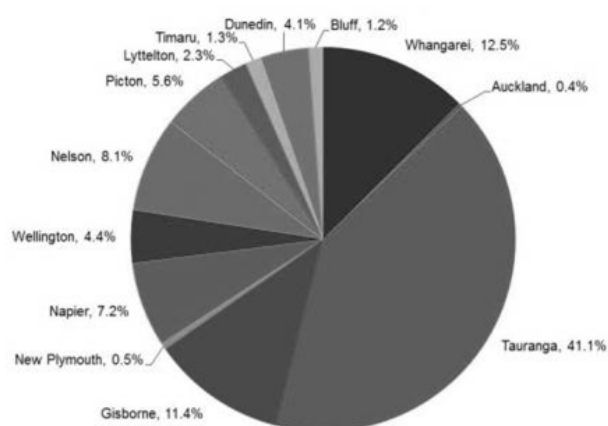
The major exporters of forestry products include:

- Carter Holt Harvey – pulp and paper, timber products
- Norske Skog – paper
- WPI International – pulp
- Pan Pac – timber, pulp, woodchip, logs
- JNL panel – products
- various sawn timber producers.

Given the high costs of transport (as a proportion of product value) as far as possible all exported logs, and the majority of forestry products, are exported through the nearest port. Intra-regional trips are relatively long (on average 90km) reflecting the distance of the log-producing areas from ports or processing facilities. Figure 4.7 illustrates this point as it shows the large number of ports that are used to export logs.

The export of forestry products is primarily by dedicated shipping vessels capable of accessing the majority of ports in New Zealand. Most ports in New Zealand ship forestry products; the Port of Tauranga is the largest forestry port and significant volumes are shipped from Napier, Gisborne, Whangarei and Nelson.

Figure 4.7 Log exports by port (year ended March 2010)



Source: New Zealand Forest Owners Association (2011)

4.4.2 Supply chain

The forestry sector supply chains incorporate all aspects of cartage of logs from forest to production facility and port, and for the transport of finished product to port.

Traditionally forestry exports, particularly logs and woodchips, have been exported in dedicated (charter) vessels. Finished product such as pulp, paper, sawn timber and panel products are exported in either bulk or containers.

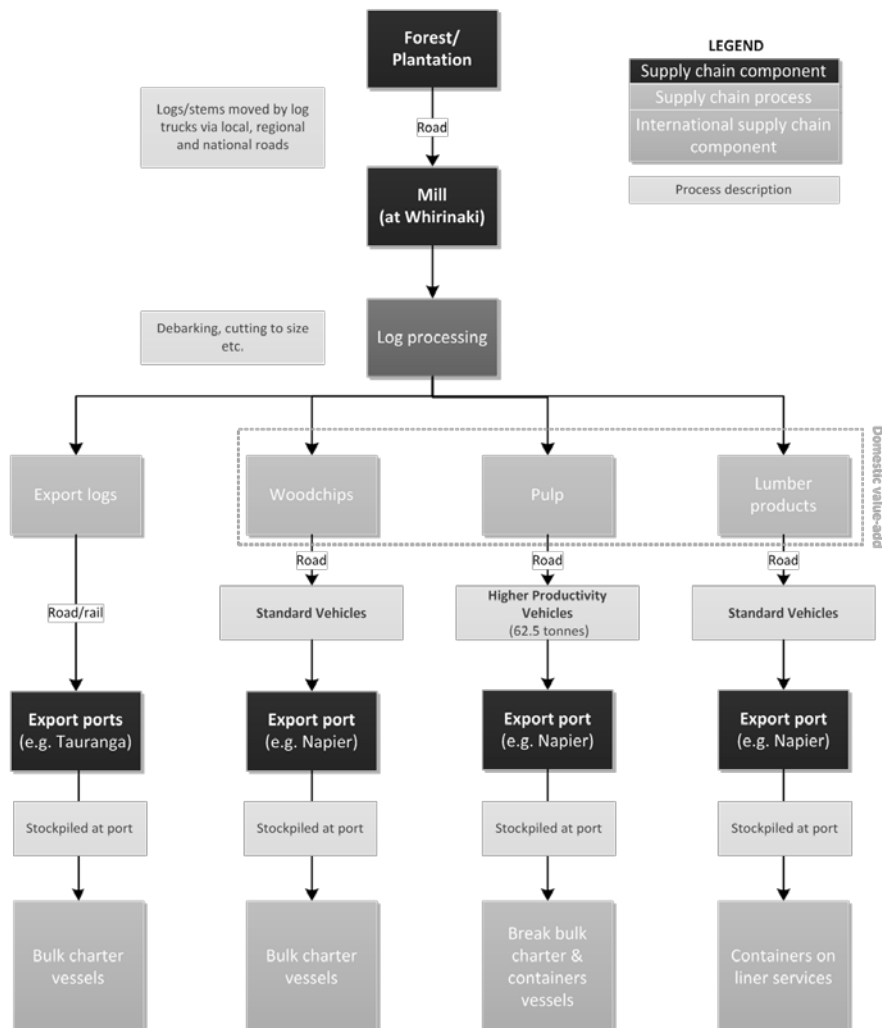
Major mills, such as Whirinaki (owned by Pan Pac), process inbound harvest logs by debarking and cutting them to size. While a significant share of logs are destined for export, woodchips, pulp and other lumber products are also produced at the mills

Figure 4.8 illustrates Pan Pac's supply chain from forest to mill to port.

Generally speaking, export timber is transported to a port within the locality of the processing mill. For the most part, road is the dominant mode used to transport timber. However, considerable volumes of logs are transported by rail from Murupara to Port of Tauranga, and from new log terminals which act as feeder hubs to ports (for example, Waingawa and Marton feeding Centreport at Wellington).

As specialised break bulk vessels are required to ship forestry products overseas, consignment sizes are large and must be assembled at the port.

Figure 4.8 Pan Pac supply chain



4.4.3 Key issues affecting the forestry sector

4.4.3.1 Industry concentration

The forestry sector tends to be concentrated around the traditional forestry growing regions of the central North Island. However, as the forest areas have expanded, processing facilities have been established in other locations areas such as Gisborne, Masterton, Kaitia and Rangiora.

Despite new areas being planted, the central North Island forests continue to dominate the sector in terms of land in forest and annual production. The central North Island accounts for 30% of total land under plantation forests (New Zealand Forest Owners Association 2011). As a result of this concentration, specific transport infrastructure, such as the railway line to Murupara and high-capacity off-road forestry roads have been constructed in the region. Elsewhere the sector shares public roads and the rail network.

As with the meat sector, most production facilities are located in regional areas. This, combined with the requirement for specialist transport equipment (particularly for logs and woodchip), means there is little opportunity to utilise backloads to reduce freight costs.

4.4.3.2 Consignment sizes

As noted, the forestry sector tends to export product in bulk and break bulk. This means consignment sizes are large and must be assembled at the port in preparation for ship loading. As a result forestry exporters have developed stockpiling and storage facilities at the port, rather than locations remote from the port on lower-value land.

4.4.3.3 Nature of product

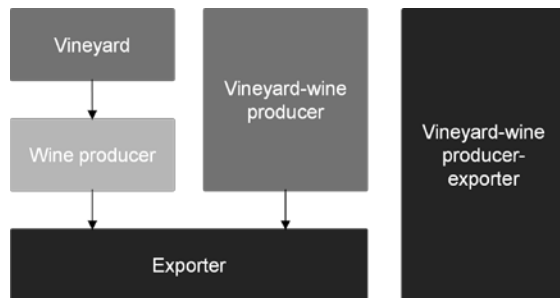
Log transport offers unique challenges to the freight sector. These range from the requirement for specialist equipment such as trailers designed to carry logs securely to on-board weighing systems to ensure trailers are not overloaded in forests. Furthermore, many logs are harvested in remote areas and rugged terrain only accessible by local roads which are often made of gravel, and are steep and winding.

4.5 Wine

4.5.1 Overview

In 2011, New Zealand winegrowers produced approximately 320,000 tonnes of wine. Production largely relies on seasonal harvests and therefore varies from year to year. The export wine sector has grown by 27.3% in the five years preceding 2008/09. By comparison, total exports grew by 8.6% over the same timeframe (New Zealand Wine 2011a).

The wine industry represents a relatively smaller proportion of the export market (compared with meat and forestry) at 2% of exports by value for the year ending September 2011. However, the industry has seen a five-fold increase in the value of wine exports from approximately \$240 million in 2002 to nearly \$1.1 billion in 2011 (New Zealand Wine 2011a). The sector has seen significant growth as international demand for high-value wine has increased over the years. The number of wineries in New Zealand has risen from less than 250 in 1996 to approximately 700 in 2011.

Figure 4.9 Export wine flow

The export wine sector is fragmented due to the number of smaller wineries and the diversity of supply chains. While certain wine growers produce and bottle their own wine, there are a number of industry players who specialise in particular parts of the supply chain – such as, solely focusing on harvesting grapes or the distribution of bulk wine to bottling plants (GS1 2005).

Sauvignon Blanc constitutes the single most important varietal exported in New Zealand accounting for just over 80% of the total volume of wine exported in 2011. Other varieties include Pinot Noir, Chardonnay, Riesling and Cabernet Sauvignon. Different varieties have diverse handling characteristics and markets which makes transport more complicated.

The Marlborough and Auckland regions account for around 28% of all the wineries in the country. Nearly 89% of these wineries are relatively small with sales not exceeding 200,000 litres per annum. There were 71 wineries in 2011 which sold between 200,000 and 4 million litres, and 10 wineries which had more than 4 million litres in sales (New Zealand Wine 2011b).

4.5.2 Supply chain

The export wine supply chain incorporates the transport of fresh produce (grapes from vineyard to winery), bulk semi-processed and processed product, and finished packaged product.

In most instances the vineyards are remote from the winery and require grapes to be transported by truck on public roads. In larger operations wineries operate bottling lines and store their production on site. However, for many small producers, bottling and storage facilities are provided by third parties.

An example of an export wine supply chain is illustrated in figure 4.10.

Due to a relatively fragmented market, consisting of small to large wineries and the varying extent to which they are involved in the production of wine, the types of supply chains can be diverse.

