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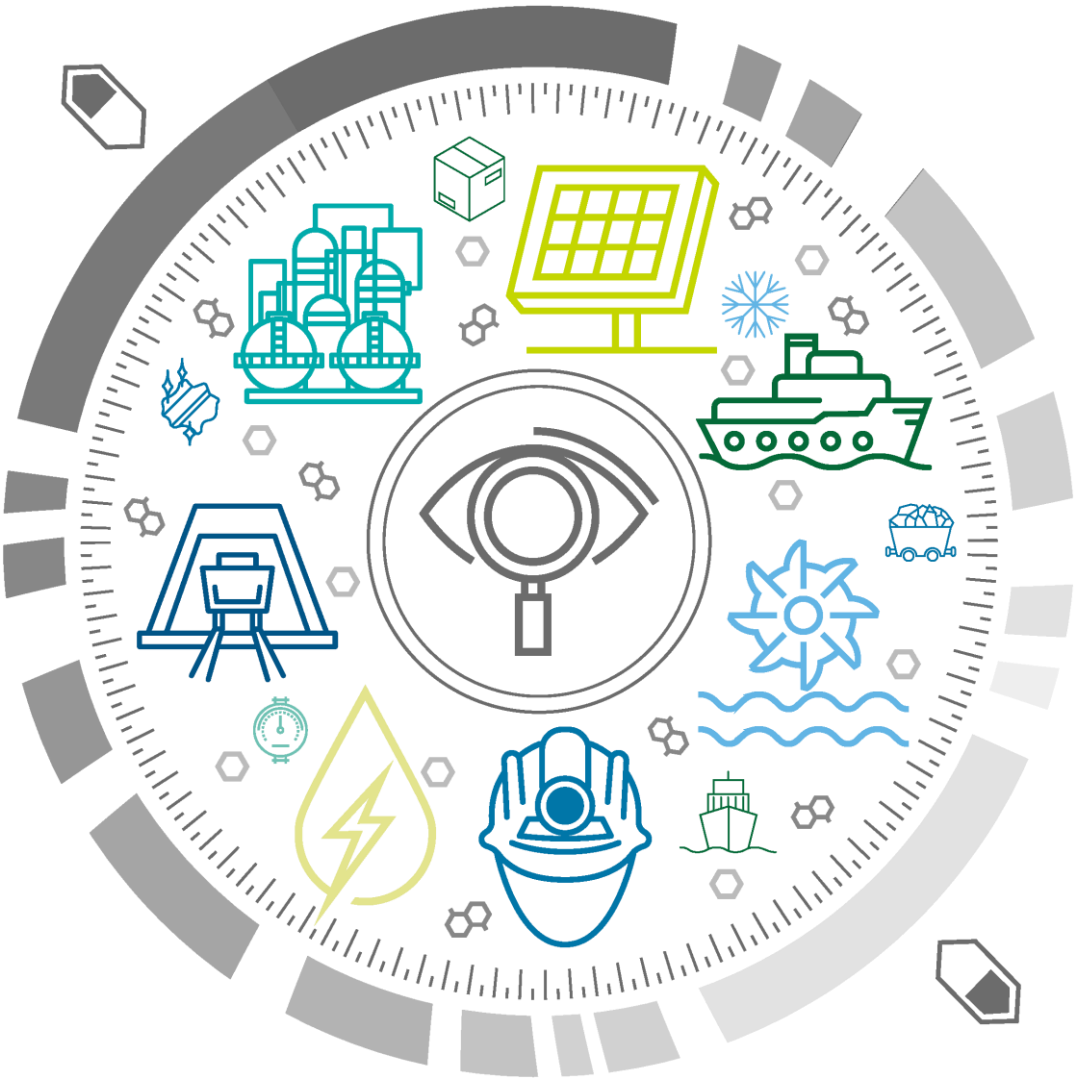


Developing the Freight Sector Elements

FINAL REPORT

September 2020

Contents

Glossary

Term	Description
3PLs	Third-Party Logistics
ACCC	Australian Competition and Consumer Commission
AI	Artificial Intelligence
AMP	Alternative Maritime Power
BEVs	Battery Electric Vehicles
BRI	Belt and Road Initiative
CDP	Carbon Disclosure Project
CNG	Compressed Natural Gas
CO2	Carbon Dioxide
ESC	Essential Services Commission
ESPO	European Sea Ports Organisation
ETA	Estimated Time of Arrival
EU	Europe Union
FCEV	Fuel Cell Electric Vehicle
FMC	Federal Maritime Commission
GDP	Gross Domestic Product
GPS	Global Positioning System
HPFV	High Productivity Freight Vehicles
ICTSI	International Container Terminal Services
IMEX	Import/Export
IMO	International Maritime Organisation
IoT	Internet of Things
LCVs	Light Commercial Vehicles
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MIRRAT	Melbourne International RoRo Automotive Terminal
MPA	Maritime and Port Authority of Singapore
MPI	Ministry for Primary Industries
NAFTA	North American Free Trade Agreement
NOx	Nitrogen Oxide
NYU	New York University
NZTA	New Zealand Transport Agency
NZX	New Zealand Exchange
OOCL	Orient Overseas Container Line
PM	Particulate Matter
PoLA	Port of Los Angeles
PoM	Port of Melbourne
PTP	Port of Tanjung Pelepas
RPA	Robotics Process Automation
TEU	Twenty-foot Equivalent Unit
UCCs	Urban Consolidation Centres

UK	United Kingdom
US	United States
VICT	Victoria International Container Terminal
VPCM	Victorian Ports Corporation (Melbourne)

Executive Summary

Context

The New Zealand Infrastructure Commission (Infracom) has been tasked with developing a 30-year infrastructure strategy for New Zealand. The intent of the Strategy is to identify:

- The ability of existing infrastructure to meet community expectations
- Current and future needs and priorities
- Barriers which could impede the delivery of infrastructure and services.

The Strategy will look at long term trends that will impact on infrastructure requirements, such as climate change, new technologies and changes in demographics.

This report has been commissioned to look at the freight sector elements of the national infrastructure. The report identifies international "megatrends" in the sector and assesses their likely impact on the New Zealand freight and ports sector. The report also looks at the international trends in port ownership and operating models and makes a comparison between these trends and the current situation in New Zealand.

It is intended that this report will be one of many pieces of work that Infracom will undertake over the next few months to help to prepare the 30-year infrastructure strategy. The information gathered in this report will guide Infracom on where to focus its next steps in information gathering.

