Ministry of **Transport**
TE MANATŪ WAKA

# Understanding Transport Costs and Charges

## Phase two - Transport costs in freight logistics

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# 1 Introduction

This study is being undertaken as part of the 'Understanding Transport Costs and Charges' (UTCC) project – Phase two, in order to understand the relative importance of transport costs in freight logistics.

The efficiency of freight movement is important for supporting our economy by enabling smooth flow of goods from producers or suppliers to market places or consumers, both domestically and internationally.

Logistical capability improvement can help to lift New Zealand's comparative advantage in production through reducing delivery times and transport costs. This will in turn help to achieve national economic and productivity growth.

This paper provides a quick overview of the literature and summarises the results of ten case studies of key businesses or industries, to enable a better understanding of the role of transport costs in freight logistics.

Due to the commercial sensitivity of the data, only aggregated data are summarised in this paper and all the comments are anonymous so no individual or company can be identified.

The key insights from the literature review and the case studies are summarised as follows.

- The key factors that affect transport costs include distance, delivery time, fuel price, cargo value and weight, the direction of freight routes, and load factors.
- Location decisions, efficient distribution processes and better information management can help to improve logistical efficiency by reducing the costs associated with inventory holdings and storage.
- The case studies show that total logistics costs represent around 8.4 percent of total turnover.
- While important, transport costs only amount to a small part of total turnover, estimated at 4.1 percent for international transport and one percent for domestic transport.
- Costs associated with customs and bio-security represent around 1.8 percent of total turnover.
- Port charges, warehousing and logistics administration each represent less than one percent of total turnover.

This paper is organised as follows:

- section 2 provides a brief overview of the role of transport costs in freight logistics
- section 3 reports the results of the case studies
- section 4 summaries the results

The information included in this paper can help to inform policy decisions related to improving the efficiency of freight supply chains as sought by the Government Policy Statement on Land Transport Funding 2009/10 to 2018/19.

## 2 Roles of transport costs in freight logistics

### 2.1 Transport, logistics and supply chain management

Supply chain management is an important aspect of business operations because it helps to reduce the costs associated with inventory holding and stock wastage, and to improve business competitiveness. The role of transport and the interrelationships between transport, logistics and supply chain management can be illustrated as shown in Figure 1.

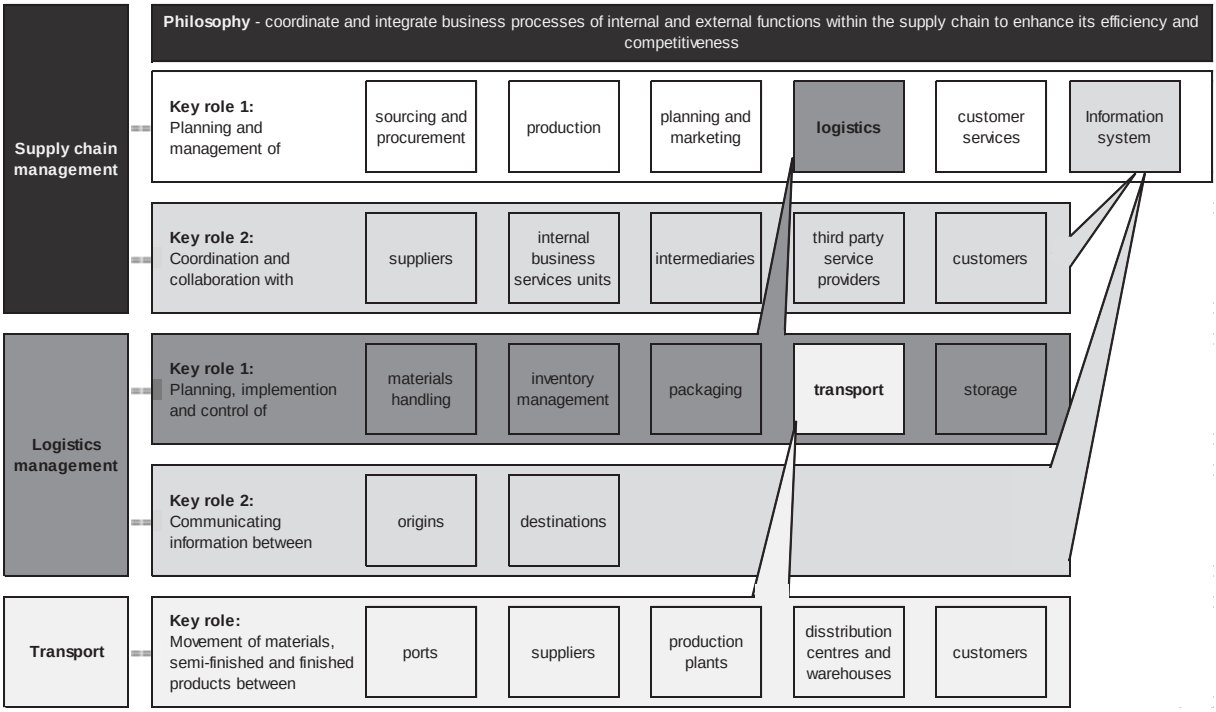
The management of a supply chain encompasses the planning and management of all activities involved to bring the end products to the market, and includes coordination and collaboration with suppliers, internal business services units, intermediaries, third party service providers and customers.

Transport, through which the movement of goods physically takes place, is an important part of logistics and supply chain management. The efficiency of transport arrangements affects the lead time for delivery and the level and costs of stock holding, which in turns affects the competitiveness of businesses.

Efficient logistics management is about providing the right quantity and quality of the right goods at the right times and locations, in a way that minimises transport costs, time, storage and stock wastage. Hence, an efficient supply chain requires an effective information system to allow monitoring of the supply of, and demand for, freight and its movements.

The choice of transport mode, the distribution model and the locations of distribution centres or warehouses are also important in improving freight logistics and supply chain efficiency.

**Figure 1: The role of transport in supply chain management**



## 2.2 Definitions

There are three perspectives from which freight transport costs can be considered differently.

- From the freight transport operators' perspective, freight transport costs refer to the expenditure they incur in providing the services. This includes labour costs, fuel, road user charges and other vehicle operating costs.

- From the freight owners' perspective, freight transport costs refer mainly to the prices or charges they pay to freight transport operators.

- From the national perspective, freight transport costs include costs associated with social, environmental and economic aspects, which include financial, non-financial, tangible and intangible components.

To better understand the relative importance of transport cost in freight logistics, the primary focus of this study is the financial costs faced by freight owners. Therefore, wider social, environmental and economic costs are outside the scope of this report and will be investigated under other UTCC work streams.

The total logistics costs faced by freight owners include:

- direct transport costs:
    - international movements
    - domestic movements
    - mode interchanges
- indirect transport costs:
    - port charges
    - customs and bio-security
    - insurance
- other logistics costs:
    - packaging
    - warehousing
    - inventory holding costs
    - stock wastage
    - logistics administration
    - logistics information systems

The intention of the case studies is to collect examples of all of the above cost components.

## 2.3 Determinants

### 2.3.1 International maritime transport

Over 99 percent by weight, and around 82 percent by value, of New Zealand's overseas trade is transported by sea[1]. So what factors determine ocean freight rates and the total costs of sea freight transport? Summarised below are eight key factors that influence ocean freight rates.