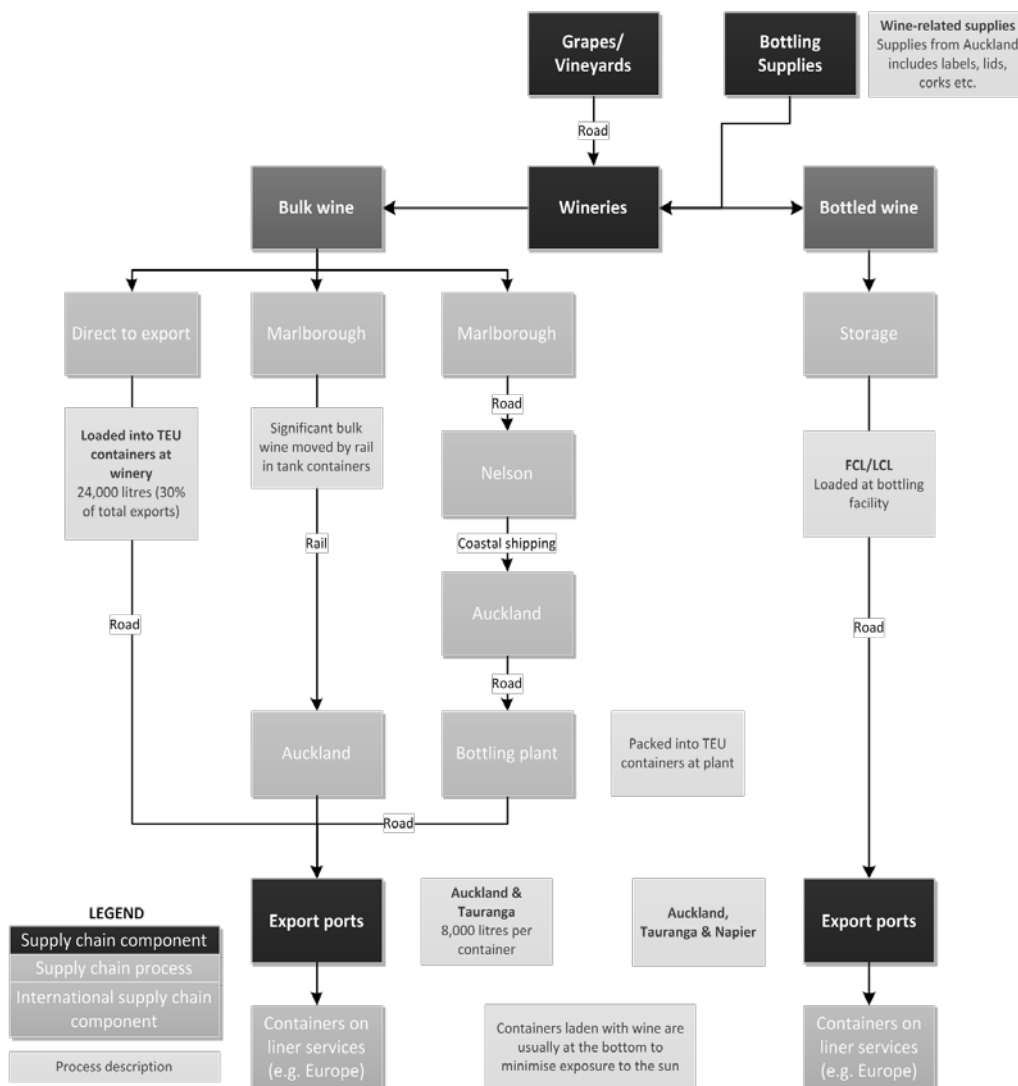
Wine is predominately exported in bottles. However, a growing volume of wine is exported in bulk as either branded or unbranded product.

Bulk wine destined straight to export is loaded into a ‘bladder’ in a 20-foot container onsite before being transported by road to the port. Wine is also transported in bulk from the growing regions (such as Marlborough and Hawke’s Bay) to Auckland for bottling and then packed in 20-foot containers for export.

Mostly wine is bottled and stored at source. Larger producers or cooperatives are often able to generate FCL consignments while smaller players provide less than container loads to third party logistics providers to minimise shipment costs.

Wine is not generally transported in temperature controlled containers and as such can be exposed to varying temperature ranges which can affect wine quality. Recent innovations by some exporters include the introduction of liner bags to reduce the temperature swings within containers.

Figure 4.10 Export wine supply chain



4.5.3 Key issues affecting the wine sector

4.5.3.1 Scale

Due to the size and fragmented nature of the sector the opportunities to develop scale are limited. Where this is possible larger operators are able to transport product in bulk to lower cost bottling operations in the Auckland region and overseas.

4.5.3.2 Geographic concentration

As most wine is produced in proximity to the vineyards, the industry tends to be clustered in specific geographic regions such as Marlborough, Hawke’s Bay etc. This means that specialist bottling, storage and transport companies have become established to provide logistics services to the sector. This is particularly helpful for the small producers who do not have the volumes to support in-house logistics services.

However, some regions are geographically isolated from main transport hubs (for example Central Otago), which means transport costs are higher than would otherwise be the case.

4.5.3.3 Bottling

The location of bottling facilities is a key driver of wine supply chain costs in New Zealand. All wine bottles are manufactured in Auckland. This means empty bottles are required to be transported to the bottling plants, many of which are located in the wine-growing regions.

4.5.3.4 Bulk exports

Effective bulk transport technology has enabled producers to export wine in bulk. In some cases this wine is bottled off shore as branded product but in others it is sold as a generic New Zealand product. While the transport of wine in bulk is considerably more cost effective than in bottles, generic bulk wine is sold at a discount, which undermines the premium product marketing strategy of the industry.

5 Identifying innovation opportunities in the selected export sector

5.1 Considerations tested

A number of considerations identified in the literature review were tested through the industry engagement process. The considerations tested are summarised in the table below.

Table 5.1 Opportunities for innovation

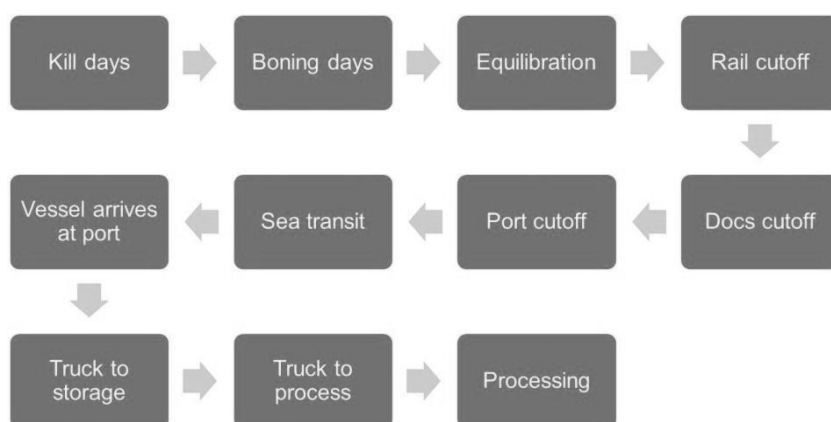
Considerations
The impact of larger container vessels on international shipping routes.
The benefits of higher productivity road vehicles.
The benefits of increased investment in rail infrastructure and rolling stock.
Delaying added-value processes (eg manufacturing, processing, packaging) to final stages of the supply chain.
Clustering through co-location of certain facilities along the supply chain to generate economies of scale.
The uptake of rapid changes in information and communication technologies.
Increased shift to intermodal transport to alleviate concerns with urban freight management faced by road haulage.
Opportunities for regional coordination of transport purchasing within and across sectors.
Impact of link between operational and commercial interfaces along the supply chain.
Opportunity for developing corridor-based efficiencies.

5.2 Meat

Changes to international shipping services are a key driver motivating innovation within the meat export sector. Of immediate impact is the introduction of slow steaming by the international shipping lines, which has reduced the shelf life of chilled meat in market from 15 to 10 days.

The ordering, meat processing and transport system involves a number of steps over a long distance.

Figure 5.1 Steps involved in meat exports



Longer term, the introduction of larger vessels into the New Zealand service is likely to have a significant impact on the port call rotation and transit time to market. Of major concern to the industry is the potential of New Zealand services ‘hubbing’ via the larger Australian ports. This would increase transit

time and costs to the New Zealand producer. This is exacerbated by reduced regional port calls and resulting increased reliance on inland transport.

In order to address these challenges and to ensure the long-term competitiveness of the meat industry, the sector is seeking ways to improve efficiency in its supply chains. Specific opportunities for improvement include:

5.2.1 Leveraging reach

Increasingly, producers are seeking ways to leverage reach in order to better utilise existing capacity within the transport system. Kotahi, a joint venture between Fonterra and Silver Fern Farms was established to generate efficiencies in the supply chain through the pooling and coordination of demand for shipping services (both offshore and the land links from production facilities to ports). It is envisaged that this aggregated demand will result in a better utilisation of existing transport services (including utilisation of available empty containers) and ultimately encourage port investment to ensure bigger ships will call at New Zealand ports.

In order to achieve these goals a detailed understanding of the freight and capacity flows (particularly the movement of loaded and empty containers) is required. Kotahi is developing sophisticated optimisation models to identify opportunities to utilise excess capacity and match bi-directional loads.

5.2.2 Increased control

Some meat producers are taking more control of their supply chains rather than relying on transport and shipping companies to organise plant to port movements. This involves increased transparency and unbundling of pricing from shipping companies (including rates from various ports) and land-based transport operators (both road and rail).

This means producers can make transport decisions based on the best option for them, rather than the best option for the shipping companies. Previously shipping prices were bundled for all of New Zealand, resulting in some processing plants effectively subsidising other plants' land transport costs.

5.2.3 Utilising infrastructure networks

Meat processors utilise all links in the transport network. Processing plants with direct links to the rail network utilise these services as they generally generate cost savings over road. This is particularly the case in the South Island due to the location of processing plants in relation to the ports and the availability of rail access into production facilities. In order to enable greater access to the rail network, road and rail services are being coordinated through intermodal terminals and onsite coordination of transport services by operators. An example of this is KiwiRail's onsite services at Silver Fern Farms processing facility at Takapau.

Processing plants located off the rail network may need to work with local and central government to facilitate higher truck loads on the first mile. A way to facilitate this could be through the use of HPMV permits over these specific routes. This seeks to ensure load capacity is optimised through the entire system.

5.2.4 New investment and technical innovation

The investment by KiwiRail in new container wagons enables higher payloads (two heavy containers can now be loaded more often on one wagon). This generates lower transport costs and enables operating efficiencies for producers by reducing the requirement to reposition wagons for loading. KiwiRail has also

implemented a number of innovations which enhance service delivery and assist with product quality. These include:

- operating wagons in packs of five to optimise use of generators for temperature control.
- improved remote monitoring of temperature through implementation of a 24/7 reefer monitoring team in Auckland.
- an increased buffer stock of generators, supplied by a third parties and located around the country in order to meet fluctuating demand.

5.2.5 Collaboration to optimise capacity

The transport of livestock from farm to processing plant is a critical element in the meat supply chain. Due to the fragmented purchasing market (dominated by rural service firms and processor procurement teams) and the need to utilise processing capacity, competition for livestock can be strong. The need to optimise utilisation of production facilities can result in cross-regional movement of livestock. These multiple channels for livestock procurement can lead to poor utilisation of livestock vehicles. Collaborative arrangements between trucking companies and processors are assisting in improving the utilisation of vehicles through the sharing of information with regard to complementary stock movements.

Despite these initiatives a number of barriers to innovation have been identified:

5.2.5.1 Historical arrangements

The shipping companies have been able to dominate the supply chain arrangements. They have tended to make operational decisions with little reference to the customers. For example it is understood that the introduction of slow steaming was done without consultation with the customers and none of the benefits (lower fuel consumption) have been passed back to them.

5.2.5.2 International regulations

The opportunity to increase the payload of meat containers leaving New Zealand may be limited due to road weight restrictions at the destination. For example even if producers could obtain higher mass limit permits to operate larger vehicles in New Zealand, the heavy containers would not be allowed to operate on roads in the destination market.