Method of Analysis

The approach to the work entailed three clear areas of investigation:

A high-level review of the New Zealand freight sector including: the role of road, rail and port infrastructure; analysis of freight movements, and identification of the distinguishing characteristics of the New Zealand situation, and how these have shaped the country's freight infrastructure.

Identification of international mega trends in freight and port grouped into four 'themes', these are: evolving global trade patterns, freight industry commerciality, digitisation of supply chains, and social and environmental impacts. An assessment of the likely implications for New Zealand of these mega-trends has also been considered.

A review of current international trends in port ownership and governance, focussing on how these trends are impacting private sector investment in ports. A summary of New Zealand's port sector ownership and governance structures has also been provided.

The information for the review has been gathered through extensive desk top research, and input from Deloitte's subject matter experts.

New Zealand's Freight and Logistics Sector

New Zealand's geography has shaped its freight infrastructure and the freight and logistics sector more generally. New Zealand's varied terrain has placed a need for infrastructure that can facilitate steep gradients and narrow winding corridors. This has contributed to a network of hinterland ports that traditionally service regional economies.

New Zealand's Freight Infrastructure Network

Port network 	• This report identifies 13 main commercial ports handling around 3m IMEX TEU per annum (in aggregate) and 50 mtpa of bulk and break-bulk products (including forestry and mining products). • The Port of Tauranga and Port of Auckland handle over half of the country's IMEX container volumes (~63%). • The regional ports service predominately agricultural and forestry-based exports (both containerised and bulk). Most imports arrive through either the Ports of Auckland or Tauranga
Rail network 	• Rail is responsible for approximately 6% of the freight task in terms of tonnes, or 12% in terms of tonne-kms. • The network is owned and operated by KiwiRail, a State-Owned Enterprise. • The network is narrow gauge and has a relatively low (compared to international standards) 18 tonne axle load rating (or gross weight per wagon of approx. 72 tonnes).
Road network 	• The road network plays a vital role in the NZ freight task, carrying 93% of the NZ freight task in terms of tonnage. • The state highway network is the responsibility of the NZTA and comprises 11,000 kilometres of road. • The road network can handle vehicles with gross weights of up to 50 tonnes on approved areas of the network.
Coastal shipping network 	• Coastal shipping is responsible for approximately 2% of the NZ freight task in terms of tonnage or 13% in terms of tonnes-kms. • Comprises domestic bulk and intermodal cargoes, the movement of containers from feeder ports to international ports for transhipment and repositioning of empty containers. • Domestic bulk movements mostly consist of petroleum product t originating from the Northland refinery and cement movements.
Air freight network 	• Air freight accounts for 0.3% of New Zealand's trade by weight and 21% of trade by value. • Commodities predominantly comprise fish, fruit and vegetables, machinery (and components) and electrical items • While there are some dedicated airfreight services the majority of airfreight is carried in the holds of passenger aircraft.

In terms of the freight task, the forestry and agricultural sectors are key generators of freight, with much of it destined for export. Log and wood, for example, represents 50% of New Zealand's exports in terms of volume.

Megatrends in the Freight and Logistics Sector

The megatrends analysed in this report are grouped into four categories:

Evolving global trade

Freight industry commerciality

Digitisation of the supply chain

Shifts in consumer preference and sustainable practices

The COVID 19 pandemic has, and will continue to have, a major disruptive impact on the sector. The responses to the pandemic, such as remote working, contactless documentation, "on-shoring" of supply chains, to name a few, are accelerating several the megatrends identified in this report.

1. Evolving global trade

The global freight task is experiencing significant change. Economic centres will shift as a result of faster population growth in emerging regions. This will impact trade flows and key freight routes.

In parallel a rise in geo-political complexities is leading to a shift towards national protectionism. For example, the multi-year trade tensions between the US and China is already driving a 'decoupling' of these global economies.

Population growth in Africa will account for 66% of worldwide population growth over the next 40 years, while Europe's population will shrink.

It is expected that global trade will continue to increase, and demographic trends will offset any political destabilising factors and barriers.

2. Freight industry commerciality

Ongoing price pressures generated by a globally evolving freight and logistics industry is forcing the sector to adapt. This has largely been driven through scale and operational efficiencies:

- **Scale efficiencies:** The sector is witnessing a strong trend towards scale efficiencies particularly in the shipping industry. Major shipping lines are forming strategic alliances with their competitors, to capture new cost efficiencies through slot chartering and vessel sharing. This is becoming increasingly pertinent as ship sizes increase.
- **Operating efficiencies**: The freight and logistics sector is also improving its operational efficiency through the ongoing growth in containerised cargo and new fuel types (such as hydrogen).

Over 80% of the world's container trade is handled by three strategic shipping alliances:

1. *The 2M Alliance: Maersk, MSC and Hyundai*
2. *Ocean Alliance: CMA, CGM, COSCO, Evergreen and OOCL*
3. *THE Alliance: Hapag-Lloyd, Yang Ming, Ocean Network Express and MOL*

The pursuit for scale and operational efficiency particularly in the shipping industry will place financial pressure on ports - the bargaining power of the three alliances will threaten port fees and the increasing size of ships will drive the need for investment in new port infrastructure. Ports will also need to capture larger import and export volumes to increase their commercial attractiveness to shipping lines and to justify new capital investment.

3. Digitisation of the supply chain

In the rapidly transforming manufacturing and logistics landscape, data-driven solutions are becoming the new normal.

As much as 90% of all data was created in the last two years, largely due to a substantial increase in computing power.

Digitisation refers to the use of the digital world to inform decision making and streamline processes. The increasingly rapid development of cheap technologies has enabled more processes, machinery and equipment to generate virtual data, facilitating the development of 'smart' and automated systems.

The benefits from the use of upcoming disruptive technologies are vast including, for example:

- Less 'slack' in the system traditionally arising from human error or inefficiency - this will mean that margins can be tighter (with supply chain cost savings ultimately passed through to the consumer)
- Better management of vehicles, vessels and equipment will also result in productivity improvements and a reduced carbon footprint.

In the long-term, digitisation will facilitate transparency and collaboration across the supply chain, which will unlock new efficiencies for all players and enhance service offerings for consumers.

These benefits will only be realised to the extent that there is participation from the parties along the value chain – lack of co-operation is likely to serve as a key barrier to globally connected supply chains.

4. Shifts in consumer preference and sustainable practice

Customers are demanding more transparency, control and convenience as supply chains become more sophisticated – this will inevitably define the future of the movement of goods.