- **Distance and time** – Distance affects fuel consumption, total journey times, shipping asset and labour utilisation, and hence the overall shipping operation costs. Doubling the distance can generate at least a 20 percent increase in transport costs (Clark et al., 2002). Depending on the sector and export market, it has been estimated that a 10 per cent rise in the time to export reduces trade by between 5 and 25 percent (WTO, 2009). Furthermore, it has been estimated that, for

[1] For the year ending June 2010, New Zealand handled 46.6 million tonnes of merchandise imports and exports, which had a combined value of around $80 billion.

agriculture products, it would cost around three percent of the volume of trade for each day of delay[2].

- **Bunker fuel prices** – International literature has found that, for each percentage increase in crude oil prices, ocean freight rates increase by at least 0.25 percent[3].

  Given the importance of bunker fuels in total shipping costs, volatility in fuel prices can have significant influences on overall freight charges.

- **Characteristics of the commodity** – Commodity types, their volume and values, all have significant impacts on transport costs (e.g. Hummels and Lugovskyy, 2008 and Hummels et al., 2009). Different commodities may have different weights or cubic volumes and may require different cargo holding facilities (e.g. refrigeration) and have different cost implications.

  Further, shipping companies are more willing to negotiate with high-volume freight owners, due to the benefits from economies of scale and greater certainty of utilisation. Low trade volumes are usually serviced by smaller vessels and freight rates will increase due to reduced economies of scale.

- **Quality of port infrastructure** – Ports generally take the role of handling sea trade, and providing storage and distribution facilities. An increasing use of hub-and-spoke arrangements world-wide means ports are gradually taking on the roles of transport consolidators[4] and centres for cargo exchange.

  It is a costly exercise to equip a port with the appropriate infrastructure and equipment for handling Capesize and Post Panamax vessels. While larger ports tend to be more efficient, it is a challenge to balance the supply of, and demand for, extra capacity without creating additional constraints for the freight sector.

  A number of studies have found that access to ports is important to reduce transport costs because ocean transport is typically more cost efficient than land transport[5].

- **Trade imbalances** – The direction of a freight route and trade imbalances can have significant impacts on transport costs (Hummels, 2009). As the quality and capacity of transport infrastructure at ports are not necessarily symmetric for a given pair of origin and destination (Combes and Lafourcade, 2005), any time slot delays and cargo handling inefficiencies can add

[2] ARH (2009)

[3] For example, Hummels (2009) estimated that bunker fuel price elasticity on ocean freight is around 0.25. On the other hand, Notteboom and Vernimmen (2009) estimated that fuel represents at least 50 percent of total ship operation costs alone, and around 30 percent of total shipping costs, including container costs, administration and cargo handling costs.

[4] For example, the Port of Tauranga teams with KiwiRail Group to support MetroPort Auckland. Under this arrangement, imports destined for Auckland are aggregated at the Port of Tauranga before being delivered to Auckland by rail, and the reverse applies for exports.

[5] For example, Limao and Venables (2001) found that, all else being equal, transport costs for landlocked countries could be as much as 50 percent higher.

costs for shipping operators and freight owners.

Cubic and Njord (2009) noted that differences in import and export volumes and their cargo mixes have created an excess of demand for empty containers at certain ports, but an excess of supply at other ports[6]. Such trade imbalances mean that containers are sometimes moved empty.

With trade imbalances the equilibrium charges for front-haul are inherently greater than those for backhaul, as the demand price is high in the front-haul direction (Takahashi, 2010). Shipping operators prefer backhauls to empty returns and may therefore offer lower rates for backhaul markets.

- **Port calls** – As New Zealand is a small country, many argue that it does not have high enough freight volumes to support thirteen international sea ports. For certain liner services, vessels may need to stop at several ports before reaching their capacity. However, once cargoes have arrived in New Zealand, it is generally cheaper to ship them by sea to destination ports than by land transport modes.

  While limiting the number of port calls will shorten round-trip time and minimise the number of vessels required for that liner service, adding port calls can generate additional revenue if the additional costs from the added calls are more than offset by revenue growth. Many large shipping operators are now offering multimodal door-to-door services. The utilisation of coastal shipping for transhipment is one way to reduce total transport costs for their operations.

- **Institutional changes** – WTO (2009) asserted that the development of open registry shipping[7], scale effects from increased trade, and containerisation are the three major technological and institutional changes that have resulted in lowered ocean transport costs over the last fifty years.

- **Competition** – The effect of competition on freight rates was first recognised as an issue as long ago as the early 1870s[8]. At that time, liner conferences were put in place to establish freight rates and to control capacity levels. Market changes such as the advent of containerisation, global competition and anti-trust laws have, however, weakened the industry's ability to enforce price cartels[9].

  In New Zealand, competition between domestic and international shipping companies has been seen as a major factor affecting ocean freight rates and the profitability of domestic carriers.

[6] Cubic and Njord (2009) estimated that New Zealand imports about empty 256,000 TEU containers and exports about 104,000 empty containers, and that there is a surplus of 20' containers but a shortage of 40' containers.

[7] This refers to registering ships under flags of convenience to circumvent regulatory requirements and reduce manning costs.

[8] Stopford (2009), Chapter 13.

[9] Stopford (2009), Chapter 16 and OECD (2010).

### 2.3.2 Domestic transport

For domestic movements a critical decision is on what transport mode or modes to use. Rockpoint (2009) interviewed a number of freight owners on the determinants of modal choice and found that the reliability of a transport mode is the top criterion, followed by product care, safety, timeliness and costs.

Although costs are ranked fifth in Rockpoint (2009), modal choice decisions can have a significant influence on costs because the factors affecting modal choice decisions can have a flow-on effect on stock-holding requirements and cargo damage (for perishable products).

- **Reliability and congestion at pick-up and drop-off locations** – For major delays, future economic opportunities could be lost as customers lose confidence and trust in freight suppliers. If these are persistent, even minor delays can increase the costs of doing business through increased operational costs.

- **Delivery time** – For just-in-time delivery, the preferred mode of transport is either by air or by road. These modes tend to be more expensive (especially by air) but have shorter lead times. Rockpoint (2009) estimated that, on average, the total transit time between Auckland and Christchurch is around 24 hours by truck, 36 hours by train and over 40 hours by coastal shipping. When the time required to wait for scheduled services, cargo aggregation and exchange is included, the total delivery time on average is around 1.2, 2 and 9.5 days for road, rail and coastal shipping, respectively.

- **Distance** – Rail and coastal shipping are generally more viable for long distance routes.

- **Cargo value-to-weight ratio** – For heavy but low-value cargoes, the use of coastal shipping or rail can help to reduce transport costs and increase profit margins.

- **Competition** – Rail and coastal shipping are limited by routes, schedules and the availability of direct rail or seaport links between origin and destination points[10]. Therefore, competition between modes occurs only for a limited range of transport tasks. In fact, road, rail and sea are frequently used together as part of an integrated logistics operation.

  For multimodal freight movements, journey time reliability and the cost of freight transfer between modes are particularly important. Any delays in one leg of a journey can have significant flow-on effects on subsequent legs of the journey and add costs for businesses.

- **Other characteristics** – The size of the freight task, locations and the availability of loading and unloading facilities, physical restrictions (e.g. tunnel heights) and the availability of backhauls all influence mode choice decisions and the associated transport costs.

[10] For example, TERNZ (2006) estimated that the contestable proportion of prospective rail freight that was being transported by road was between three and seven percent only.

## 2.4 Measures

### 2.4.1 International freight transport costs – ocean freight

The OECD has recently established the maritime transport cost (MTC) database[11], which includes two useful measures – average unit transport cost and ad-valorem transport cost.

The MTC database, which covers 43 importing countries and 97 commodities, is very extensive in design. However, the level of detail available varies by country. For example, of the top ten New Zealand export trading partners, only data for Australia and the United States[12] are available.