5.2.5.3 Product characteristics

Worldwide, the trend among shipping lines to increase the use of 40-foot containers results in considerable benefits to low-density freight (the cost to ship a 40-foot container is less than double that of a 20 foot). However, the high-density nature of the meat products (particularly boned cut meat) means there is no benefit in using a 40-foot container. (The average load in a 20-foot container is 20 tonne and due primarily to the structural conditions of a 40-foot container combined with road restrictions and a limited ability to lift heavy containers at processing plants, only an additional three or four tonnes can be loaded in 40-foot containers). The migration to 40-foot containers will also add pressure on the supply of suitable export containers to the New Zealand market in general.

5.2.5.4 Industry structure

Meat companies are competing against each other for both the purchase of livestock and the sale of finished product. This is considered a barrier to industry cooperation and ability to utilise scale purchasing power.

The lead time from ordering product to delivery is very short, with significant fluctuations in demand from week to week, for example it is understood that demand for empty containers can flex up/down by 3000

containers per week. This puts considerable strain on the system to move empty containers at very short notice to the area of demand. This issue is compounded by the imbalance in demand for export refrigerated containers versus import refrigerated containers.

5.3 Forestry

The forestry sector faces a number of specific challenges in reducing its logistics costs.

For the forest to mill (or port) shipment of logs, forestry operators often need access to local roads of variable quality (in terms of pavement type, width, gradients etc). Most often, access to these roads is required once every 20 or 30 years at which time use is intensive. Furthermore, as trucks are loaded with logs (of variable weights) at remote sites it is very difficult to gain accurate load weights while the trucks are loaded. This impact is overcome to a certain extent by on-vehicle weigh systems, which has improved productivity.

The transport of finished product (pulp, timber, panel products) is relatively straight forward as the product is dispatched in uniform packages and travels over defined routes.

Key areas where the sector is achieving productivity improvements through innovation include:

5.3.1 Investment in new equipment

The introduction of larger trucks for both the transport of logs from forest to processing plant and/or export port and the transport of finished product from processing plant to port has improved productivity. Using larger trucks enables a higher payload per vehicle as well as reducing capital costs by having fewer vehicles to move the same volume of freight (which also generates associated safety and environmental benefits through a requirement for fewer trucks on the road to carry the same volume of freight). For example Pan Pac's new higher payload vehicles for transporting pulp from plant to port has increased gross mass per vehicle from 44 to 62.5 tonnes. In order to operate these vehicles, Pan Pac has obtained a permit under the HPMV regime. This permit process requires the trucks to be designed to meet stringent axle load and operating criteria. These vehicles are now operating successfully on the run from Pan Pac's mill at Whirinaki to the Port of Napier. The introduction of these vehicles has resulted in considerable savings in fuel consumption, loading and unloading costs, and improved asset utilisation.

Applications for similar permits for logging trucks are also underway within the sector.

A number of innovations are also taking place in the rail services provided to the sector. KiwiRail has recently converted 100 container wagons into log wagons using ExTe bolsters from Sweden. These bolsters are made of very light-weight high-tensile steel and layered like a leaf spring to provide flex. This has meant an increase in wagon payload of between 8 and 12 tonnes due to lower tare weight (1.7 tonnes for high-tensile bolsters compared with 5 tonnes tare equivalent for mild steel) in conjunction with using the longer ex-container flat wagons.

New locomotives have also been introduced to forestry trains which have resulted in operating efficiencies (through higher trailing tonnes per locomotive and improved fuel efficiency) and improved reliability of services. These new locomotives also have positive spin-off environmental benefits.

Figure 5.2 Pan Pac HPMV



Figure 5.3 New log wagons



5.3.2 New technologies enable improved utilisation and safety

The use of on-vehicle weigh systems has meant logging trucks can be loaded with higher tonnages and with a greater level of confidence that they will not exceed the weight limit. This technology has meant increased consistency in truck loadings, improved utilisation of vehicles and safer loads.

Geographic positioning system (GPS) scheduling for vehicles, utilising 3G technology is enabling improved scheduling of vehicles.

This technology is also enhancing safety through the monitoring of driver hours and driving behaviour (eg speed).

5.3.3 Collaboration to improve asset utilisation

Vehicle and driver utilisation has also improved through the central control of vehicle scheduling for a number of forestry owners and truck operators. For example, in Hawke's Bay the centralised management of logging truck operations from forest to port has reduced delays at the port (average waiting time at the Port of Napier is approximately 27 minutes), which has resulted in improved vehicle turnaround and utilisation.

Companies are also seeking opportunities to better utilise back load opportunities for logging trucks. This is occurring to a limited degree where production facilities have specific log requirements which cannot be sourced locally. In these instances, the production facility is required to source logs further afield from

forests which may have their own adjacent production facility. This provides the opportunity to carry logs in both directions.

5.3.4 Utilising integrated transport services

The development of inland log stockpiles, with road feeder services to rub hubs, is enabling the campaigning of logs to meet shipping schedules, rather than stockpiling logs on the wharf.

A number of barriers to innovation have also been identified:

5.3.4.1 Complicated regulatory processes

Businesses find obtaining HPMV permits is complex. A key issue is the potential conflict between local government objectives and the objectives of users (and the NZTA), in particular, where local government is required to upgrade roads but does not receive any of the benefit through increased funding.

There are also a number of differences causing concern to industry with regards to the heavy vehicle permitting and penalty system (particularly with the treatment of HPMVs).

5.3.4.2 Access to new technologies

Due to the remote locations that logging trucks operate in, 3G mobile telephony and internet-based systems are not available. Digital radio systems are being introduced to provide data capable systems that will aid in load allocation, scheduling and fleet management.

5.3.4.3 Sector marketing strategies

The range of export log grades adds considerable complexity to the operations and cost of producing, storing and marshalling logs for export.

5.4 Wine

The wine sector faces similar challenges to the meat and forestry sector. However, the wine sector does not enjoy the same scale of operation as the forestry and meat sectors. Furthermore, most wine is exported and sold in bottles. This has major implications for the supply chains as empty bottles (which are manufactured in Auckland) must first be transported to the winery or bottling plants. Even though significant volumes of wine are shipped in bulk from Marlborough (approximately 50%), Hawke's Bay and Gisborne for bottling in Auckland, a large proportion of wine is bottled in the wine growing regions that must then be transported in bottles to the port of export, which is often Auckland. In addition, some semi-processed fruit is moved in bulk from the wine growing regions to Auckland for final processing. Due to the unstable nature of this product it is highly time sensitive.

5.4.1 Reorganised supply chains

Within New Zealand some producers have been able to take advantage of the economies of shipping wine in bulk from the winery to the bottle facility. This occurs particularly from both Hawke's Bay (road) and Marlborough (rail and coastal shipping) for bottling in the Auckland region. This process results in a number of benefits such as:

- eliminating the need to transport the empty bottles to the wine regions which saves transport costs and reduces bottle stock levels due to a shorter order time for empty bottles
- transporting wine in bulk is more cost effective than transporting wine in bottles
- ensuring the finished product is closer to the port of export (Auckland).

5.4.2 Creating scale

The introduction of branded bulk wine exports has had a major impact on reducing supply chain costs, by reducing transport costs (a 20-foot container carries 24,000 litres of bulk wine compared with 8000 litres of bottled wine), enabling producers to leverage offshore larger-scale bottling processes and scale purchasing of bottles, packaging materials etc.

In addition, wine makers utilise outsourced bottling, storage and consolidation services provided by third parties, which means smaller producers can access some of the benefits of scale. For example, these can include value-added services such as temperature-stable warehousing, in-house laboratory analysis, and road tankers dedicated to wine collection, which are aimed at improving the integrity of the wine supply chain.

5.4.3 New equipment

Improvements to container packaging, for example container liners, has improved product quality (through better temperature control). The sector is also assessing new lighter-weight glass bottles and flexi bags.

A number of barriers to innovation have been identified. These tend to be driven by lack of scale and market positioning of the product.

5.4.3.1 Fragmented market

Few wine makers have the scale of operation, volume of product and/or the international connections (sister companies) to leverage the branded bulk wine business model.

The large number of small operators means there is very little purchasing leverage available to the sector; producers tend to take what is offered, rather than seek innovative alternatives.

5.4.3.2 Market perceptions

There is considerable resistance in the industry to bulk wine exports due to perceived diminution of brand and quality of product. This is particularly in the case of the non-branded bulk exports which tend to be sold at a discount and diminish the New Zealand wine marketing objective of selling a premium product.

6 Common themes and issues

A number of common themes with regard to innovation have emerged across the three sectors. These include:

Collaboration⁴

Supply chain owners are seeking ways to reduce costs through collaboration. This not only generates economies of scale and purchasing power benefits, but also improves utilisation of available capacity.

Information technology (IT)

Various forms of IT are being leveraged to not only improve vehicle scheduling (yielding higher utilisation), but also to monitor the condition and location of consignments. IT is also being used to match capacity against product flows with the aim of reducing waste.

Transparency and control

As producers are taking more control of their supply chains, service and price offerings from transport suppliers are being dismantled and the producer is able to increase control to lower their supply chain costs.

New transport technologies

New investment in improved rail and road equipment means increased payloads, lower operating costs and improving utilisation of equipment. On road this is evidenced through the introduction of HPMV and on rail by new investment in wagons and locomotives, which should deliver a lower transport cost to supply chains.

Supply chain structuring

Supply chains can be structured to reduce the transport costs, for example, by identifying the most suitable location in the supply chain to package product as evidenced in the wine sector.

Leveraging relationships

International relationships can be leveraged to exploit scale of economy in production and purchasing power.

Cluster benefits

The common regional locations of producers has enabled third party operators to provide packaging, storage and transport services at costs not obtainable if small producers undertook the process themselves.

⁴ While there is no fixed template for successful collaboration, work undertaken in 2011 on behalf of Infrastructure Australia by the Transport and Logistics Centre identified nine collaboration principles which could be useful as a checklist for collaboration initiatives (see Hull 2012).

7 Potential initiatives

Based on our findings, we have identified a number of initiatives that could be considered by the government and the private sector. The implementation of these initiatives will help to facilitate the desired outcomes of the study namely:

- increase freight efficiency and reduce freight costs to export industries
- contribute to economic growth
- increase the efficiency of infrastructure use
- improve connectivity for regional communities
- improve road safety
- reduce the impact of freight transport on the environment.