Unilever estimates that as much as 70% of its carbon emissions footprint depends on the products that the consumer chooses to purchase.

The consumer's need for supply chain transparency is driven by the preference for locally produced and eco-friendly products. The need for control and convenience has been fuelled by e-commerce giants such as Amazon, who have disrupted the industry by offering customers end-to-end logistics services that are flexible and fast. The success of these services will drive significant change in business models over the next 30 years.

The sector will also see a significant change in operations to reduce its carbon footprint. A global transition to a cleaner and greener sector is underway – this is led by increased international maritime environmental regulations for sulphur emissions. However, pressure from society is likely to grow, as younger generations will directly feel the impacts of climate change.

International trends in port ownership and competition

Traditionally, due to the strategic nature of ports, governments around the world have played a major role in port ownership and operation. However, since the 1980's the sector has seen major reform and privatisations.

To enable private sector participation, governments have adopted operating models that ensure ongoing public ownership and control of strategic assets (such as port land, shipping channels, and seabed) freeing up terminal and landside operations for private investors.

Investors in port terminal operations tend to come from the shipping, freight and logistics sectors. Taking the form of shipping lines vertically integrating through ownership and control of port terminal operations, and/or terminal specialists developing international networks through ownership of terminals at several ports around the world.

Institutional investors have also participated strongly in the sector where governments have entered into long term leases of port land (and other assets) with investors who are seeking stable and predictable returns (such as superannuation funds, pensions funds, sovereign wealth funds and life insurers).

At the same time competition between container ports has increased as shipping lines seek lower fees and more efficient port operations. Ports are actively seeking increased volumes to ensure return on investment in new facilities and technologies.

Competition can take the form of both inter-port competition and intra-port competition. Inter-port competition is most common where competing ports have access to the hinterland of neighbouring ports, this access is often enhanced through the development of intermodal 'inland' ports, which enable the ports to transport cargoes longer distance on lower cost rail services, and as a result expand their natural hinterlands. Intra-port competition tends to occur where there is enough volume of cargo (and space) to allow two or more terminal operators in the same port. Shipping lines can then choose the best service and price offering for their needs.

Like the international market, New Zealand's port ownership and competitive dynamics are complicated and evolving. Unlike international trends there has been limited private investment and disaggregation of operating models in the New Zealand port sector. All the New Zealand ports analysed in this report are majority owned by local government or community interests. Four ports are partially privately owned through public listings on the New Zealand stock exchange. Furthermore, there has not been a move to disaggregate stevedoring/cargo handling operations from the marine operations and landlord functions, as has been common overseas.

Due to the relative proximity of ports, there is considerable inter-port competition. This has been further enhanced by the major ports (Auckland, Tauranga and Lyttelton) investing in networks of inland ports to expand their hinterland's and increase cargo volumes. This expansion of the major ports is placing considerable pressure on smaller ports, particularly when faced with the requirement to make new investments in infrastructure to meet the changing needs of shipping lines (for example to accommodate larger vessels).

Where to next?

A key aspect of Infracom's mandate in developing the 30-year Infrastructure Strategy it to identify barriers which could impede the delivery of infrastructure and services. This report has highlighted several areas where potential barriers may arise. It is recommended that a more detailed examination (including stakeholder engagement) of the following areas will provide Infracom with a richer base of knowledge on which to develop the freight elements of the Strategy.

1) Adequacy of the method and level of public and private **investment in rail and road infrastructure** to meet the growing demands of the freight sector, particularly considering changing demographics and productive regions, and increasing competition between ports. The new arrangements for rail and road funding outlined in the NZ Rail Plan, marks a significant change in the way rail infrastructure is funded. The effectiveness of this change will require scrutiny over the medium term to ensure the anticipated benefits are realised, and that both modes continue to efficiently support freight supply chains.
2) Development of **infrastructure to support emerging "green" fuel sources**, such as electric and hydrogen propulsion systems, including distribution of new fuel types. The private sector is likely to play a key role in this area; however, appropriate policy settings and regulatory support will be required to facilitate investment. Early examination of possible government interventions to help enable this emerging sector, may facilitate private investment in the future.
3) **Barriers to adoption of new technologies and digitisation of supply chains**, such as block chain technology and IoT. Better understanding of the enablers behind investment in these technologies may help government to identify initiatives and policy settings to encourage investment. For example, the scale of freight operations in New Zealand (road, rail and port) may inhibit the adoption of these new technologies. Likewise, lack of collaboration between freight sector operators may be reducing the benefits from digitisation of supply chains.

4) The transition of the industry from traditional operations of trains, trucks, and port equipment to new technologies such as autonomous vehicles and robotics, will require **a new type of workforce**. Forecasting the next generation of skills required by the industry, will help educators to prepare suitable training, help to identify new career paths, and encourage more people into the sector.
5) **Limited private ownership in ports** may inhibit the sector's ability to respond to the changing demands of international supply chains, such as investment in new plant and equipment to meet the needs of larger vessels, or investment in new technologies to increase productivity of operations and provide better information to customers. Examination of the effects of port ownership models on investment, competition and supply chain efficiency will provide government with critical information in developing road map for the future. Critical to this analysis would be detailed consultation with industry to gain deeper insights into the key drivers of individual business models, and how these may impact the sector.

A more detailed examination of these potential barriers would further inform Infracom in its examination of current and future infrastructure requirements.

1 Introduction

1.1 Purpose of the Report

New Zealand Infrastructure Commission (Infracom) has been tasked with developing a 30-year Infrastructure Strategy (the Strategy) to replace the government's current 30-year plan. The first plan will be reported to government by the end of 2021, and thereafter at least every 5 years.

The Strategy will assess the ability of existing infrastructure to meet current and future needs and will also look at the barriers that could impede the delivery of new infrastructure.

The purpose of this report is to commence development of a body of information to inform the freight sector elements of the Strategy. This report takes a high-level look at the existing freight infrastructure (ports, rail and road), it makes a broad assessment of international trends and highlights areas where these trends may have implications for New Zealand.

1.2 Approach to the Report

The approach to undertaking this assessment has been to focus on global freight megatrends grouped into four key themes: evolving global trade, freight industry commerciality, digitisation of supply chains, and social and environmental impacts.

A high-level examination of the New Zealand freight sector 'landscape' has been undertaken considering these trends to identify likely impacts and implications for ports and the freight system.

The report also provides an overview of New Zealand port ownership and governance models as compared to port operating models elsewhere around the world.