*2.4.1a Average unit transport cost*

This is the average maritime transport cost per kilogram (in USD).

A comparison of the average maritime transport cost for trading between New Zealand and (i) **Australia,** and (ii) the **United States**, found some interesting results (see Figures 2 and 3).

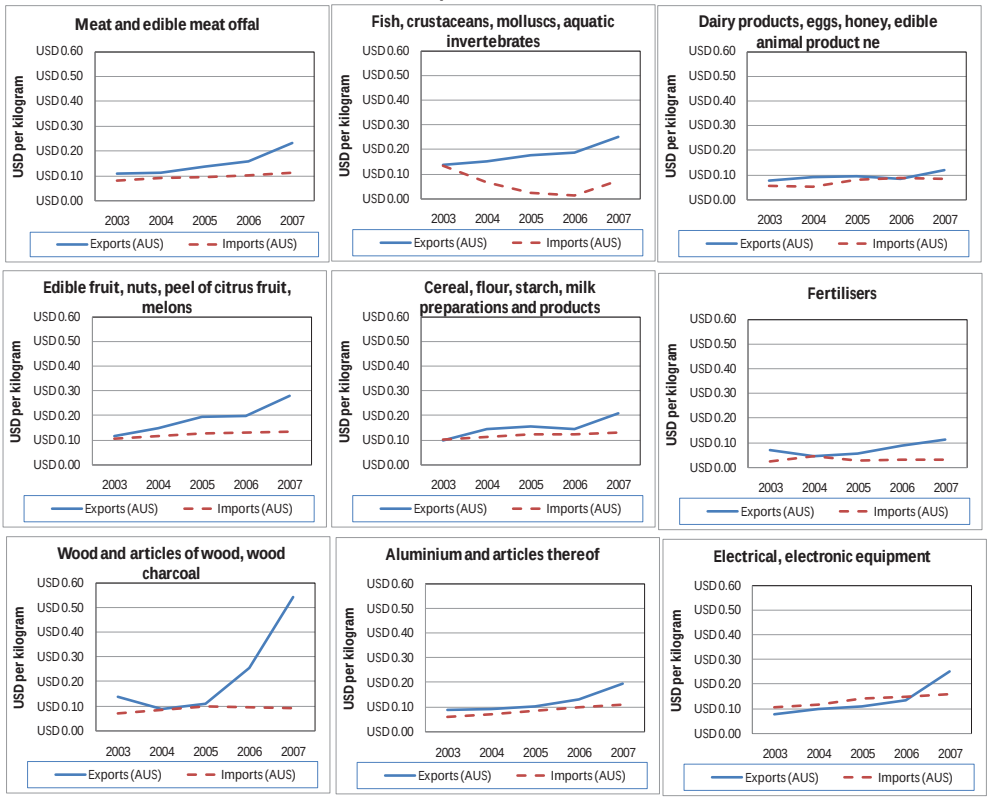
- Average maritime transport costs (MTC) vary with the commodity[13] but mostly lie between USD0.10 and USD0.20 per kilogram for trading with Australia, and between US$0.10 and USD0.50 per kilogram for trading with the United States.
- The average MTC has increased over time but the size of the increase is not consistent across all commodity types.
- For trading with Australia, the average MTC is consistently higher for exports, but the opposite is found for trading with the United States (i.e. it is higher for imports).
- Except for fish, dairy products and electronic products, the difference in average MTC for trading with the two countries is less than proportionate to the difference in their average distances from New Zealand (see Table 1). This observation confirms the conjecture that there are many other factors affecting ocean freight rates besides distance.

**Table 1: Ratios of average maritime transport costs for trading with the United States compared to Australia**

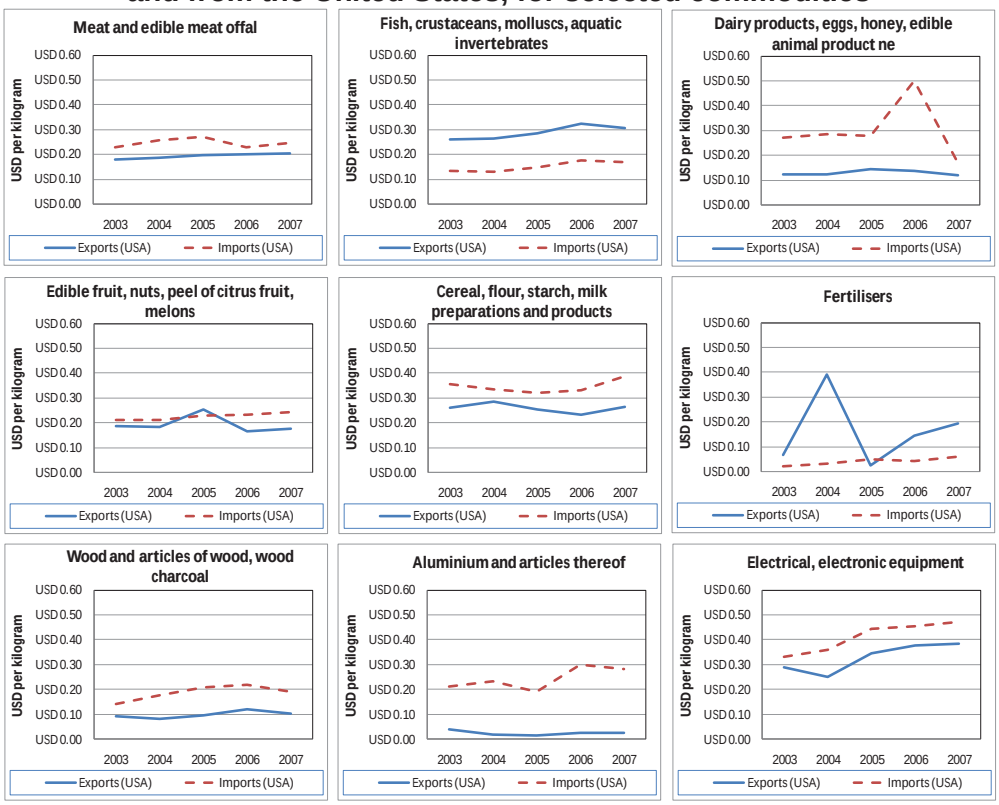
| Ratio of the transport cost for trading with the United States to the transport cost for trading with Australia (Average for 2003-07) | Exports (US/AUS) | Imports (US/AUS) |
|---|---|---|
| Meat and edible meat offal | 1.4 | 2.6 |
| Fish, crustaceans, molluscs, aquatic invertebrates | 1.6 | 4.7 |
| Dairy products, eggs, honey, edible animal product | 1.4 | 4.2 |
| Edible fruit, nuts, peel of citrus fruit, melons | 1.1 | 1.8 |
| Cereal, flour, starch, milk preparations and products | 1.8 | 2.9 |
| Fertilisers | 2.7 | 1.3 |
| Wood and articles of wood, wood charcoal | 0.6 | 2.1 |
| Aluminium and articles thereof | 0.2 | 2.6 |
| Electrical, electronic equipment | 2.7 | 4.7 |

[11] OECD (2010).
[12] Australia is New Zealand's biggest trading partner (in terms of both imports and exports) accounting for over 20 percent of its international trade. The United States is New Zealand's third biggest trading partner (in terms of both imports and exports), representing around 10 percent of its international trade.
[13] Apart from fertilisers, all commodities are transported in containers.