Table 7.1 Potential initiatives – issues, implications, responses and actions

Issue	Implications	Potential response	Possible actions
Long-term trend towards larger vessels on international shipping routes.	<p>As shipping companies introduce new and larger vessels onto the east- west global routes, it is likely that they will ‘cascade’ the current east-west fleet onto the north-south trades (including services to New Zealand). This could have a number of implications:</p> <ul style="list-style-type: none"> • The size of ship serving New Zealand will increase, requiring deeper access to ports, upgrades to port berths and cranes and improved landside access to accommodate higher liftings per vessel. • Shipping lines may ‘hub’ larger vessels through Australia and send small feeder vessels to New Zealand. This would lead to further delays in transit times from New Zealand to key markets, increasing inventory carrying costs and further decreasing product shelf life in the market. • Shipping lines may continue to service New Zealand using smaller vessels, many of which are currently ‘hubbing’ European services via Asia, which causes delays to transit times. 	As the shipping lines will make the decision as to the type of vessels and the schedules that will service New Zealand, it is important to influence those decisions to ensure the needs of exporters are met.	Encourage dialogue between shipping lines, exporters, port operators and land-based freight providers to better understand the key drivers for the shipping lines’ actions. If this is understood, options which will best meet the needs of New Zealand export supply chains can be developed.
		Attract smaller vessels to provide direct services to markets.	<p>Exporters could work together to better understand the mix of cargoes (eg dairy, meat, fresh produce) to identify opportunities to build cargoes across export sectors for specific destinations.</p> <p>Special consideration must be given to the time sensitivity and temperature controlled nature of the cargo.</p>
		Consolidate cargoes to achieve scale and encourage shipping lines to utilise larger vessels for New Zealand trade.	<p>As an owner of rail and roads, the government can support the private sector, the ports and independent developers by ensuring complementary landside infrastructure is available to support changing freight patterns.</p> <p>The government can provide further support through complementary land-use planning and regulatory arrangements (if required, these may include special permits to operate HPMV from port to intermodal terminals etc).</p>
Integration and connectivity between modes	Road, rail and sea each have distinct characteristics which traditionally attract specific types of freight. For example, road is thought to be best suited for time-sensitive high-value freight, whereas rail attracts high-volume point-to-point freight and coastal shipping, high-volume, non-time sensitive bulk freight. Improved integration between modes will assist in leveraging the benefits of each mode. For example through consolidation of freight at intermodal terminals,	Encourage and facilitate transport operators to develop integrated service offerings.	<p>Ensure transport and land-use planning recognises and facilitates interconnectivity, eg through preserving land for intermodal terminals.</p> <p>Encourage investment in intermodal terminals and innovative equipment (eg intermodal containers, higher capacity/axleload rail wagons) by ensuring roads and rail lines are operating efficiently.</p>

Issue	Implications	Potential response	Possible actions
	individual exporters can benefit from the volume attributes of rail and coastal shipping which would not otherwise be available to them.		
Infrastructure investment	Without the ongoing upgrade and replacement of infrastructure (rail, roads and ports, the private sector can be limited in its ability to undertake investment in related assets. For example, poor quality and congested roads mean it is difficult to maximise the utilisation of new trucks. This in turn limits the operator's ability to achieve a sustainable return on investment. This includes investment in new rail rolling stock and port equipment.	Encourage continued investment (by both the government and the private sector) in road, rail and port facilities.	Government policy on transport infrastructure must consider the needs of the freight sector along with issues of public good and amenity. Continued dialogue with freight industry operators and users will enhance the understanding of the key cost drivers in the sector, which will assist in good infrastructure planning. The provision of efficient road, rail and port infrastructure will encourage investment in related assets (eg new trucks, railway wagons, intermodal terminals, warehouses, increased structural gauge envelope for railway, etc). Government should continue to investigate ways in which the private sector can invest directly in public infrastructure.
Regulatory environment	Transport providers are obliged to operate within the regulations stipulated by the government. Uncertainty and the likelihood of changes to regulations mean that operators delay investment and forgo opportunities to realise benefits.	Timely implementation of new regulations and repeal of out-dated regulations.	Ensure regulatory change is robust and undertaken in a timely manner. Any changes must not only meet the needs of government and infrastructure providers but also be cognisant of the needs of and implications for transport providers and cargo owners.
Network resilience	Unexpected events can have major impacts on the exporter's ability to get their goods to market. Failure of one part of the network puts strain on the rest of the network which results in higher costs to all users. Recent examples include the Christchurch earthquakes, the slip in the Manawatu gorge and the strike at the Ports of Auckland.	Work with industry to ensure contingencies are in place.	Undertake a system-wide approach to freight infrastructure planning. Identify and understand existing and potential bottlenecks in the system. Identify alternatives and develop contingency plans in case of system outages. Utilise short-term regulatory levers to overcome outages (temporarily allow longer drive hours to facilitate the efficient use of a detour). Support continued interoperability capability between modes to limit exposure to single

Issue	Implications	Potential response	Possible actions
Economies of scale	In general, New Zealand suffers from a lack of scale particularly when compared with the international companies with whom New Zealand exporters often compete. This is particularly evident in the export wine sector. However, there are opportunities for cross-industry and intra-regional collaboration which could help to develop scale and improve both market leverage and cost efficiencies.	Assist industry and government agencies to work together in order to generate scale.	network failures and improve supply chain resilience Central and local government can facilitate intra-regional and cross-industry forums to get businesses together to seek ways of leveraging collaborative actions, eg the industry-led cross sector scheduling of logging trucks into the Port of Napier (see section 5.3). Likewise industry peak bodies could help to facilitate cross industry cooperation and information sharing. Ensure anti-competitive regulations do not inadvertently restrict collaboration opportunities for exporters who are competing on the world market, not within New Zealand. Identify information and encourage research (eg via universities and industry peak bodies) that may assist industry and government agencies to develop a better picture of what is happening across industries and regions.
Higher payloads	Road and rail operators can realise significant improvements in asset utilisation and reduction in operating costs by increasing the payload of their vehicles and rolling stock.	Increase the number of HPMV permits.	Implement recommendations for application process as per the September 2011 review of HPMV permit regime, particularly with regard to clarity and uniformity of process. Address differences in the treatment of HPMV vehicle infringements compared to infringements by other heavy vehicles. Identify ways to incentivise local government to approve HPMV applications, eg through linked funding for upgrades to accommodate the HPMV fleet. Ensure that regional and local plans have mechanisms which enable them to keep up with the pace of change in the private sector, eg local plans should make provision for the introduction of HPMVs.

Issue	Implications	Potential response	Possible actions
		Update the rail rolling stock fleet.	<p>Investigate the options for private sector investment in rail rolling stock (particularly wagons), intermodal terminals and private sidings. This should be accompanied by performance guarantees for KiwiRail to ensure optimal utilisation of the assets.</p> <p>Assess opportunities for alternative contract arrangements (eg in the form of take or pay agreements) which would facilitate a lower risk environment in which KiwiRail can invest.</p>
Information	Good information is critical to robust transport decision making. As more data is collected and stored digitally this provides the opportunity to utilise new and existing databases in transport decision making.	Utilise new and existing databases for transport planning.	<p>As more road operators move to electronic administration of RUC – this data could help to build up a comprehensive (and current) picture of road use patterns, which can be used in road planning.</p> <p>Work collaboratively across organisations to facilitate communication and share data, eg utilise KiwiRail’s freight data in infrastructure planning.</p> <p>New types of data such as the NAIT system can be used to monitor livestock movements and identify potential efficiencies in the use of trans-regional transport operations. As such, NAIT data should be seen as a valuable source of transport information and NAIT should be encouraged to actively publish interregional ‘flow’ statistics.</p>

8 Conclusion

This research has identified a wide range of innovations which are taking place within the freight and logistics sector. These innovations are generating real benefits to the meat, forestry and wine export sectors and as a result contribute to New Zealand's economic growth.

Key drivers of innovation include the need for exporters to:

- remain price competitive within the markets they serve
- continue to deliver high-quality product to export markets
- adapt to the changing transport environment.

The exporters examined face a number of barriers to innovation such as:

- lack of scale which means it is difficult to have influence in the larger international markets
- the small size of many participants, which means less capacity to invest in innovation (particularly in an uncertain economic climate)
- long and fragmented supply chains with multiple participants which add to the complexity of implementing change.

Despite these challenges the export supply chains examined in this research are successfully implementing change and innovations in various ways.

A number of technology-based innovations have been identified, such as improvements to road vehicles which optimise payloads (and utilisation), new higher-capacity rail wagons, more efficient locomotives, and the use of mobile information technology to improve fleet scheduling, product monitoring and capacity management.

These innovations tend to be a key component of the cycle of reinvestment in freight and logistics assets, which naturally incorporate new generation technology.

Industry participants are also playing a greater role in managing their supply chains and are seeking greater transparency of service delivery and prices. They are seeking ways to restructure supply chains in order to reduce transport costs and to unlock benefits of scale.

Moreover, innovative ways of organising freight and logistics services are also being facilitated through collaboration, information sharing and relationship building both within and across sectors. This collaboration seeks to overcome issues generated by lack of scale whether through the provision of regionally based, specialist third party logistics services or the joint management of cross-sector transport requirements. This collaboration can only take place within an environment of information sharing and aligned objectives.

Exporters see the transport network as an integrated system in which freight is moved between modes in order to generate the most efficient outcomes for each supply chain.

While industry is leading these initiatives, the government has an important role to play in facilitating new initiatives, particularly by encouraging appropriate land-use planning, ensuring an inclusive regulatory environment and facilitating the generation and sharing of information. Furthermore, as major owners of transport infrastructure, national and local government must ensure that continued investment in these assets aligns with the changing needs of the sector.

The willingness of industry to participate in this study indicates a desire by the export and transport sectors to work with the government to continually seek efficiencies and improvements in the freight and logistics sector. These efficiencies will ultimately improve the competitiveness of New Zealand's export sector.

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Appendix A: Literature review

The following table provides an overview of 81 documents identified during the desktop review exercise. A list of abbreviations used in this table follows at the end.

Title	Organisation/author	Year	Relevance	NZ	Int'l	Stats	Freight	Logistics	Innovation	Meat	Forestry	Wine	Other	Description	Link
<i>Global supply chain benchmark report</i>	Aberdeen Group	2006	Low		◀		◀	◀	◀					This report looks at key improvement areas and how large, mid-market and small companies are building game plans for success. Trends in strategies for increasing logistics agility are also addressed. The findings are based on benchmarks in May and June 2006 of more than 150 companies. Fully 45% of respondents were vice president or C-level executives, with most others at a director of supply chain or manager level.	www-935.ibm.com/services/us/igs/pdf/aberdleen-benchmark-report.pdf
<i>Food miles – comparative energy emissions performance of New Zealand's agricultural industry</i>	Agribusiness and Economics Unit (AERU) research report no.85	2006	High	✓	✓	✓	✓	✓	✓	✓			✓	Many examples of innovation can be found across supply chains in New Zealand. For example, Fonterra is the world's largest exporter of dairy products and has continuously sought to reduce costs through its supply chain to maintain competitive advantage. New Zealand's food export supply chains have been shown to be more cost effective and sustainable compared with those in Europe and other parts of the world, even when significant transport distances are taken into account. New Zealand's ability to land products in distant markets at prices that are competitive with those of local producers depends heavily on supply chain efficiencies. New Zealand lamb is four times more energy efficient in terms of production relative to the UK. This includes energy use of transport from New Zealand to the UK.	www.lincoln.ac.nz/Documents/2328_RR285_s13389.pdf
<i>Comparative energy and GHG emissions of New Zealand's and the UK's dairy industry</i>	AERU	2007	Low	✓	✓	✓		✓	✓				✓	This report builds on <i>Food miles</i> , which stated the UK used twice as much energy per tonne of milk as New Zealand, including transport from New Zealand to the UK. It includes additional GHG emissions and concludes the UK produces 34% more emissions and 30% more space than New Zealand for milk production. It concludes that it is possible for the UK and other countries to	www.lincoln.ac.nz/PageFiles/1494/RR%20297w%20updated%20Mar08.pdf