The analysis has been undertaken entirely through literature and desktop research, and with input from subject matter experts.

2 The New Zealand Freight Sector

New Zealand's geography has shaped its freight infrastructure

New Zealand's geography, demographics and agricultural sector have to a large extent dictated the evolution of the country's freight infrastructure.

Figure 1: Map of New Zealand

New Zealand is a long-thin country (it is over 2,000 km from Cape Reinga to Bluff and is approximately 450 km across at its widest part) see Figure 1. It is also a country of islands with varied topography often requiring road and rail infrastructure to be constructed over rugged terrain and unstable ground conditions, resulting in steep gradients and narrow winding corridors. Further, the main freight link between the North and South Islands is by roll-on roll-off (RoPax) shipping – adding further complications to freight transport within New Zealand.

These conditions have meant that ports have traditionally been a critical part of the New Zealand transport infrastructure, not only for import and export goods, but also for the distribution of freight within the country.

2.1 Freight infrastructure assets

All three modes; road, rail and sea are critical to the efficient distribution of freight throughout New Zealand and internationally. Air freight also plays an important role, particularly for trade in high value perishable goods, such as seafood and electrical items.

Ports

New Zealand is unique in that it has 13 main commercial ports nationally, all within proximity to each other. This varies to nearby jurisdictions, such as Australia, which has eight key ports over a much larger land mass.

During 2019 the nine ports involved in international containers handled throughput of 3.24m TEU (total throughput of full and empty TEU).

The Ports of Auckland and Tauranga combined accounted 63% of all container movements in 2019. Up until 2014 Ports of Auckland was the largest container port in New Zealand. Port of Tauranga has since surpassed Auckland, driven mainly by a high level of exports. In 2017, the Port of Tauranga became the first in New Zealand to handle more than 1 million TEU.

By world standards, New Zealand's ports are small. Shanghai, China's leading port in TEU throughput, handling almost 40 million TEU per annum (2020). Port of Rotterdam is one of Europe's largest container ports, handling around 15 million TEU (2020). More locally, in 2020 the PoM handled around 3m TEU for a similar population catchment.

The regional nature of New Zealand's port network has persisted; its regional ports export large amounts of agricultural products both containerised cargo (such as dairy, meat, fish, fruit and foodstuffs) and bulk (which is primarily timber products).

New Zealand's port locations are outlined in Figure 2.

Figure 2: Location of New Zealand ports and associated trade

1 Northport

Deep-sea port that handles a wide range of cargoes including logs, woodchip, veneer, coal, kiwifruit, cement and fertiliser.

2 Ports of Auckland

First port of call for a number of international services. Strong import port that services Auckland and regions beyond.

3 Port of Tauranga

Largest port in the country in terms of cargo volume, and container throughput.

4 Eastland Port

Second largest log exporter in New Zealand, located in Gisborne City.

5 Port Taranaki

Only deep-water port on New Zealans's western seaboard and services bulk liquids, dry bulk and project cargo.

6 Port of Napier

Key trades include agricultural produce and forestry. Its productive hinterland drive throughput.

7 CentrePort

Deep-water port in Wellington. Primarily bulk cargoes such as export logs.

8 Port Nelson

Port that supports several key industries in the region including forestry, fishing and pip fruit.

9 Port Marlborough

Deep-water port in Picton. Main cargo handled is export logs.

10 Lyttelton Port

Largest coal export facility in New Zealand. Container cargo includes dairy, vegetables, fruit foodstuffs.

11 Primeport Timaru

Deep-sea port that handles a wide range of cargoes including logs, woodchip, coal, kiwifruit, cement and fertiliser.

12 Port Otago

Primary products for export from the region's catchment. This includes dairy, meat, fish, apples and processed timber.

13 South Port

Services a hinterland yielding forestry, fish and meat exports. Imports include oil, feed stock and services NZAS's aluminium smelter.

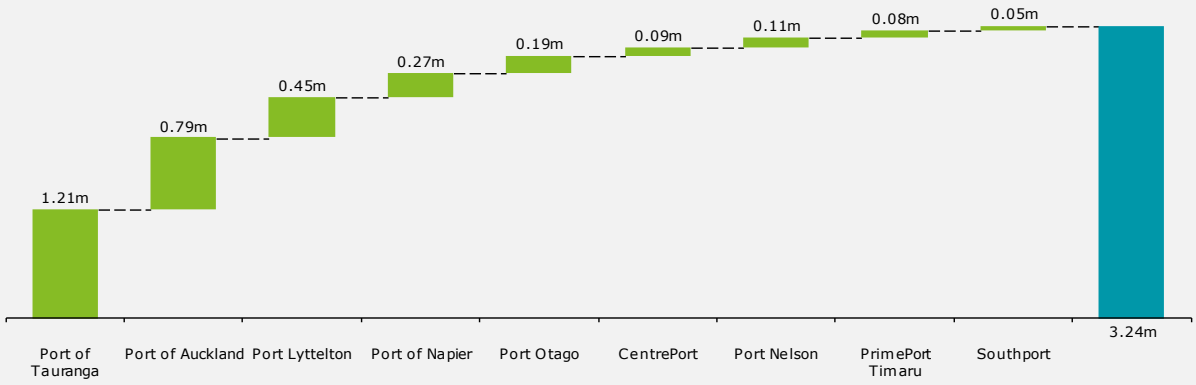
Bulk Container

Trade volumes through New Zealand ports – Q2 2019

Container Trade

- Port of Tauranga and Port of Auckland hold 62% of New Zealand's total TEUs (~3.2m)
- 65% of this trade is handled by ships larger than 4,000 TEU (increasing from 34% in Q3 2014). In 2019 Maersk upgraded the weekly 'Southern Star' service with 5,900 TEU Rio class vessels calling at Tauranga, Napier, Lyttelton and Port Otago
- Figure 3 outlines the breakdown by port of container trade in New Zealand.