## Figure 2: Average maritime transport cost per kilogram (USD), New Zealand to and from Australia, for selected commodities




## Figure 3: Average maritime transport cost per kilogram (USD), New Zealand to and from the United States, for selected commodities



*2.4.1b Ad-valorem transport costs*

Ad-valorem transport costs are used to compare the costs of freight and insurance for moving a dollar's worth of goods between destinations. This measures the mark-up between cost insurance and freight (CIF)[14] and Freight on Board (FOB).

Freight and insurance costs for goods with higher values may be higher because (i) insurance costs increase with the value of the goods and (ii) goods with higher value tend to have lower transport price elasticity, and freight owners are generally willing to pay more for better freight services.

Ad-valorem transport costs provide some insights about the relative importance of transport costs for businesses, at the commodity level for each trading partner.

Figures 4 and 5 show the ad-valorem transport costs for trading between New Zealand and Australia, and with the United States.

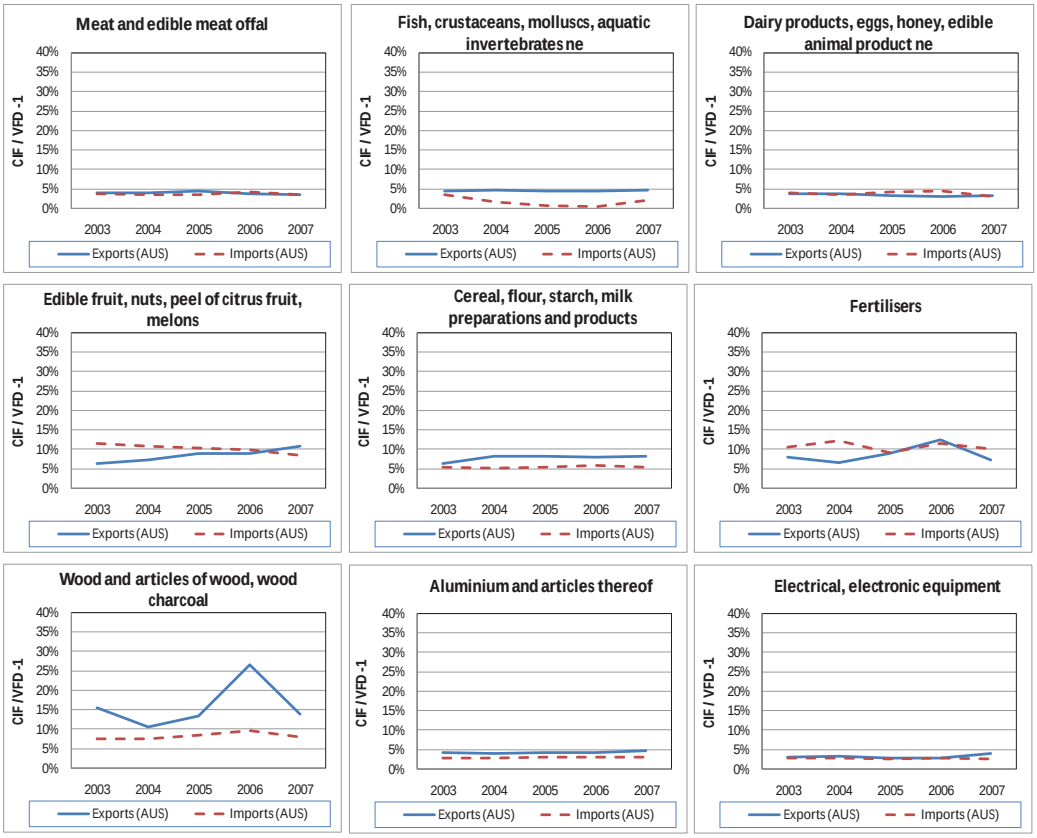
- The total cost of transport and insurance as a percentage of value of goods varies between 2 and 10 percent for importing from **Australia,** and between 3 and 16 percent for exporting to Australia. At a commodity level, the percentages for importing from and exporting to Australia are of a similar magnitude (except for wood products).

- For trading with the **United States**, the equivalent figures vary between 7 and 24 percent for imports, and between 1 and 16 percent for exports. At a commodity level, the costs of importing from the United States are generally higher than those for exporting to that country.

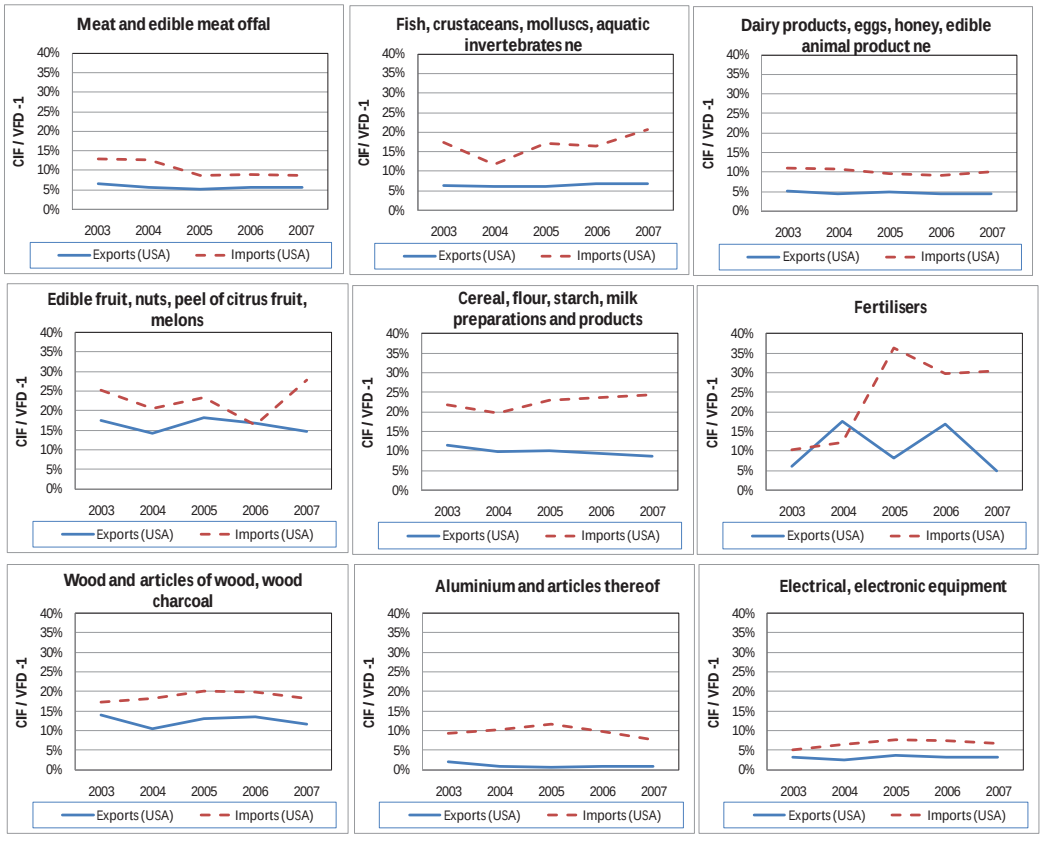
- Ad-valorem transport costs can vary significantly between commodities (e.g. due to the influence of world prices).

[14] CIF includes land transport costs plus the costs associated with port-to-port movements. For land-locked countries, land transport costs can be quite high (e.g. Martinez-Zarzoso and Nowak-Lehmann, 2007).