Supply chain innovation: New Zealand logistics and innovation

Title	Organisation/author	Year	Relevance	NZ	Int'l	Stats	Freight	Logistics	Innovation	Meat	Forestry	Wine	Other	Description	Link
														replace New Zealand imports with their own production; however, this is not likely to happen due to limited capacity of production and different production environments.	
<i>An international comparison of models of innovation and their implications for New Zealand</i>	AERU research report no.323	2011	Med	✓	✓				✓					Compares public perception of innovation in New Zealand with other countries. It found little evidence that New Zealand government initiatives seeking to promote innovation as part of the country's national identity had been embedded in the public consciousness. It explicitly compares New Zealand with Australia where innovation identity is similar but Australia is seen as healthier. The Commonwealth Science and Industrial Research Organisation has been recognised as being innovative compared with New Zealand's Crown Research Institutes. It also said that the rest of the world innovates to get ahead or get recognition, while New Zealand seems to innovate to catch-up. Also, New Zealand is well placed to achieve recognition in environmental innovation, comparable to Denmark and Sweden, as the country already has a clean green national identity.	www.lincoln.ac.nz/PageFiles/1494/RR%20323w.pdf
<i>Comparison of innovation policies in selected European, Asian and Pacific Rim countries: How best to optimise innovation governance in New Zealand</i>	AERU research report no.321	2010	Low	✓	✓				✓					A study comparing EU and Asian national innovation policies with New Zealand's. It found that many EU countries are leaders while Asian countries were well placed to transition to the EU model. It concluded that New Zealand could improve its policies by giving attention to factors including establishing a clear national vision towards innovation, private sector research and development on innovation, entrepreneurship and new firm creation etc.	www.lincoln.ac.nz/PageFiles/1494/RR321w.pdf
<i>Sustainability trends in key overseas markets: market drivers and implications to</i>	AERU research report no.319	2010	Med	✓	✓	✓	✓		✓	✓	✓		✓	The paper explores increasing consumer awareness on the environmental and social impacts, especially in the premium segment (which New Zealand tends to fall into). In the case of agricultural products, consumers are paying more attention to carbon foot printing, water foot printing, and animal welfare.	www.lincoln.ac.nz/Documents/RR%20319w.pdf

Appendix A

Title	Organisation/author	Year	Relevance	NZ	Int'l	Stats	Freight	Logistics	Innovation	Meat	Forestry	Wine	Other	Description	Link
<i>increase value for New Zealand exports</i>														Government initiatives in other countries have made more effort in enforcing reforms on farms whereas New Zealand, due to existing large amounts of conservation, has not seen the same pressure on its farmers. This is seen as a potential threat in the longer term. Furthermore, environment concern has even led to a decrease in demand for meat and dairy due to high emissions from livestock. Also, consumers are increasingly demanding more out of their food on top of basic nutrition.	
<i>Economic strategy issues for the New Zealand region in the global economy</i>	AERU research report no.317	2009	Low	✓	✓									Three major points in this paper outlining: 1) A national economic strategy must begin with a credible analysis of the country's positioning in the global economy; 2) The economy's capability to respond to international market opportunities is determined by six major types of capital: physical, financial, human, natural, social and cultural; 3) A national economic strategy needs to pay particular attention to the country's core export sectors on the basis that they are internationally competitive and generate incomes that fuel domestic demand.	www.lincoln.ac.nz/PageFiles/1494/RR%20317w.pdf
<i>Modelling climate change impacts on agriculture and forestry with the extended LTEM (Lincoln Trade and Environmental Model)</i>	AERU research report no.316	2009	Low			✓				✓			✓	Not relevant - compares results after integrating its forestry model with its agricultural model.	www.lincoln.ac.nz/PageFiles/1494/RR%20316.pdf
<i>The key elements of success and failure in the New Zealand venison industry</i>	AERU research report no.312	2008	Low	✓	✓		✓		✓	✓				Looks at how game meat, while a small market share, has managed between 1980 and 2007. Due to demand exceeding supply, venison in New Zealand (farmed deer by applying farming techniques on traditional animals) was easily picked up in western markets requiring little advertising and promotion. However, Chernobyl led to a large decrease in demand and New Zealand tried to	www.lincoln.ac.nz/Documents/6178_RR312w_s20187.pdf

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														differentiate through point of origin by brands with varying degrees of success. Market control and value proposition strategies have also been effective when supply exceeded demand.	
<i>The key elements of success and failure in the New Zealand sheep meat industry from 1980-2007</i>	AERU research report no.308	2008	Med	✓			✓	✓		✓				This study explores the nature and performance of the New Zealand sheep meat industry from 1980 to 2007. As almost 94% of sheep meat produced in New Zealand is exported, the focus of this study is on the export sector of the sheep meat industry, and in particular, the lamb meat export industry.	www.lincoln.ac.nz/Documents/5670_RR308w_s18665.pdf
<i>Factor cost analysis of a NZ meat processing company</i>	AERU research report no.169	1985	Low	✓		✓	✓			✓				Very outdated. In this report, true factor costs for killing and processing are obtained and analysed for a typical company. From this analysis the authors are able to confirm and quantify the widely held belief that throughput flows significantly affect per unit costs. Further, an economic explanation is advanced to explain this phenomenon in terms of the particular nature of fixed and variable costs within a multi-chain system operating in the face of significant manning and seasonal constraints.	http://researcharchive.lincoln.ac.nz/dspace/bitstream/10182/226/1/aeru_rr_169.pdf
<i>Advancing productivity and competitiveness through innovation</i>	Atlanta Logistics Innovation Council	2009	Low		✓	✓		✓	✓					Has definition for logistics and supply management (same as US DoT's). A benchmarking report comparing US cities in terms of logistics innovation. It identifies key technology patents and trends, key players, leading geographies, opportunities.	www.logisticsatlanta.com/logisticsFullStudy.pdf
<i>An investigation of best practice landside efficiency at Australian container ports</i>	Australasian Transport Research Forum (ATRF) Proceedings	2011	Low		✓			✓	✓				✓	A report highlighting the need for better balancing of competitive strengths of, and the enhancing of cooperation between, companies operating in Australian container ports following the National Ports Strategy. It benchmarks five areas-- peak demand management, truck turnaround, congestion, rail mode share related to container movements.	www.atrf11.unisa.edu.au/Assets/Papers/ATRF11_0031_final.pdf
<i>Contribution of transport to economic growth</i>	ATRF Proceedings	2011	Low	✓		✓							✓	Not entirely relevant but provides some statistics on highest productivity gains by industry between 2003 and 2007. Agriculture, forestry and mining saw the biggest gains with 7% in	www.atrf11.unisa.edu.au/Assets/Papers/ATRF11_0011_final.pdf

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<i>and productivity in New Zealand</i>														terms of output and 17.34% in terms of value. Road and rail saw 1.35% and 3.78% respectively, water and air transport 3.84% and 10.31% respectively, and services to transport at 3.55% and 5.91% respectively.	
<i>Heavy vehicle productivity trends and road freight regulation in Australia</i>	ATRF Proceedings	2010	Low		✓	✓	✓							A report presenting a case to forecast productivity growth with the road freight task having increase 6-fold over the past 35 years by kilometres travelled has only increased 3-fold – suggesting substantial increases in productivity due to: easing in HV mass and dimension regulations, permitting larger and more productive vehicles to the wider road network and introduction of larger HPVs (eg B-doubles). An empirical model forecasts aggregate HV freight shares and productivity growth. It suggests that even without significant further reform, substitution of larger HV combinations will continue, resulting in further increases in HV productivity but at a much lower rate than previously.	http://patrec.org/web_docs/atrf/papers/2010/1877_223%20-%20Mitchell.pdf
<i>Emissions and energy use by road freight vehicles under alternative freight land use development options</i>	ATRF	2009	Low		✓			✓	✓					A study demonstrating how land use development policies contribute directly to the efficiency of freight operations. Using Victoria (via <i>Freight futures</i>), if its strategies were implemented, up to 5% of energy and emissions savings could be expected based on reduction of trip lengths, consolidation of freight activities. It also facilitates a greater use of more productive vehicles.	http://patrec.org/web_docs/atrf/papers/2009/1736_paper45-Ramsay.pdf
<i>Review of vehicle emission modelling and the issues for New Zealand</i>	ATRF	2009	Med	✓	✓			✓	✓					Compares emission models and databases from US and EU (NAEI, COPERT, HBEFA, ARTEMIS, MOBILE) including approaches, strengths shortcomings and relevant to New Zealand. It compares them to New Zealand's vehicle fleet emissions and vehicle emission prediction models. The paper concludes that New Zealand's models have significant room for improvement. Particularly with regard to accuracy of emission factors unique to the New Zealand vehicle fleet. It also notes that emission data for	http://patrec.org/web_docs/atrf/papers/2009/1738_paper88-Wang.pdf

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														HVs is especially scarce and a priority should be given to data collection.	
<i>Using ITS to improve the capacity of freeway merging sections by transferring freight vehicles</i>	ATRF	2008	Low		✓			✓	✓					Explores the use of ITS to alleviate the negative impact HVs have on traffic conditions when merging on major arterials and highways, particularly during more congested periods. Using VMS to direct HVs to pre-emptively switch lanes or relying on in-vehicle navigation to improve throughput of the system showed potential but required further research.	www.atrf.info/papers/2007/2007_Sarvi.pdf
<i>Auckland regional freight strategy</i>	Auckland Council	2006	High	✓			✓	✓	✓					Features actions to improve the efficiency of regional freight movements and reduce the impacts of freight on the community and environment. Key issues include congestion, struggles with rail freight, travel demand management, funding mechanisms, data collection, environmental concerns etc with policies to address these issues.	www.arc.govt.nz/plans/regional-strategies/auckland-regional-freight-strategy.cfm
<i>Red meat sector strategy report</i>	Deloitte	2011	High	✓			✓	✓	✓	✓				Red meat sector is a significant industry for New Zealand's economy. New Zealand is unique in that approximately two-thirds of merchandise exports are generated from the primary sector. Additionally, year-round grass-fed systems enable high-quality meat. However, the sector is under threat from competing land uses that provide better returns, ie dairy conversion threatening finishing country, and forestry threatening hill country. This has been masked by recent price increases which will not aid the sector in realising its medium to long-term opportunities. A rebalance of incentives and practices needs to be achieved through fairness and trust, in order to attain sustainable profits. The strategy revolves around three key themes: 1) coordinated market behaviour; 2) efficient procurement; and 3) sector best practice. Economic evaluation of the strategy has been valued at \$6bn of nominal value growth to \$3.4bn of real growth for the sector by 2025.	www.mia.co.nz/docs/Red%20Meat%20Sector%20Strategy%20Report%20-%20May%202011.pdf