Figure 3: Container trade in New Zealand: Rolling annual container trade handled at New Zealand ports Q2 2019 (TEU)

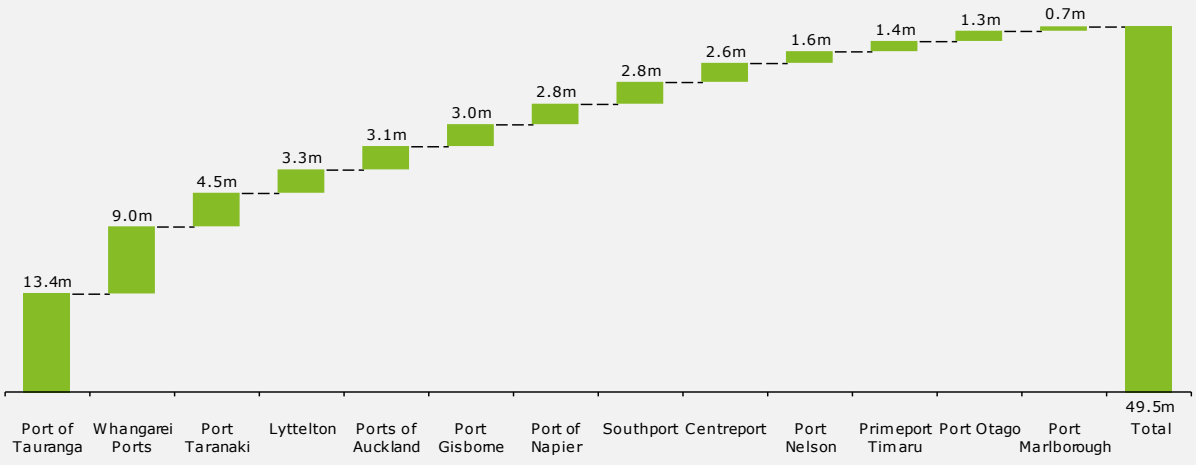


Source: FIGS Data. Adapted by Deloitte.

Bulk Trade

- Port of Tauranga holds 27% of New Zealand import and export (IMEX) bulk commodity (predominately wood products) in terms of market share. This includes domestic deliveries of oil from Marsden Point (noting, petroleum product is also transported by pipeline to Wiri, Auckland)
- Coastal volumes are dominated by bulk trades in petroleum products from the refinery at Marsden Point (Whangarei) and cement from Portland (Whangarei). There is also some intermodal domestic freight carried on dedicated coastal services as well as coastal freight carrier on international carriers.
- Figure 4 outlines the breakdown by port of bulk trade in New Zealand.

Figure 4: Rolling annual bulk trade handled at New Zealand ports Q2 2019 (tonnes)



Rail

KiwiRail is the national freight rail service provider in New Zealand, operating as a State-Owned Enterprise.

KiwiRail assets include:

- 4,000 km of track
- 198 locomotives
- 4,585 freight wagons.

Rail plays a major role for the delivery of items in international trade, particularly exports (both bulk and containerised), to and from most ports. KiwiRail assets serve nearly every port in the country, excluding Northport, Eastland Port and Port Nelson, see Figure 5.

New Zealand's rail network differs to similar jurisdictions due to its private siding services; for example, Fonterra has structured its supply chain around direct access to rail services (which means no need for pick-up and delivery by road, reducing costs).

Similarly, the countries topography has influenced design characteristics of the network.

New Zealand's entire rail network is of narrow-gauge. While this enables tighter curves to navigate New Zealand's varied topography, it is somewhat unique when compared to other jurisdictions, as seen in Table 1.

Figure 5: New Zealand's Rail Network

Table 1: Average track gauge comparison across jurisdictions

Country	Narrow (600mm – 1,067mm)	Standard (1,435mm)	Broad (1,495mm – 1,676mm)
New Zealand	✓		
Australia	✓	✓	✓
Europe		✓	
North America		✓	
South Africa	✓		
China		✓	
India			✓

Most of the network has a maximum axle load of 18 tonnes, allowing for a gross weight per wagon of around 72 tonnes. This is low compared to similar narrow-gauge networks, constraining the efficiency of the network. For example, Queensland, one of Australia's narrow-gauge networks, has a maximum axle load of 26.5 tonne, allowing it to carry a gross weight per wagon of 100 tonnes on its heavy haul coal routes. Its standard freight lines have an axle load limit of 20 tonnes.

The recent Future of Rail Review and subsequent Draft New Zealand Rail Plan recognise the importance of both the road and rail networks. The review recommended major changes in the way that investment in rail is planned and funded. It proposes to consider road and rail investment in a co-ordinated manner, by including rail network investment under the long-term land transport planning and funding framework in the Land Transport Management Act.

Historically rail network funding has been undertaken on a year to year basis with investment for specific projects made by the Crown supplemented by targeted Government spending. As a result, the condition of KiwiRail's asset are slowly declining, resulting in declining service levels and reducing competitiveness of rail freight services. The proposed changes in funding under the plan will enable more effective long-term planning and facilitate investment in, track and structures, new locomotives and wagons and new interisland ferries[1].

Road

The road network plays a vital role in linking the ports to inland markets and production facilities. Containerised IMEX freight is carried over the majority of New Zealand's state highway network and many local roads.

The state highway network is the responsibility of NZTA and has almost 11,000 kilometres of road, with 5,981 kilometres in the North Island and 4,924 kilometres in the South Island. It links almost 83,000 kilometres of local roads - 17,298 kilometres urban and 65,600 kilometres rural.

According to the World Economic Forum Global Competitiveness Report, the quality of New Zealand's road asset ranks high relative to its rail network – although has some way to go to compete on an international scale (ranking 52nd out of 141 countries).

The average heavy vehicle speed in New Zealand decreased between 2005 and 2015, as described in Table 2.

Table 2: Average heavy vehicle speeds (km/hr)

	2005	2010	2015
Open Road Average Heavy Vehicle Speeds	88.9	89.2	87.9
Urban Road Average Heavy Vehicle Speeds	51.0	49.7	46.8

Source: Ministry of Transport Speed Survey Results

It has, however, seen a rise in the use of HPFV in recent times that can carry a maximum gross weight of 50 tonnes on New Zealand roads (dubbed 50MAX trucks). This has enabled payload increases of up to 20%. Operation of these vehicles is subject to special permit over specific routes.

Coastal shipping

Coastal shipping is an important mode of transport for New Zealand freight movement given its challenging geography.

Shipping services are provided by both New Zealand based ship operators and the international shipping lines. The New Zealand operators tend to concentrate on the movement of domestic cargoes, whereas the international lines primarily reposition empty containers to where the cargo is located (for example empty repositioning from Ports of Auckland and Tauranga to the South Island ports), or tranship loaded export containers to utilise international services.

New Zealand also ships large amounts of bulk products domestically. Domestic transport of petroleum products is primarily from the Northland refinery via pipeline to Auckland and Auckland Airport and coastal distribution across the country. Cement is manufactured at a plant in Northland for distribution by coastal ships and then road and rail.