## Figure 4: Ad-valorem transport costs for trading between New Zealand and Australia




## Figure 5: Ad-valorem transport costs for trading between New Zealand and the United States

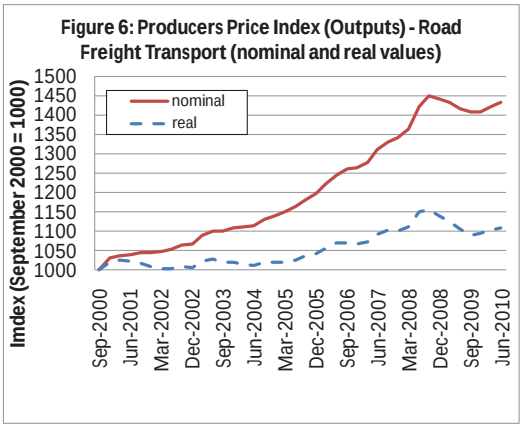


### 2.4.2 Domestic freight transport costs

*2.4.2a Road*

A measure of inflation in road freight transport is Statistics New Zealand's Producers Price Index (outputs) for road freight transport. Figure 6 shows that, over the last ten years, the cost of road freight transport has increased by around 10 percent in real terms.

Factors that have contributed to such an increase include oil price inflation, road user charge increases and wage inflation.




In a survey of road freight operators prepared for the Road Transport Forum (RTF) by the University of Waikato, RTF (2006) found the median gross income was $2.63 per kilometre (see Table 2). Vehicle costs made up around 44 percent of gross income, wages and salaries accounted for 20 percent, and 14 percent were operating profits.

RTF (2006) did not provide statistics on tonne-kilometres to enable an assessment to be made of costs per tonne-kilometre. However, if the average pay load is 20 tonnes, the gross income to freight transport operators (or the cost to freight owners) would be around $0.13 per net tonne-kilometre.

Based on RTF (2006) and an assumed 20 tonnes per two twenty-foot equivalent unit (TEU) loads, Rockpoint (2009) estimated that the average road transport cost was around $0.99 per net tonne-kilometre for operators with less than six trucks, and around $0.13 per net tonne-kilometre for operators with more than six trucks.

Hence, after accounting for inflation, the average cost per net tonne-kilometre would be around $0.15 in 2009 dollars. If the average pay load is 7 tonnes, the average cost per net tonne-kilometre in 2009 dollars would be about $0.40.

**Table 2: Median cost of truck operations per kilometre – 2006**

| Median cost per kilometre travelled ($) | Operator type | | | | |
|---|---|---|---|---|---|
| | Whole industry | Urban | Intercity | Rural North | Rural South |
| Gross income per km | 2.63 | 2.78 | 1.98 | 2.73 | 2.54 |
| Fuel & Oil | 0.35 | 0.26 | 0.29 | 0.41 | 0.36 |
| Vehicle costs | 0.81 | 0.59 | 0.64 | 0.95 | 0.88 |
| Wages and salaries | 0.53 | 0.55 | 0.34 | 0.54 | 0.55 |
| Other operating costs | 0.58 | 0.59 | 0.42 | 0.60 | 0.54 |
| Operating profit (including wages to owner-operator) | 0.37 | 0.79 | 0.29 | 0.23 | 0.21 |

Note: Derived from RTF (2006). Vehicle costs include vehicle ownerships, insurance, maintenance, road user charges and tyres.

*2.4.2b Rail*

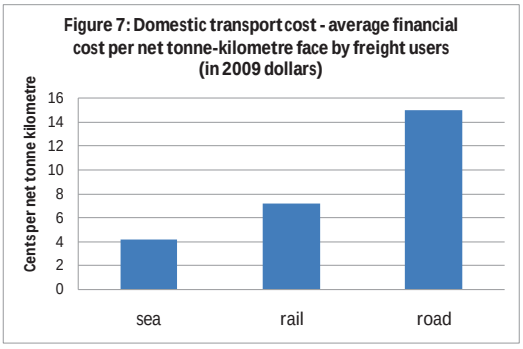
Bolland (2009) analysed the variable, semi-variable and fixed costs of KiwiRail's freight operations, and estimated the short and long-run marginal costs by line of business. The short-run marginal cost includes appropriate variable costs and some semi-variable costs, whereas the long-run marginal cost includes all costs except the cost of capital.

Bolland estimated that the short-run marginal cost of rail freight for the year ended June 2009 was between $0.10 and $0.15 per net tonne-kilometre for the majority of lines, with a long-run marginal cost of around $0.20.

For the year to June 2009, the average freight rate is $0.072 per net tonne-kilometre[15]

*2.4.2c Coastal shipping*

Rockpoint (2009) estimated that, for an annual volume of 36,400 TEUs, the average price to the customer is around $0.042 cents per tonne-kilometre. This estimate excludes the cost associated with freight transfer between modes.




[15] Data source: KiwiRail Annual Report 2009 (total freight revenue of $284.5 million was generated from 3,962 million net tonne-kilometres).

# 3 Case studies

## 3.1 The objectives

The following case studies include ten key businesses or industries that require movements of freight into, out of, and around the country.

The objectives of the case studies are to:

- identify what factors businesses consider important when selecting transport modes and transport service providers
- identify what businesses see as the most important factors that affect the efficiency and effectiveness of transport logistics
- collect detailed information on direct freight transport costs and related logistics costs (such as customs inspection, storage and other stock-carrying costs)
- collect information on the relative shares of freight transport costs and total logistics costs as a percentage of sales value and the costs of production

Due to the small sample size, the primary focus of this exercise is to understand any distinct patterns regarding transport and logistics costs, and understand the reasons for any differences observed. Therefore, the estimates to be discussed in this section are indicative only.

## 3.2 Selection criteria

To maximise the benefits of the study, a good coverage of key businesses and freight movements is important. The following selection criteria have been used:

1. the organisation must be able to provide reliable information on logistics costs
2. the list of businesses must include small as well as large freight owners, and cover a range of industries that is important for New Zealand
3. the businesses must cover:
    - o international freight movements
    - o containerised and bulk cargo movements, and
    - o road, rail and sea domestic transport modes

Table 3 summarises the key freight movement characteristics and other information about the selected industries or companies.

### 3.3 The approach

A face-to-face interview with a follow-up questionnaire was chosen as the preferred approach for completing the case studies.

An invitation was sent to the prospective participants in February 2010 and the face-to-face interviews took place during March and April 2010. Nine of the ten participants returned their completed or partially completed questionnaires by mid-June 2010.

**Table 3: Key characteristics of the selected industries or companies**

| Business type | Freight movement characteristics | | | | | | | | Company or industry size (number of FTEs) | Annual turnover (NZ$) | Cargo value to cargo weight ratio ($ / tonne) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | importer | exporter | containerised | refrigerated | break bulk | domestic transport mode choice: road | rail | maritime | | | |
| Manufacturer A | √ | √ | √ | | | √ | √ | √ | >100 | 1-2 billion | > 5,000 |
| Manufacturer B (Co-operative) | | √ | | | √ | √ | √ | √ | 50-99 | < 0.5 billion | < 500 |
| Manufacturer C | √ | | | | √ | √ | √ | √ | >100 | 0.5-1 billion | 100- 800 |
| Manufacturer D | | √ | √ | | √ | √ | √ | √ | 20-49 | < 0.5 billion | 5,000 |
| Primary producer A | | √ | √ | √ | | √ | √ | | >100 | 1-2 billion | 2,000 – 5,000 |
| Primary producer B (industry-wide) | | √ | | | √ | √ | √ | √ | >100 | 1-2 billion | < 100 |
| Primary producer C (co-operative) | | √ | √ | √ | √ | √ | √ | √ | >100 | > 8 billion | Not provided |
| FMCG importer and retailer | √ | | √ | | | √ | √ | | >100 | 1-2 billion | 4,000 – 6,000 |
| FMCG manufacturer | √ | | √ | | | √ | √ | √ | >100 | < 0.5 billion | Not provided |
| DG importer and distributor | √ | | √ | | √ | √ | | √ | >100 | 0.5-1 billion | > 5,000 |