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<i>Venturous Australia</i>	Department of Innovation, Industry, Science & Research	2008	Low		✓				✓					The best summary statistic for Australia's success in embracing new and better ways of doing things is productivity growth. Sometime around 2002 Australian productivity went from growing substantially faster to growing substantially slower than the OECD average. Though some of this may be an artefact of increased mining investment, it is unlikely to be the whole story. The conclusion is that, had it not been for the hunger the emerging giants of the developing world have had for our resources, we would have felt the effects of our complacency more directly as stalling living standards.	www.innovation.gov.au/Innovation/Policy/Documents/NISReport.pdf
<i>Powering ideas: an innovation agenda for the 21st century</i>	Department of Innovation, Industry, Science & Research	2009	Low		✓				✓					Innovation is the key to making Australia more productive and more competitive. It is the key to answering the challenges of climate change and national security, and the age-old challenges of disease and want. It is the key to creating a future that is better than the past. Investing in innovation is also one of the most effective ways we can cushion Australia against the effects of the global downturn and accelerate recovery. It will simultaneously keep people in work today and generate jobs for the future. The 2009–10 budget includes \$8.58 billion for science and innovation, an increase of 25%.	www.innovation.gov.au/Innovation/Policy/Documents/PoweringIdeas.pdf
<i>Canterbury regional land transport freight plan</i>	Environment Canterbury	2005	Med	✓			✓	✓	✓	✓	✓		✓	Provides actions to improve the efficiency of regional freight movements and reduce the impacts of freight on the community and environment. Discusses logistics around forestry and livestock. Main issues for the freight network, while considered overall as well catered for, not enough robustness around planning especially for the future.	http://ecan.govt.nz/publications/Plans/FAP.pdf
<i>Best practices in freight transport operations</i>	Environment Canterbury	2008	High	✓				✓	✓					Explores regional government leadership in terms of developing best practice freight systems. Canterbury has done well with identifying and communicating freight routes through urban areas. Freight hubs are emerging as best practice for coordinating the efficient movement of regional and urban freight. However,	http://ecan.govt.nz/publications/General/BestPracticeFreightTransportOperations.pdf

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														further work is needed to examine suitable ownership/ operation of urban freight villages. Intermodal terminals (IMTs) are also recommended as best practice, regarded as a cost-efficient link between shipping, rail and road operations. Overseas experience suggests potential for large growth in using IMTs. Urban freight pickup/delivery requires accessibility to business and controls on loading/unloading zones. Freight accessibility guides have been effective. For new district councils, a more proactive approach is recommended to ensure new businesses at least plan for future rail links in their design and layout. Resources and risk management are increasingly being seen as requiring best practice as well, especially with regard to planning for the future.	
<i>Presentation to CRRP Board</i>	EROAD NZ	2011	High	✓		✓		✓	✓					A presentation providing insights on New Zealand experience of world's first network-wide cellular electronic RUC system for HVs - technology trends, inter-operability, institutional and procurement model, pricing and reform, privacy issues, compliance and enforcement, agency experience, user experience, and commercial services.	Scanned from hardcopy
<i>Intermodal freight transport & logistics best practices</i>	European Intermodal Association	2007	High		✓		✓	✓	✓					Provides comprehensive case studies on four intermodal examples in Europe.	http://cms.tutech.net/eurifit/Intermodal_Best_Practices_example_EIA.pdf
<i>Supply chain top 25</i>	Gartner	2011	Med	✓	✓		✓	✓						The top five include three mainstays — Apple, Dell and P&G - and two that joined the list for the first time last year - Research In Motion (RIM) and Amazon. Four new companies joined the list this year: Nestle, Starbucks, 3M and Kraft Foods. Four key themes emerged this year among the leaders, including how they deal with volatility, their approaches to value chain network integration, their focus on sustainable execution and their abilities to orchestrate.	www.gartner.com/resources/213700/213740/the_gartner_supply_chain_top_213740.pdf

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<i>2010 third party logistics</i>	Georgia Tech	2010	Low		✓			✓	✓					An annual report looking at the state of logistics outsourcing. Reports that 64% of 3PLs cited total landed cost (TLC) as a critical measure. TLC is the sum of all costs associated with making and delivering products to the point where they produce revenue. 3PLs, while complex and challenging, are seen as an industry which can add significant value. Views differ on how 3PLs can help FMCG.	www.scl.gatech.edu/research/supply-chain/20103PLReport.pdf
<i>Wine supply chain traceability</i>	GS1	2005	High	✓			✓	✓	✓			✓		Provides detail on generic wine supply chain and outlines key data/metrics for traceability data for each part of the supply chain, eg bulk wine distributor who receives, stores, dispatches, processes, samples and analyses bulk wine as well as keeping records of what has been received and dispatched. It also provides information on GS1 standards for product identification and exchanging information between supply chain participants using global location number, global trade item number and serial shipping container code.	www.gs1.org/docs/traceability/GS1_wine_traceability.pdf
<i>Industry report: global logistics – shipping</i>	IBISWorld	2010	Low		✓	✓	✓							Provides an analysis of the global landscape in terms of competition, lifecycle, barriers, market conditions, key success factors, technology, key players, forecast in terms of revenue and trend. New Zealand is part of the South Pacific route from western US to Australia, Indonesia and southern Asia. New Zealand is a large exporter (along with US, Canada and Australia) for dry shipments which have the largest market share in terms of tonnage; EU is the largest dry cargo market for both exports and imports.	Subscription
<i>Industry report: global logistics – air freight</i>	IBISWorld	2011	Low		✓	✓	✓							Provides an analysis of the global landscape in terms of competition, lifecycle, barriers, market conditions, key success factors, technology, key players, and forecast in terms of revenue and trend.	Subscription
<i>Industry report: global logistics – marine port operation</i>	IBISWorld	2011	Low		✓	✓	✓							Provides an analysis of the global landscape in terms of competition, lifecycle, barriers, market conditions, key success factors, technology, key players, and forecast in terms of revenue and trend. SSA Marine operates 150 ports worldwide	Subscription

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														including New Zealand and has an estimated global market share of 4.4%.	
<i>'Cottesbrook's' New Zealand sauvignon blanc wine to Tesco</i>	Lincoln University.	2007	High	✓				✓	✓			✓		A case study on the development of custom-made sauvignon blanc and pinot noir for export to Tesco, followed by a move to 3L bag-in-box (BiB) of the same types of premium wine (requested by Tesco). Tesco wanted to be the first supermarket to supply higher end New Zealand wine in bags in the UK but was unable to secure supply that arrived in good condition (cartons were damaged from ship voyage). Cottesbrook contracted with wine producers in France where wine was received in 20ft 'bladder' containers before being packed in cartons to be shipped by road (via Channel Tunnel) to the UK. A slightly biased account on the success of Cottesbrook but provides some detail on their export supply chain from production in New Zealand to a Tesco store in the UK for both regular bottles and BiB. BiB could be seen as an innovative move (demanded by customers/supermarkets, takes up less inventory, wine lasts longer as it does not oxidise, fewer 'food miles' due to economics of packaging etc) as well as other lessons learned, ie when Cottesbrook started, two of their partners were experienced in the export meat industry which shared similar complexities in their supply chains (many smaller niche producers making tailored products for larger customers).	http://researcharchive.lincoln.ac.nz/dspace/bitstream/10182/497/3/Cottesbrooks_New%20Zealand_Sauvignon.pdf
<i>St Helena Wine Estate (1978-2008)</i>	Lincoln University.	2008	Med	✓			✓	✓	✓			✓		This paper is a case study of the production and marketing successes and travails of a medium-sized New Zealand winery, which has only existed for 30 years. It highlights the influence of family; the role of export marketing; the nature of the wine supply chain from New Zealand to a UK supermarket; the role of channel coordinators in maintaining: the increasing place of developing 'new labels' in marketing strategy to find new 'blue oceans'; and the on-going turnover of business arrangements for most wine businesses over time.	http://academyofwinebusiness.com/wp-content/uploads/2010/04/St-Helena-wine-estate_paper.pdf

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<i>Statistics published by Meat Industry Association of New Zealand</i>	MIA NZ	2011	High	✓	✓	✓	✓			✓				Summary of sheep meat and beef exports by volumes: <ul style="list-style-type: none"> • red meat exports sector contribution • sheep meat exports by market • beef exports by market. 	www.mia.co.nz/industry_information/statistics/
<i>Meat in focus</i>	MIA NZ	2009	High	✓		✓	✓	✓	✓	✓				This report is an overview of the industry, from its beginnings through to its significant contribution to the economy today. It is a source of information on: the industry's size and contribution to the economy; the industry's export scale and diversity of markets; the attributes and qualities of New Zealand red meat; the diversity of products produced by the industry; the meat industry's historical development; and on-going technological innovation in the industry.	www.mia.co.nz/publications/industry_profile_document/
<i>NZ MIA annual report 2010/11</i>	MIA NZ	2011	Low	✓		✓				✓				Not entirely relevant – annual report for NZ Meat Industry Association.	www.mia.co.nz/publications/annual_report/
<i>New direction for NSW: NSW government statement on innovation</i>	NSW Government	2006	Low		✓				✓					The NSW Government sees its innovation strategy as a key part of its commitment to support economic growth in NSW, and accepts the three core principles that: 1) The efforts of government to support and build innovation should be focused on those industries most likely to produce benefits for the broader economy, and where innovation will be boosted by the government's support; 2) Policies and support to these sectors should be based on an analytical understanding of the actual innovation processes specific to these sectors in the NSW economy; 3) The government's role in supporting innovation should be focused on complementing, not replacing the market.	www.business.nsw.gov.au/_data/assets/pdf_file/0019/5374/NSW_INNOVATION_STATEMENT_NOV2006.pdf
<i>Business guide to a sustainable supply chain</i>	NZ Business Council for Sustainable Development	2003	Low	✓			✓	✓	✓					This guide explains why organisations should act, and to provide tools which can be adapted by individual companies to meet their own needs. It includes companies in New Zealand and overseas that are engaged in sustainable development but also identifies what needs to happen to make a difference.	www.nzbcSD.org.nz/supplychain/SupplyChain.pdf

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<i>NZ plantation forest industry: facts & figures</i>	NZ Forest Owners Association	2010	High	✓		✓	✓	✓			✓			Provides comprehensive annual statistics on forestry ownership and plantations. Includes detail on supply chain, players, volumes, location, product types, export information.	www.nzfoa.org.nz/images/stories/pdfs/fandf2011web.pdf
<i>Meat: the future</i>	Ministry of Agriculture and Forestry (MAF)	2009	High	✓			✓	✓	✓	✓				A strategy and investment statement for the meat industry. Four scenarios are explored to support future decision making following an analysis of sector constraints and benefits in the future, and mega trends. 1) Slippery slope worst case scenario; 2) New market orientation, diversification; 3) Shrink to fit, specialisation; 4) Knowledge industry, innovation step-change.	www.mia.co.nz/docs/Meat%20the%20future.pdf
<i>National freight demands study</i>	Ministry of Transport (MoT)	2008	High	✓		✓	✓	✓		✓	✓	✓	✓	Comprehensive view of New Zealand's freight task and supply chains. Provides detail on sub-products for meat, forestry, including volume, indicative value, origin-destination, issues, some key players, supply chain information, infrastructure and other constraints by mode type, logistics trends, mode choice drivers, forecasts etc.	www.transport.govt.nz/research/Documents/FreightStudyComplete.pdf
<i>2011 Freight charge comparison report</i>	MoT	2011	Med	✓	✓	✓	✓	✓					✓	A report from consultation with ports, freight forwarders, road haulage, KiwiRail and coastal shippers providing a breakdown of import/export costs for major international routes (eg Singapore/Australia/US-Auckland-Christchurch, Shanghai/UK-Wellington via Sydney). It provides costings for movement of technology products, aluminium and other metals, and frozen goods.	www.transport.govt.nz/research/Documents/UTCC-2011-Freight-Charge-Comparison-Report-Aug-2011.pdf
<i>Understanding transport costs and charges - phase two - costs of freight transport: legislation and freight transport</i>	MoT	2011	High	✓			✓	✓						This paper focuses on the impacts of legislation on supply chain efficiency and investigates the legislation that is perceived as having an important influence on the freight sector. It does not seek to carry out a full review of all legislative measures that apply to freight transport. Three case studies are presented: 1) Maritime Transport Act impact on freight transport costs via coastal shipping; 2) difference in tax requirements between domestic and international shipping operators impact on freight transport costs; 3) impact of emissions trading scheme on costs.	www.transport.govt.nz/research/Documents/UTCC-Legislation-and-freight-transport-costs-May-2011.pdf