New Zealand's coastal ship operators include:

- **Coastal Bulk Shipping:** Operates the MV Anatoki which carries bulk cargo such as wheat, dolomite, cement and fertiliser

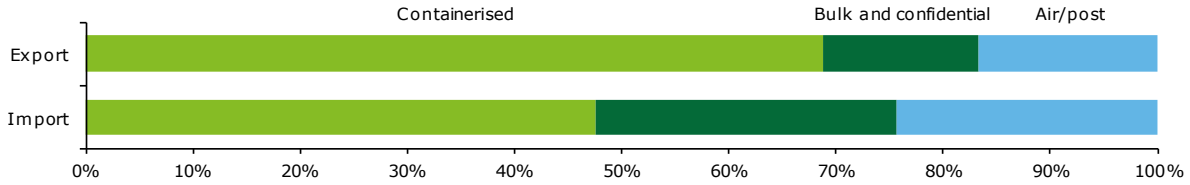
[1] Source: The Draft New Zealand Rail Plan 2019, Ministry of Transport

- **Golden Bay Cement:** Operates a bulk carrier out of NorthPort
- **Holcim:** Carries cement to ports around New Zealand
- **Interislander (KiwiRail):** Ships heavy vehicles, passenger vehicles, and railway wagons between Wellington and Picton
- **Pacifica Shipping:** Coastal ship operator and domestic cargo carrier around the country
- **Silver Fern Shipping:** Moves more than 2 million tonnes of oil products from Marsden Point to ports around New Zealand
- **Bluebridge (Strait NZ):** Ships heavy vehicles, livestock, containers and other roll-on, roll-off freight between Wellington and Picton.

Air freight

Air freight plays a key role in New Zealand's international trade for high value products which require a short time to market. Although airfreight only accounts for 0.3% of New Zealand's trade by weight, it accounts for 21% of trade by value. This is demonstrated in Figure 6.

Figure 6: IMEX split between containers, bulk and air in terms of value



Source: FIGS

Air freight rates are typically 10-20 times higher than sea freight. For example, goods exported to Shanghai generally have sea freight rates of 0.10 ($NZD/kg), whereas airfreight rates tend to be 2.06 ($NZD/kg).

The commodities transported by air freight are perishable and non-perishable – predominately fish, fruit and vegetables, machinery (and components) and electrical items.

While there are some dedicated airfreight services the majority of airfreight is carried in the holds of passenger aircraft. Tasman Cargo Airlines and two other commercial airlines dominate these services in New Zealand.

There is often some uncertainty regarding the movement of goods by passenger aircraft. For example, passenger baggage takes priority in the holds of the aircraft and the amount of baggage on commercial flights is often unknown until shortly before departure.

The volumes carried by air fluctuate yearly, but have generally been stable, with imports declining slightly and exports rising slightly. However, air freight's total international trade by volume has declined from a peak of 0.55% in 1998 to under 0.3% in 2015. In contrast, sea freight volume growth has been consistently strong.

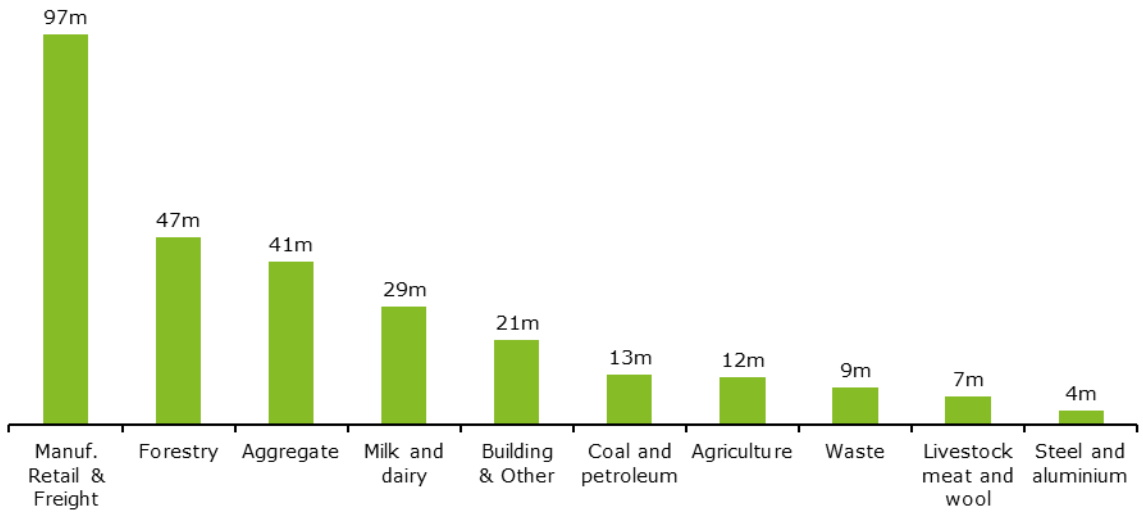
The movements of air freight is largely concentrated at Auckland Airport, handling 80% to 85% of air traffic in terms of value. This is followed by Christchurch Airport which handles nearly all the balance.

COVID 19, and the collapse of international air services, has had a catastrophic impact on air freight. In recognition of the importance of air freight to the New Zealand economy the government has implemented a financial support package (International Air Freight Capacity (IAFC)) to support 70 weekly international flights as at the beginning of August.

2.2 New Zealand Freight Task

New Zealand's freight task (by volume) as identified in the National Freight Demand Study is set out in Figure 7. Manufacturing retail dominates the freight task, followed by forestry aggregates and dairy products.

Figure 7: New Zealand Freight Task 2017/18 (tonnes)



Source: National Freight Demand Study 2017/18

Log and wood products representing over 50% of New Zealand's exports in terms of volume (tonnes)[2].

Clear patterns are evident in domestic freight flows. Primary producing areas generate flows to export ports, typically via processing facilities. Population is a major driver of both consumption and manufacturing activity.

As a result, domestic freight tends to flow from Auckland to points further south, with an imbalance of freight moving north to south, leading to an excess capacity on the south to north routes (particularly out of the South Island).

The Auckland region accounts for 37%[3] of New Zealand's population and is its major manufacturing centre. Around 50% of New Zealand's population is located in the three adjacent regions of Auckland, Waikato and Bay of Plenty (i.e. the 'Golden Triangle') making these three regions a major generator of both demand and supply of goods. For example, Auckland, Waikato and Bay of Plenty produce 45% of New Zealand's freight tonnage from the agricultural and forestry industries in the region.