FMCG: Fast moving consumable goods; DG: Durable goods

## Case study 1: Manufacturer A

*This company manufactures goods in the North Island from local and imported raw materials. A range of raw materials and finished products is imported, mainly through Ports of Auckland, with a small percentage going through the Lyttelton and Tauranga ports. To minimise the costs associated with distribution and storage, the company coordinates deliveries from its two distribution centres (DC's), located in Auckland and Christchurch, to customers or customers' DC's.*

*Roughly 70 percent of the company's sales are destined for the New Zealand and Australian markets, with the other 30 percent going to other international markets. The majority of the international cargoes are transported by sea and are containerised. Around 80 percent of the company's domestic freight movements are break bulk cargoes, of which 100 percent are transported by road. The remaining 20 percent of the domestic freight movements are containerised, of which 95 percent are transported by coastal shipping and 5 percent by rail.*

## Case study 2: Manufacturer B

*This company manufactures non-metallic mineral products in both the North and South Islands from local and imported raw materials. The company uses mainly the ports of Auckland, Tauranga and Lyttelton. The product manufacturing season is of six months' duration, commencing in early October. Harvesting usually begins in early March and lasts for four to six weeks. Maintenance work and other year-round activities are conducted during the off-peak season.*

*The company has two DC's in the North Island and four DC's in the South Island. As the product has a low value-to-weight ratio, transport costs represent a significant component of doing business for this company. The majority of the company's sales by weight are destine for the domestic market and are transported in bulk by road. All freight movements are contracted to third-party service providers. The company also exports high-grade products overseas. These products are packed in containers and are transported from production sites to ports by rail, and then by sea to overseas ports.*

## Case study 3: Manufacturer C

*This group of companies manufactures basic chemical products in both the North and South Islands, from local and imported raw materials. The group has four main manufacturing sites, one in the South Island and three in the North Island, that are located close to port facilities. The group uses mainly the ports of Tauranga, Whangarei, Marsden Point and Bluff.*

*Apart from exporting some high-value products overseas, the majority of the products manufactured by the group are sold within New Zealand. Each year, they move about 50,000 million tonnes of products around the country using contracted third-party service providers. To assist with this task, they have established over 50 service centres and over 100 third-party consignment stores in many locations across New Zealand for the storage and distribution of the manufactured products. Once manufactured, products are distributed to stores throughout the country using these two distribution networks so that distances are shortened and transport needs are minimised. The group also owns a specialised aviation company for the distribution of some of its products.*

## Case study 4: Manufacturer D

*Nearly 90 percent of the beverages manufactured by this company are for export to overseas markets, mostly via Ports of Auckland. The company has two manufacturing sites, one in Marlborough and one in Auckland. Once manufactured, beverages are transported in bulk, primarily by rail, to the Auckland packaging facility, to minimise damage due to transport and to obtain benefits from economies of scale in the packaging process. Packaging materials are sourced mainly from domestic suppliers. All freight movements are contracted to third-party service providers. The company does not see transport cost as a major hindrance to its operation.*

*In a recent benchmarking survey for the industry, the average distribution cost is estimated at between one and five percent of turnover. Packaging, an important element for this industry, costs between 10 and 14 percent of turnover. There is an increasing trend to export products in bulk in recent years to reduce packaging and transport costs (and carbon footprints). This move could have unintended consequences associated with New Zealand's premium brand if the quality control and packaging procedures are less stringent overseas.*

## Case study 5: Primary producer A

*The group markets horticulture products for export to overseas markets. It has 2,700 New Zealand growers and a further 1,300 growers around the world. Growers deliver produce to the designated pack houses before transport to the nearest distribution centres for storage, redistribution and export. According to their annual reports, the costs of freight and distribution represent between 10 and 13 percent of annual turnover.*

*The group uses mainly the Port of Tauranga and occasionally also the ports of Marsden Point, Nelson and Gisborne. The product harvesting season is of approximately three months duration, commencing in mid-March. The shipping season begins in late March and lasts for up to seven months. Over 70 percent of the exports by weight are transported via chartered vessels in bulk, mainly by sea. The remaining cargoes are transported in containers by sea. The time slot and shipping space guaranteed from using chartered vessels mean that products can be delivered to markets at the highest quality with minimum damage due to delays.*

## Case study 6: Primary producer B – The forestry and logging industry

*Logs, wood and wood articles are New Zealand's third largest export commodity group, representing over five percent of the total value of merchandise exports. At present, the split of plantation forests by hectare between the North and South Islands is about 70:30. The majority of wood processors are located in the central North Island, Southland and Nelson-Marlborough regions, reflecting the locations of the wood supply. Given the locations of the plantations, around 95 percent of logs are transported by road, which costs from 18 to 24 cents to transport one cubic metre of wood over one kilometre[16]. The remaining five percent of domestic movements is carried by rail, mainly to ports for exports.*

*For the year ended March 2009, around one-third of harvested logs (in cubic volume) are exported in log form with the remaining amount processed in New Zealand into various wood articles and related products[17]. All log exports are transported by sea, with the majority (over 80 percent) going through the ports of Tauranga, Whangarei, Gisborne, Napier and Nelson.*

[16] NZFOA (2010)
[17] NZFOA (2010), "Facts and Figures 2009/10".

## Case study 7: Primary producer C – The dairy industry

*Milk powder, butter and cheese are New Zealand's largest export commodity, valued at around $8-9 billion per year and around 20 percent of the total value of merchandise exports.*

*The majority of the dairy cows are located in the South Auckland region, followed by Taranaki and North Canterbury[18]. The industry has 80 processing plants and some 20 manufacturing sites to process up to 3,000 tanker loads of milk a day during peak season. It also has 80 warehouses to coordinate and deliver products to over 140 overseas markets via 11 ports. To improve supply chain efficiency, the industry is looking to increase export volumes through the use of fewer export ports (Auckland, Tauranga, Lyttelton and Napier).*

*For domestic transport, the majority of products are transported by its tanker fleet (comprising over 400 milk tankers), which travels over 81 million kilometres per year to collect milk from various manufacturing sites. The industry pays extensive attention to tanker routing, allocation and scheduling to reduce costs and minimise movements, with the use of IT systems (Sankaran and Luxton, 2003). More recently, strategies have also been developed to minimise fuel use by pre-concentrating milk prior to transport, increasing the use of rail transport and progressively upgrading the tanker fleet. According to the industry's 2009 annual report, distribution expenses represent around three percent of total revenue from the sale of goods.*

## Case study 8: Fast moving consumable goods importer and retailer

*This company is a store-based retailer that sells mostly imported merchandise. The majority of the imports are transported by sea (in containers) and air transport is mainly used for high-value lightweight and perishable products. Each year this company imports over 10,000 twenty foot equivalent containers into the country. Approximately two-thirds of the containers go to the Auckland DC. The company also has three other DC's (two in the North Island and one in the South Island) to dispatch merchandise to its stores across the country. The company contracts delivery services to third-party providers and uses mainly road and, to a lesser extent, rail.*

## Case study 9: Fast moving consumable goods manufacturer

*This company manufactures food products in the Auckland region from local and imported materials. All imports go mainly through the ports of Auckland and Tauranga. To minimise the costs associated with distribution and storage, the company coordinates deliveries from its two distribution centres (DC's), located in Auckland and Christchurch, to customers or customers' DC's.*

*The majority of the company's sales go to the domestic market, with approximately 20 percent going to overseas markets by sea. Exports mainly go through the ports of Auckland and Tauranga. All freight movements are contracted to third-party service providers. For freight movements between DC's, the company uses mainly coastal shipping (around 80 percent) and rail (the remaining 20 percent). For freight movements between DC's and customers (mainly wholesalers), the company uses only road. The company also established a vendor network (six vendors in the North Island and one in the South Island) to deliver products to retailers.*

[18] Source: New Zealand Dairy Statistics 2008-09, p.12.