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<i>Understanding transport costs and charges – phase two – transport costs in freight logistics</i>	MoT	2010	High	◀		◀	◀	◀			◀	◀	◀	This paper provides a quick overview of the literature and summarises the results of 10 case studies of key businesses or industries, to enable a better understanding of the role of transport costs in freight logistics. Includes a case study on forestry and horticulture. Findings from the case studies found that total logistics costs represented 8.4% of total turnover. Transport costs attributed a further 4.1% for international transport and 1% for domestic. Costs associated with customs and security represented 1.8%. Port charges, storage and logistics administration each represented less than 1%.	www.transport.govt.nz/research/Documents/UT-CC-Transport-and-freight-logistics-final-report-Aug-11.pdf
<i>International freight transport services</i>	NZ Productivity Commission	2012	High	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	The Productivity Commission has been asked to find ways to improve the performance of international freight transport services. An efficient international freight transport system is essential for New Zealand to compete effectively in the global economy. New Zealand's international freight costs as a percentage of product value fell from 1989 to 2009. However, they are still higher than in Australia and are significant, representing about \$5 billion or 2.7% of GDP in 2010. The sector experienced a productivity surge from the mid-1980s to the mid-1990s due to innovation and sustained structural reform. This productivity surge has since dissipated. This underlines the importance of removing any impediments to competition, investment or uptake of innovation.	www.productivity.govt.nz/draft-report/988
<i>The question of bigger ships</i>	NZ Shippers Council	2010	High	✓			✓	✓	✓					This report focuses on bigger ship services between New Zealand and South East Asia as a case study, as it is the most likely route for a bigger ship service to operate between New Zealand and major international transshipment hubs initially. (Ships larger than 7000 20-foot containers (TEU) already operate beyond these hubs.) Over time, other routes may also use bigger ships, as volumes on those lanes grow. It is anticipated more vessels with capacities in the range of 4000 to 7000 TEU will be redirected from major international trading lanes to smaller lanes such as	www.shipperscouncil.co.nz/documents/The_Question_of_Bigger_Ships.pdf

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														New Zealand, as major trading lanes become serviced by larger and larger ships (up to 14,000 TEU). There is an opportunity for New Zealand to increase the efficiency, reliability and cost-effectiveness of its supply chain infrastructure through the introduction of larger container ships (ie 5000 to 7000 TEU).	
<i>New Zealand meat industry</i>	NZ Trade & Enterprise	2010	High	✓			✓	✓	✓	✓				Fact sheet on New Zealand meat industry.	http://cache.business.newzealand.com/vAmseKA/media/103386/meat_industry_fact_sheet.pdf
<i>New Zealand productivity inquiry into international freight transport services</i>	The Treasury	2011	Low	✓	✓		✓	✓	✓					Not relevant – only a commission inquiry outlining context and scope.	www.treasury.govt.nz/publications/informationreleases/productivitycommission/pdfs/nzpc-tor-ha.pdf
<i>Vineyard economic benchmarking – Hawke's Bay</i>	NZ Wine	2007	Low	✓		✓						✓		The aim of this project was to create a series of benchmarks for the cost and profitability of growing Chardonnay, Sauvignon Blanc, Merlot and Cabernet Sauvignon in Hawke's Bay in the 2005/06 season. A survey was sent out to all vineyards in Hawke's Bay and the information from the returned surveys was entered into a database to calculate block profitability. Benchmarks were created by calculating the average, and upper and lower quartiles for each variety group. Merlot was the most profitable variety, closely followed by Sauvignon Blanc. Chardonnay was the least profitable. Insufficient survey replies were received for Cabernet Sauvignon to create a representative benchmark. The key driver of profitability in top performing blocks was a higher than average yield per hectare. Conversely, the key driver of low profitability in poor performing blocks was low yields per hectare. Operating costs across both high and low performing blocks were relatively constant.	http://wineinf.nzwine.com/research_outputs.asp?id=126&cid=2&type=r

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<i>Statistical annual</i>	NZ Wine	2009	High	✓		✓	✓					✓		Historic annual statistics on wine growers, production volumes and sales etc	www.nzwine.com/info-centre/
<i>Winery region list</i>	NZ Wine	2011	Low	✓		✓	✓					✓		Lists number of wine producers per region and splits them by production size.	http://wineinf.nzwine.com/downloads_process.asp?sID=12345&cID=4&fID=2179&dID=638
<i>R&D strategic plan</i>	NZ Wine	2005	High				✓	✓	✓					Strategy contains a summary SWOT analysis on New Zealand's wine industry along with medium-term objectives.	http://wineinf.nzwine.com/archive/WRC_Strat_final.pdf
<i>NZ wine annual report</i>	NZ Wine	2011	Low	✓ <input type="checkbox"/>		✓						✓		Not entirely relevant - annual report for NZ Wine association.	www.nzwine.com/info-centre/
<i>Productivity, profitability and industry good activities</i>	NZIER	2007	Med	✓									✓	Reevaluates dairy productivity benchmark target of 4% by exploring derivations of dairy productivity and profitability. It explores the benefit of industry good activities (ie activities that benefit the entire industry regardless of who burdens the cost, which often requires a coordinated approach to make possible in a fragmented sector, eg coordinated collection and dissemination of data/info, industry research etc). While not directly relevant to target sectors, it uses dairy as an example to illustrate how industry goods partially contribute to productivity and profitability, how productivity is a component of profitability and suggestions of how to measure these better. It may be a good source if innovation to productivity or profitability is used.	http://nzier.org.nz/publications/productivity-profitability-and-industry-good-activities
<i>The evolving NZ-US trade relationship, selected case studies</i>	NZ Institute of Economic Research (NZIER) working paper	2011	High	✓	✓		✓		✓	✓		✓	✓	A paper providing case studies on mutually beneficial business relationships between New Zealand and the US, including meat, agricultural technology, environmental goods and services, and niche manufacturing/innovation. Includes case studies on meat and niche manufacturing. Niche manufacturing talks a lot about New Zealand's innovation that is, while small on a global scale, starting to dominate niche ends of respective markets. Targeting	http://nzier.org.nz/sites/nzier.org.nz/files/WP%202011-1%20The%20evolving%20NZ-US%20trade%20relationship_0.pdf

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Title	Organisation/author	Year	Relevance	NZ	Int'l	Stats	Freight	Logistics	Innovation	Meat	Forestry	Wine	Other	Description	Link
	2011/1													higher-end products with more value-add, expanding choice instead of displacing/competing with existing products, innovating with unique New Zealand features such as natural ingredients or quirky designs, and developing strong business relationships and networks with US counterparts.	
<i>NZ exports – more diverse than commonly thought</i>	NZIER	2009	High	✓		✓				✓	✓		✓	A brief which discusses the export goods New Zealand had a comparative advantage in during 2007. Notably, livestock products were one of the highest with over 80 products believed to have a comparative advantage globally. Forest products had over 40 products. Wine was not on the list (possibly grouped in Misc. or another category).	http://nzier.org.nz/sites/nzier.live.egressive.com/files/NZIER%20Insight%20-%20NZ%20exports%20more%20diverse.pdf
<i>A look at New Zealand's comparative advantage</i>	NZIER	2002	Med	✓		✓			✓	✓	✓		✓	Outdated - might be noteworthy that wine and certain forestry products were identified as Area 1 in terms of highest comparative advantage and faster than world growth. Other forestry products were also seen in Area 2 (ie comparative advantage (CA) but not yet faster than world growth, this area flagged as interest area ie CA goods that have not matured yet, still room to accelerate growth). However, meat came into Area 3 (CA but exported to slow growth markets and has slow growth as well) and Area 4 (CA with faster than global growth but targeting markets with slow growth). Note, this is based on 1999 data.	http://nzier.org.nz/sites/nzier.live.egressive.com/files/WP2002-04%20New%20Zealand%27s%20comparative%20advantage.pdf
<i>Real barriers to trade in forest products</i>	NZIER	2000	Med	✓		✓				✓				Outdated - but a reputable source to support removal of trade barriers, gains from liberalising tariffs on forest products have been realised, non-tariff measures are an issue etc.	http://nzier.org.nz/sites/nzier.live.egressive.com/files/WP2000-04%20Real%20barriers%20to%20trade%20in%20forest%20products.pdf
<i>Freight futures</i>	NZIER	2010	High	✓	✓	✓	✓	✓	✓					Paper focuses on supply and demand factors influencing efficiency of the sea freight sector including: role and trends in world trade, impact of the shipping cycle, trends in New Zealand shipping, detailing future patterns of strategic behaviour in the New Zealand	http://nzier.org.nz/sites/nzier.live.egressive.com/files/Freight%20futur

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														context. A base case and three scenarios were developed: 1) Hubbing in Australia; 2) two ports in New Zealand; 3) Fewer ship operators to New Zealand. All scenarios show losses relative to the base case due to inherent inefficiencies from the status quo. However, the supply side scenarios (1, 2) decreases were less significant in affecting efficiency compared with the demand side scenario (3). Analysis suggests all options explored are unlikely to improve efficiency; however, demand side factors (eg export growth, shipping cycle stage, ship operator competition) are likely to be more important than supply side factors (eg port size, hub) when thinking about policy interventions.	es.pdf
<i>Economic impact of the NZ wine industry</i>	NZIER	2009	High	✓		✓	✓					✓		After taking into account the New Zealand wine industry's interlinkages with the rest of the economy, the industry contributes over \$1.5 billion to New Zealand's GDP and supports over 16,500 full-time equivalent (FTR) jobs. The industry generates over \$3.5 billion of revenue through its own direct sales and the sales it induces from related sectors. It also experienced export growth of nearly 24% YoY for past 20 years compared with 5.9% for merchandise exports. Contributes 5% of New Zealand's export goods and plays a pivotal role in regional economies.	www.nzwine.com/assets/sm/upload/v9/q6/e9/Is/NZIER_Rep_April_09.pdf
<i>Dairy's role in sustaining New Zealand</i>	NZIER	2010	Low	✓		✓	✓						✓	Key points on New Zealand's dairy industry. The sector: <ul style="list-style-type: none"> • directly accounts for 2.8% of GDP • is responsible for a wide range of indirect economic links such as workers' income, links to supplying firms, rural economic growth etc • employs 35,000 workers • provides around 65% more jobs than the sheep and beef farming sector • \$1 per kg pay-out increase results in approx. 4600 more FTE workers or \$270 of additional spending for households 	www.fonterra.com/wps/wcm/connect/fcf7000044f43b8bb2b2fbac5c5d2692/NZIER+economic+report+to+Fonterra+and+DNZ+2010.pdf?MOD=AJPERES&CACHEID=fcf7000044f43b8bb2b2fbac5c5d2692