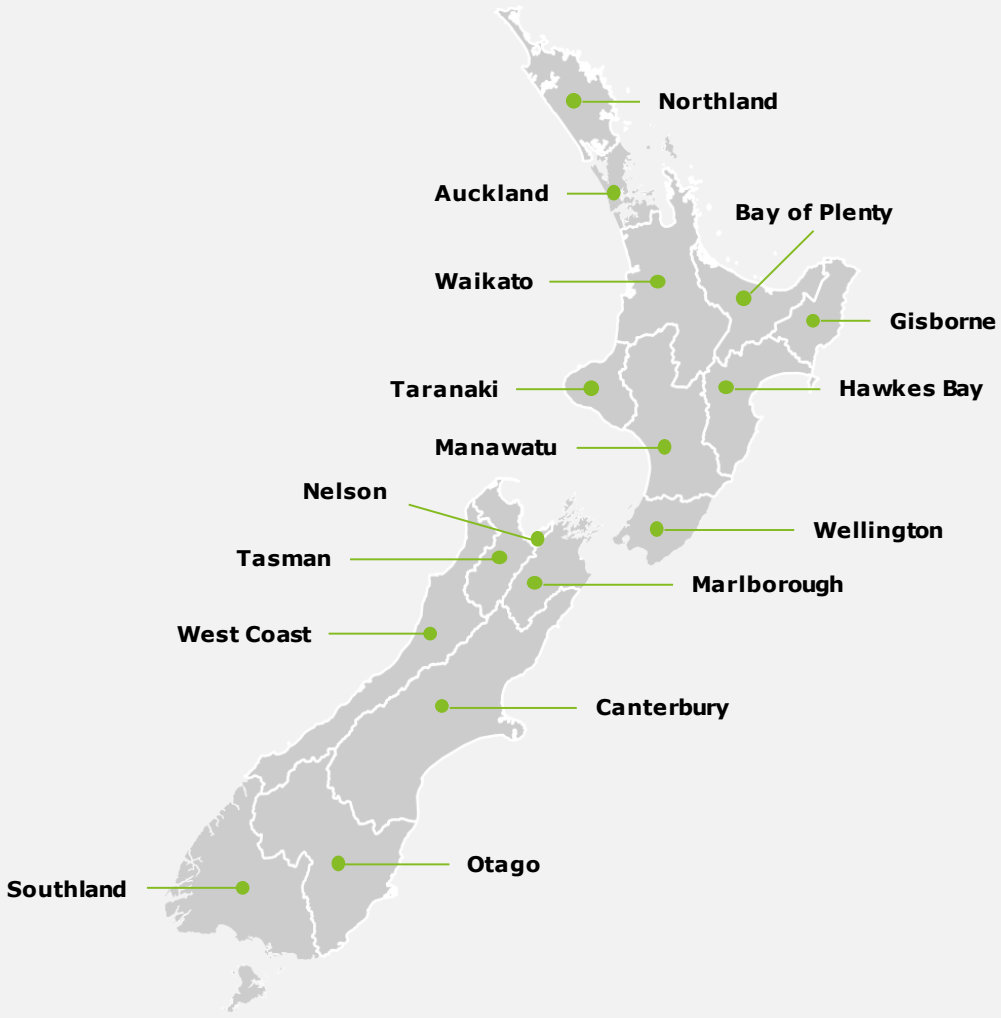
Other key regions for the freight task in New Zealand are summarised on the following page, as described in the Deloitte Freight Yearbook 2020[4]:

[2] FIGS data
[3] 2018 Census data
[4] 2020 Ports and Freight Yearbook. Accessed at https://www2.deloitte.com/nz/en/pages/finance/articles/new-zealand-ports-and-freight-yearbook.html

Key New Zealand freight IMEX regions

- **Canterbury** is the dominant freight generator in the South Island producing 15% of the national freight task
- **Waikato**, **Taranaki**, **Manawatu**, and **Southland** are well-suited to dairy production, as is **Canterbury** if suitable irrigation is available
- This is similar for forestry, where warm climate and lower-value land have attracted substantial plantings in: **Northland; Waikato; Bay of Plenty; Gisborne; Hawkes Bay; and Tasman / Nelson / Marlborough**
- Crude oil flows are either a direct export (from **Taranaki**) or direct import (to **Marsden Point** in **Northland**). Domestic transport of petroleum products is primarily from the Northland refinery via pipeline and coastal distribution, with a rising direct import share, and then by truck to the nation's service stations
- Cement is manufactured at a plant in **Northland** for distribution by coastal ships and then transported by road and rail. Cement was also manufactured in the **West Coast** of the South Island but this has been superseded by direct import
- **Southland** hosts the Tiwai Point Aluminium Smelter which generates import and export flows.

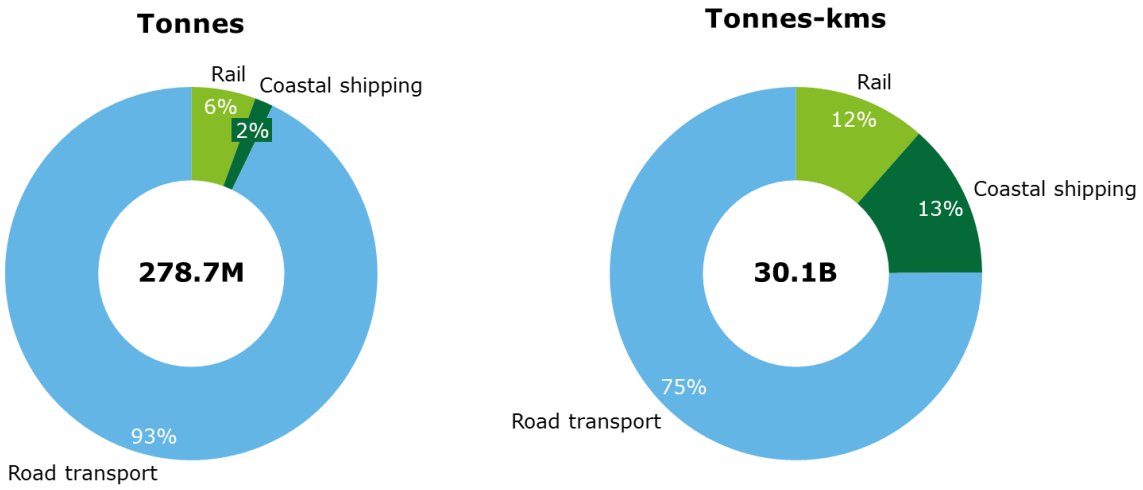
Figure 8: New Zealand regions



2.2.1 Domestic freight

The total scale of the domestic freight task in New Zealand (containerised and bulk/confidential freight only) was estimated in the National Freight Demand Study 2017/18 to be 278.7M tonnes or 30.1B tonne-kms. The freight task is split across road, rail and coastal shipping, with road being the dominant mode, as shown in Figure 9.