## Case study 10: Durable goods importer and distributor

*Based in the North Island, this company is a durable goods importer and distributor. The majority of the imports are transported by sea, mainly through the ports of Auckland and Lyttelton. Small and lightweight items are imported by air. The company has four major operations in the North Island. This includes a storage facility in Ports of Auckland, two processing and storage sites located away from the port (one of which also functions as a major distribution centre) and a National Customer Centre. In the South Island, the company has one contracted site (located at the port of Lyttelton) that functions as a storage centre, a processing site and a distribution centre.*

*The majority of the company's sales and activities take place in the North Island. Once imported, products that require little or no processing are transferred to the storage facility located at the port for immediate processing and direct distribution. Products that require a medium level of processing are transferred to a processing site that is away from, but relatively close to, the port for processing. Products that involve a higher level of processing are transferred to a bigger processing site that is further away from port for processing. To minimise movements, a degree of flexibility is exercised given the availability of processing facilities in various locations.*

*At present, the majority of domestic freight movements are transported by road, with a small percentage by coastal shipping. Air freight is used only for small and lightweight items. All freight movements are contracted to third-party service providers.*

## 3.4 The questions and information collected

Listed below are the topics covered in the interviews and the follow-up questionnaires:

- information about the company and the cargoes carried
- information about freight logistics provision and arrangement
- logistics costs information for international and domestic transport and mode share
- annual aggregate data[19] on:
    - financial performance
    - direct transport costs by mode
    - other logistics costs by item
- opinions on policies or regulations that have a significant impact on supply chain efficiency
- opinions on any changes in international freight transport and logistics practices that may affect logistics operations

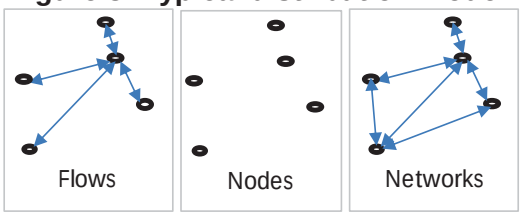
## 3.5 Feedback from respondents

### 3.5.1 Domestic transport logistics

The majority of the respondents adopt a network distribution model (Figure 8), in which distribution centres or warehouses are used to consolidate freight for specific regions, either after it arrives or before it leaves port. The routes used in this model could be either fixed or variable.

A small number of respondents adopt a flow distribution model. The major difference between a flow and a network model is that the former does not have inter-linkages between nodes. This is akin to a hub-and-spoke network. A flow distribution model can be efficient and effective for certain large-volume bulk cargoes. None of the respondents adopt a point-to-point or nodes system in their freight distribution.

**Figure 8: Typical distribution model**




Factors that affect distribution models and mode are the quantity of goods, cost efficiency, time sensitivity and the distance of travel. The majority of respondents favour road transport due to its flexibility and timeliness. However, respondents were keen to increase the use of rail and coastal shipping wherever possible, if the reliability of these services improves and freight rates become more competitive.

### 3.5.2 Choosing third-party logistics providers

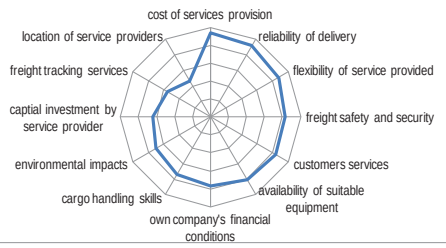
Respondents were asked to rank the relative importance of twelve key factors (Figure 9) that affect logistics services outsourcing decisions for each of the service types considered. After removing the ranking for the same service type by the same respondent, there are in total 18 sets of relative importance scores.

The top five factors respondents considered the most important were:

1. the cost of service provision
2. reliability of delivery
3. flexibility
4. freight safety and security, and customer service (fourth equal).

[19] For 2008/09 financial year or 2009 calendar year.

**Figure 9: Relative importance of factors affecting outsourcing decisions**




As noted earlier, cost is ranked fifth by freight owners when making a modal choice decision in Rockpoint (2009) but, once a mode is chosen, cost is ranked first when choosing transport service providers.

These rankings cover a range of domestic and international transport services and road, rail and sea modes.

Due to the small sample size, no further disaggregation of the relative importance scores by mode or service type has been made.

### 3.5.3 Opinions and comments related to supply chain efficiency

Table 4 summarises the feedback received from respondents on the factors they see as important regarding the efficiency and effectiveness of transport logistics.

Some of these factors will be analysed in detail in a companion paper that discusses regulation and freight transport.

**Table 4: Feedback on impediments to supply chain efficiency (by order of importance)**

| Impediment | Specific comments |
|---|---|
| Vehicle dimensions and mass | Some respondents suggested that further relaxation is required (e.g. increase the number of routes that allow longer and heavier vehicles). But this rule change is not relevant to industries with freight that is light and compact. |
| Port rationalisation | Some respondents thought that there were opportunities to increase efficiency if smaller ships were used to move products to hubs. But they were also cautious that hubbing in Australia would add journey time and reduce product shelf-life. Further, any reform would need to consider the potential impact of monopolistic behaviour. |
| Road user charges and fuel taxes | Some respondents see these as major cost components for road freight transport, especially for low-value heavy freight. |
| KiwiRail Group's performance | It was felt that KRG does not have the right quantity and quality of rolling stock to satisfy their needs, which has been causing undue delays and resulted in reduced use. |
| Emissions trading scheme | This may create an incentive for increasing coastal shipping and other carbon neutral options – but uncertainty with the shipping industry would discourage this move. |
| Shipping line consolidation | Potential negative implications for capacity and freight charges. |
| Shipping regulations | Some respondents thought that there was a need to maintain the ability to use international lines for transhipping. Some commented that they were not sure if oil pollution charges and maritime safety charges were correctly set. |
| Freight strategy | The lack of a national freight strategy creates uncertainty for port investment. |
| Economic conditions | The recession has impacted on shipping companies and services have been reduced as a result. This makes it difficult to get products to export destinations. |
| Others | Bio-security, data-sharing issues, free trade agreements, export regulations, ACC levies, holiday regulations and dangerous goods limits, etc were also mentioned as influential. |

## 3.6 Findings of the case studies

### 3.6.1 The importance of transport and freight logistics

*3.6.1a Share of total logistics costs in turnover*

Table 5 shows the share of transport and total logistics costs as a percentage of turnover, obtained from the case studies. Although the sample is extremely small (nine respondents provided six usable examples), the results are largely consistent with international findings.

From our sample, the weighted average total logistics costs as a percentage of annual turnover is 8.4 percent (the simple average of individual firms is 12.2 percent). The corresponding estimates for Finland and Norway are 14.2 percent, and it is between eight and 20 percent in the Baltic Sea Region (Table 6). Aligning with international findings and the discussion in Section 2.4, transport and total logistics costs vary significantly between industries.