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														<ul style="list-style-type: none"> improves New Zealand standard of living by its export earnings accounts for 26% of New Zealand's exports generates substantial amount of tax revenue <p>The article has a nice flowchart showing direct impact, flow-on effects and total effects.</p>	
<i>Independent review of the New Zealand road user charging system</i>	NZTA	2009	High	✓				✓	✓					<p>Highlights that New Zealand's RUC system is well placed in a global trend of moving towards more technologically reliant schemes using mass distance location charging or rather charging road users for their use of road-related assets. It has a range of recommendations, notably that road friendly suspensions should not be taken into account in their cost allocation model due to increased complexity and in resulting compliance costs for a mostly material benefit. It also recommends changing licences for nominated operating weight to maximum permissible weight (as an efficiency incentive to users).</p>	www.nzta.govt.nz/resources/road-user-charges/docs/ruc-final-report.pdf
<i>Optimisation of heavy vehicle performance</i>	NZTA	2009	High	✓	✓			✓	✓					<p>This paper aimed to benchmark operation requirements of HVs against Australia, Canada, UK and South East Asia. New Zealand HVs cause the least amount of pavement wear and are sufficiently productive to achieve best pavement performance in every transport task. The main reason for this is that HV road taxes are collected through RUCs which include a component for pavement wear. This encourages operators to be more innovative. However, New Zealand HVs tend to be truck and full trailers which might be good for low-speed manoeuvrability but more challenging at higher speeds. Larger configurations are more typical in the other countries compared (ie semis and b-doubles etc) This report suggests mass and dimensions limits could be increased to achieve productivity gains in road transport and increased freight efficiency. This report led to legislative changes through the Land Transport Rule: Vehicle Dimensions and Mass Amendment (2010).</p>	www.nzta.govt.nz/resources/research/reports/387/docs/387.pdf

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<i>A national land transport programme 2009-2012 - Canterbury</i>	NZTA	2009	Med	✓			✓	✓	✓					Provides actions to improve the efficiency of regional freight movements and reduce the impacts of freight on the community and environment. It outlines specifics for planned spending of \$632 million between 2009 and 2012.	www.nzta.govt.nz/resources/national-land-transport-programme/2009-2012/regional/canterbury/docs/canterbury.pdf
<i>Dynamic interaction between vehicles and infrastructure experiment (DIVINE project)</i>	OECD	1995-97	Low	✓	✓	✓		✓	✓					The OECD's DIVINE project has highlighted the need for the interactive effects of vehicles, bridges and pavements to be taken into account in all aspects of providing, maintaining and managing road infrastructure. These interactions are complex, however, and vary across routes, regions and countries depending on the characteristics of local vehicles and infrastructure. New Zealand played a key role in this project through the Accelerated Pavement Indoor Testing Facility (CAPTIF) at Canterbury.	www.oecd.org/dataoecd/9/22/2754516.pdf
<i>World trends in road freight transport</i>	OECD	2008	Med		✓	✓		✓	✓					Mainly discusses use of longer heavier vehicles (LHVs @ 43-44t) to replace heavy good vehicles (40t) where two can replace three for significant productivity gains. However, there is a significant risk of higher CO2 emissions (due to modal shift from road to rail). Also, road management issues arise due to incompatibility requiring substantial investments to roads, bridges, networks etc. There is also lack of certainty in sourcing loads for sustainable backloads. LHVs could introduce new safety risks but would also reduce amount of HVs on the road.	www.internationaltransportforum.org/jtrc/infrastucture/heavyveh/08Christsensen.pdf
<i>Moving freight with better trucks</i>	OECD	2009	Med		✓	✓		✓	✓					The purpose of this report is to identify potential improvements in terms of more effective safety and environmental regulation for trucks, backed by better systems of enforcement, and to identify opportunities for greater efficiency and higher productivity. The report is based on a review of literature, consultation among stakeholders, and research and analysis from working group members. It also presents the results of a comprehensive benchmarking study of 39 truck configurations in operation	www.internationaltransportforum.org/jtrc/infrastucture/heavyveh/TrucksSum.pdf

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														around the world – from typical workhorse vehicles to very high capacity vehicles – and assesses their performance in terms of dynamic stability, productivity and impact on the infrastructure.	
<i>Smart state strategy</i>	Queensland Government	2008	Low		✓				✓					This is the Queensland Government's signature policy to create a state where knowledge, creativity and innovation drive economic growth to improve prosperity and quality of life for all Queenslanders.	http://203.210.126.185/dsdweb/v4/apps/web/secure/docs/4171.pdf
<i>Innovation in the NSW freight logistics industry</i>	SAHA	2008 a	High		✓	✓	✓	✓	✓	✓			✓	This report is phase 1 of a NSW Innovation Strategy Project looking at innovation and efficiency within the NSW freight logistics industry. Comprising of three distinct elements: Part A: Overview of the industry. Part B: Identification of barriers to innovation and efficiency. Part C: Uptake of technology within the industry and potential for web-based freight matching to address port congestion. This first phase of work outlines a series of actions that could be taken by the government to stimulate innovation and efficiency within the NSW freight logistics industry in both the short and long term.	www.transport.nsw.gov.au/sites/default/files/b2b/publications/FALCO NSW-Path-to-Innovation.pdf
<i>Four key supply chains: opportunities for innovation</i>	SAHA	2008 b	High		✓	✓	✓	✓	✓	✓			✓	The project addresses four important supply chain sectors in NSW: food and beverage, heavy construction materials, steel and grain. These sectors were chosen for their significant shares of total freight and logistics activity in NSW, the importance of freight and logistics costs to their operations, and the potential for improvements to have positive impacts on the wider NSW economy.	www.business.nsw.gov.au/_data/assets/pdf_file/0014/5405/Four_Key_Supply_Chains_Opportunities_for_Innovation_20100407.pdf
<i>Best practices in freight movement</i>	Seattle Urban Mobility Plan	2008	Med		✓		✓	✓	✓					Provides some best practice examples for freight movement from a port and an urban context.	www.seattle.gov/transportation/docs/ump/10%20SEATTLE%20Best%20Practices%20in%20Freight%20Movement.pdf
<i>Innovation in New Zealand</i>	Statistics NZ	2009	High	✓		✓			✓				✓	Key findings include that nearly half of New Zealand businesses reported some form of innovation activity. Media and telecommunication services were the highest at 60% (transport,	www.stats.govt.nz/browse_for_stats/businesses/business_growth_and_i

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														portal and warehousing were just over 40%; agriculture and forestry at 30%; both below the overall innovation rate of 46%). Innovation is similar but lower than that of Australia. Four types of innovation – product, process, marketing, organisation – each represented equally at 25%. 60% of businesses prefer to innovate internally; primarily via existing staff at 74%. 90% reported increase of revenue as main reason to innovate; 39% for new goods or services. 19% saw cost to develop and introduce innovation as the highest barrier to innovation.	nnovation/innovation-in-new-zealand-2009.aspx
<i>Strategic issues facing the New Zealand wine industry in a global environment</i>	University of South Australia	2003	Low	✓		✓						✓		Examines the strategic issues facing the New Zealand wine industry. Gives a brief overview of the New Zealand industry and then draws implications for it from the trends facing the global industry. The report concludes that international links are critical for New Zealand industry. A special challenge will be how the New Zealand industry, with its mix of large, medium and small wineries, can maintain a unique international identity and adopt a collective, national approach to sustaining and developing competitive advantage.	http://academyofwinebusiness.com/wp-content/uploads/2010/05/File-028.pdf
<i>SME innovation within the Australian wine industry: a cluster analysis</i>	University of Wollongong	2006	High		✓	✓	✓	✓	✓			✓		This paper assesses core innovation activity among SMEs within different levels of cluster development. The aim of the paper, using empirical data from the Australian wine industry, is to demonstrate that innovation levels and activity intensify as an industry cluster develops. By dividing wine clusters into 'innovative' (highly developed) and 'organised' (less developed) models, the paper uses selected core indicators of innovation activity to explore levels of integration within each model. This integration is examined in the context of Porter's theory of 'competitive advantage', with implications for SMEs in particular, and lessons for industry clusters in general. It concludes that while South Australia's innovative approach has resulted in their clusters accounting for half of Australia's leading wines, Western	http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1077&context=commpapers

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														Australia, NSW and Victoria brands should not be undervalued despite being less innovative (termed an organised model).	
<i>NZ wine report 2011</i>	US Department of Agriculture	2011	Med	✓		✓	✓					✓		A summary report from US Department of Agriculture which summarises statistics derived from Statistics NZ, NZ Wine etc.	www.calwinexport.com/files/Wine%20Annual_Wellington_New%20Zealand_3-18-2011.pdf
<i>Waitakere city freight plan 2009-40</i>	Waitakere City	2009	Med	✓			✓	✓	✓					Provides some freight detail on Auckland regional freight task but Waitakere's economy has two primary roles with less relevance to the project: niche manufacturing (boat building, engineering and plastics, construction, services) and recreation.	www.waitakere.govt.nz/havsay/pdf/freightplan/draft-freight-plan.pdf
<i>Doing business</i>	World Bank	2012	Low	✓	✓									Overall in 2010/11, governments in 125 economies implemented 245 institutional and regulatory reforms, 13% more than in the previous year. A faster pace of regulatory reform is good news for entrepreneurs in developing economies. Starting a business is a leap of faith under any circumstances. For the poor, starting a business or finding a job is an important way out of poverty. In most parts of the world small and medium-size businesses are often the main job creators. Yet entrepreneurs in developing economies tend to encounter greater obstacles than their counterparts in high-income economies. Finding qualified staff and dealing with lack of adequate infrastructure are among the challenges. Overly burdensome regulations and inefficient institutions that discourage the creation and expansion of businesses compound the problems.	www.doingbusiness.org/~media/FPKM/Doing%20Business/Documents/Annual-Reports/English/DB12-FullReport.pdf
<i>The global competitiveness report 2011-2012</i>	World Economic Forum	2012	Med	✓	✓	✓			✓					The World Economic Forum publishes an annual report on the global competitiveness of countries. It uses 12 categories (or pillars) to determine the productivity and competitiveness. The 11th and 12th pillars of business sophistication and innovation are used to identify how innovation driven economies are - these factors are particularly important for countries at a more advanced stage of development. New Zealand finished in the top 30 out of 142 countries in terms of overall competitiveness, business	www3.weforum.org/docs/WEF_GCR_Report_2011-12.pdf

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														sophistication and innovation. Across all categories, New Zealand finished closely behind Australia. It should be noted that New Zealand has been categorised as an economy driven by innovation – the third and final stage of development after factor- and efficiency-driven – which comprises 35 of the more advanced economies globally.	

Abbreviations used in the table

3PL	third party logistics	ITS	information technology services
AERU	Agribusiness and Economics Unit, Lincoln University	LHV	longer heavier vehicle
ATRF	Australasian Transport Research Forum	MoT	Ministry of Transport
BiB	bag-in-box	NAEI	National Atmosphere Emissions Inventory
CA	comparative advantage	NSW	New South Wales
CSIRO	Commonwealth Science and Industrial Research Organisation	OECD	Organisation for Economic Co-operation and Development
EU	European Union	R&D	research and development
FMCG	fast-moving consumer goods	RUC	road user charges
FTE	full-time equivalent	SME	small to medium enterprise
GHG	greenhouse gases	TEU	20-foot container
HBEFA	Handbook Emissions Factors for Road Transport	TLC	total landed cost
HV	heavy vehicle	US DoT	US Department of Transport
IMT	Intermodal terminal	VEPM	Vehicle Emissions Predictions Model