**Table 5: Transport and total logistics costs as a percentage of turnover – 2009 estimates (indicative only)**

| % of turnover | Mean (note) | Weighted average (note) |
|---|---|---|
| Direct transport cost | 8.7 | 5.1 |
| Other logistics costs | 3.5 | 3.4 |
| Total logistics costs | 12.2 | 8.4 |

Note: Estimates in the column titled "mean" represent the simple averages of the individual responses. Estimates in the column titled "weighted average" are weighted by the size of the freight task.

The business survey did not provide enough information for estimating inventory holding costs. Based on an average two months' stock holding at a typical 0.03 percent value of cargo per day, the inventory holding costs could amount to another two percent of total turnover. This means transport cost as a percentage of total logistics costs will reduce to around 48 percent.

**Table 6: International findings on transport and total logistics costs**

| Reference | Country | Total logistics costs as a % of turnover | Transport cost as a % of total logistics costs |
|---|---|---|---|
| This study | NZ | 10.4 * | 48 |
| Ojala et al. (2007) for 2006/07 | Sweden | 11.0 | 35 |
| | Poland | 15.0 | |
| | Germany: (Mecklenburg – Vorpommern) | 20.0 | |
| | Finland | 13.5 | 40 |
| | Germany (Hamburg) | 12.5 | |
| | Estonia | 14.0 | |
| | Latvia | 12.0 | 50 |
| | Lithuania | 8.0 | ~ 60 |
| Solakivi, et al. (2009) for 2009 | Finland | 14.2 | ~ 40 |
| Hovi and Hansen (2010) for 2009 | Norway | 14.2 | 45 |
| CSIR (2010) for 2004-2008 | South Africa | 14.7 ** | ~ 50 |

* A 2% inventory holding cost is added to make it directly comparable with estimates from other countries.

** The estimate for South Africa represents total logistics costs as a percentage of gross domestic product.

*3.6.1b Share of transport costs in the total logistics cost*

The case study results (Table 7) show that the direct transport cost is a major component of total logistics costs and bio-security is the second highest logistics cost item, followed by warehousing. On the other hand, port charges and insurance represent a relatively small share in the total logistics costs. The relative importance of various cost factors is broadly consistent with international findings.

**Table 7: Share of total logistics costs and turnover by cost component – 2009 estimates (indicative only)**

| Weighted average % (Note 1) | Share of total logistics costs (%) | Share of turnover (%) |
|---|---|---|
| Direct transport cost | | |
| – international | 47.8 | 4.1 |
| – domestic | 12.1 | 1.0 |
| *Sub-total* | *59.9* | 5.1 |
| Customs, duties and bio-security (Note 2) | 21.3 | 1.8 |
| Warehousing | 10.6 | 0.9 |
| Port charges (Note 3) | 6.3 | 0.5 |
| Logistics, administration and information | 1.4 | 0.1 |
| Insurance | 0.40 | 0.03 |
| Total | 100 | 8.4 |

Notes:

1. All estimates are weighted by the size of the freight task.
2. This includes charges imposed by government agencies and private sector firms and includes both domestic and international components.
3. The estimated port charges as a percentage of total logistics costs may be biased upward, as the estimate includes a company that uses chartered vessels.

Estimate of transport costs as a percentage of total logistics costs is largely consistent with international findings.

The share of costs for domestic and international components varies significantly between companies[20] and is dependent on the nature of the business and the level of domestic and/or international trade engagement. It also varies with location decisions and distribution needs and models.

The results show that domestic transport costs for the surveyed businesses are relatively small, around 1 percent of total turnover (or 12 percent of total logistics costs).

In aggregate, warehousing, bio-security and logistics information represent around one-third of the total logistics costs.

### 3.6.2 Domestic direct transport costs

*3.6.2a Road transport costs*

In the follow-up questionnaire, five respondents provided a total of 11 usable examples of typical road transport routes and their direct transport costs, along with information on the freight itself. The average unit cost of road transport varies from $0.10 to $0.80 per tonne-kilometre (see Figure 10). As all the respondents outsource their trucking services, these averages relate to the direct freight charges paid to truck operators and therefore include all operating costs plus value-added[21] by the truck operators.

[20] At the individual company level, domestic transport costs vary between 2 percent and 100 percent. On average (weighted by the size of freight task), they are only about 20 percent (or 12.1 percent of total logistics costs).

[21] For most companies, it is generally more economical to outsource trucking services because truck operators can achieve better

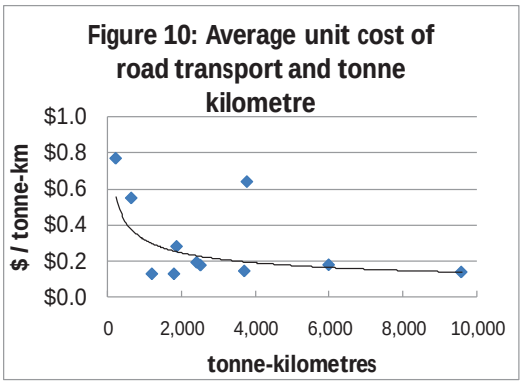



Figure 10 shows that the average road transport cost per net tonne-kilometre can be quite high for small distances or low tonne-kilometres. This is not surprising because the share of fixed costs will be higher for low volumes (either in distance or net tonne-kilometres).

It also shows that the average cost per net tonne-kilometre trends towards $0.15 as volume increases. Incidentally, this is similar to the figures discussed in section 2.4.

### *3.6.2b Rail and maritime transport costs*

There is insufficient information available on domestic rail and maritime transport costs.

### *3.6.2c Costs of freight transfer between modes*

The cost estimates discussed in Section 3.6.1a are for road journeys within the North or South Islands, and do not include any journeys that require freight transfer between modes. Our survey suggests that such costs can contribute to between 10 and 30 percent of total logistics costs.

economies of scale, by maximising the average load factor through the integration of different freight tasks. The value-added component can be viewed as the minimal resource requirement if these services were carried out in-house.

## 4 Summary

Listed below are the key insights from the literature review.

- The key factors that affect transport costs include distance, delivery time, fuel price, cargo value and weight, the direction of freight routes, and load factor.
- Location decisions, an efficient distribution process and better information management can help to improve logistics efficiency by reducing the costs associated with inventory holdings and storage.
- For international maritime transport, trade statistics confirm that the costs of transport and insurance as a percentage of goods value vary with distance and commodities. For most products, it varies between 5 and 10 percent. For products that have a low value-to-weight ratio (such as fertilisers), the percentage can increase to 30 – 35 percent.
- For domestic transport, the cost to freight owners is the lowest for coastal shipping, followed by rail and road. However, coastal shipping also has the longest delivery times. For example, the total time required, including waiting time, cargo aggregation and exchange, for moving cargoes between Auckland and Christchurch is around 1.2, 2 and 9.5 days for road, rail and coastal shipping, respectively.

Listed below are the key insights from the case studies.

- Total logistics costs (excluding inventory holding costs) represent around 8.4 percent of the total turnover of the surveyed businesses.
- Transport is an important part of logistics and supply chain management, and contributes to around 60 percent of total logistics costs (excluding inventory holding costs).
- However, the transport cost only amounts to a small part of total turnover, estimated at 5.1 percent (4.1 percent for international transport and 1 percent for domestic transport).
- Costs associated with customs and bio-security represent around 1.8 percent of total turnover.
- Port charges, warehousing and logistics administration each represent less than one percent of total turnover.
- Estimates of transport and total logistics costs as a percentage of turnover vary with commodities. For commodities with a low value-to-weight ratio (such as wood products and fertilisers), transport and total logistics costs can be significant.
- The case studies identified costs, reliability, flexibility, security and customer service as the top five factors that affect the choice of third-party logistics service providers.

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