Figure 9: New Zealand freight task split across road, rail and coastal shipping



Source: National Freight Demand Study 2017/18

2.2.2 International trade

New Zealand's international freight trade is predominately undertaken in containers, however there are also large volumes of break bulk exports (particularly from the forestry sector), with smaller volumes of export coal.

2.2.2.1 NZ sea export volumes and values

New Zealand's containerised export volumes tend to be high density food or fibre products requiring the use of smaller TEU containers and often require refrigeration. Due to this strong agricultural base, most exports originate in the regional areas where goods are processed. Agricultural exports tend to flow to the nearest port due to the higher cost of land transport.

As demonstrated in Figure 10, trade export volumes grew steadily, with growth of 2.7% in the year ending March 2019. Wood products are the largest export volume and have been growing from 2016 through to Q1 2019. Dairy volumes have also had strong growth in the past few years and were up by 4.2% from the previous 12 months as at Q1 2019.

Figure 11 demonstrates that dairy is the largest export by value, at $15b in the year to March 2019. The value of fish, fruit & vegetables and other animal products is second to dairy, reaching $12.5b in the year to March 2019.

More recently, commodity markets have weakened in response to uncertainties associated with the outbreak of the coronavirus, which has weighed on prices of key NZ exports.

These factors (New Zealand's geography, demographics and dispersed agricultural industry) have resulted in a relatively large number of small ports servicing the export market.

Figure 10: NZ sea exports by volume

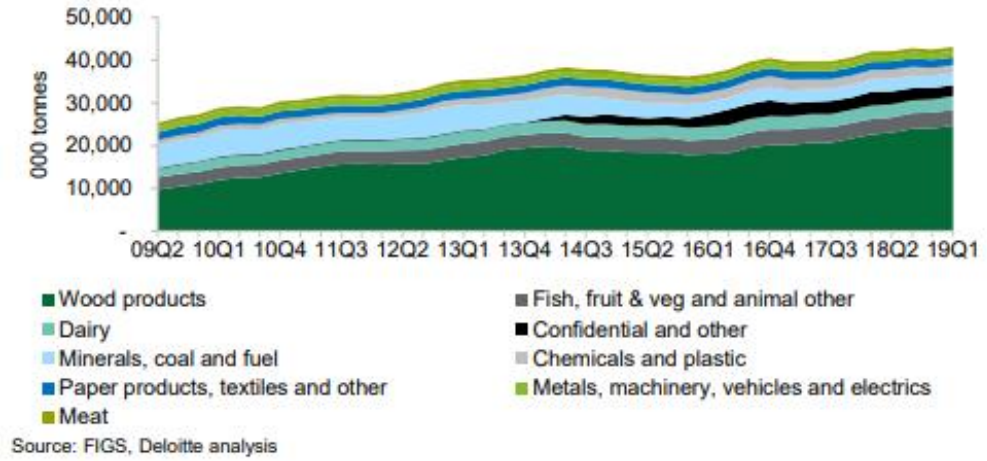
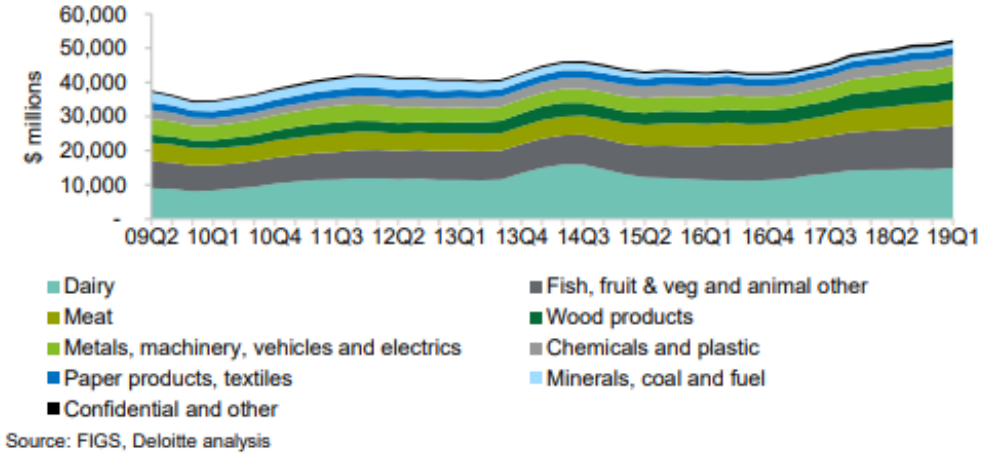


Figure 11: NZ sea exports by value



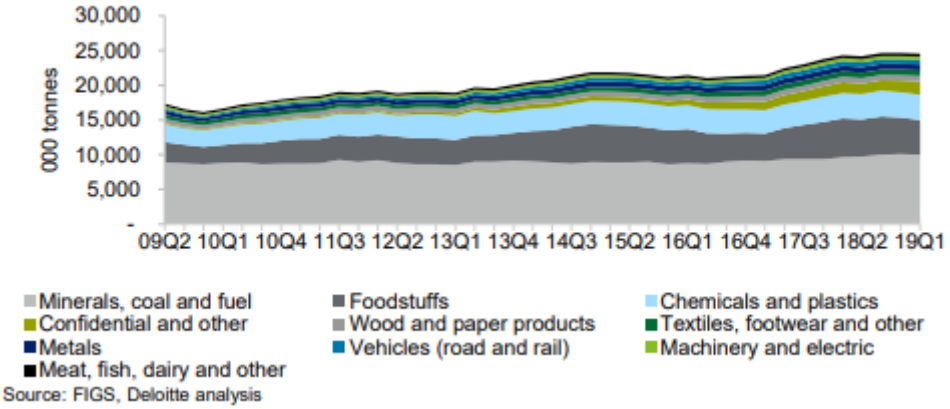
2.2.2.2 NZ sea import volumes and values

In the three years to March 2019, the average growth for total import volumes was 2.7% per annum. This growth was supported by strong GDP growth, increasing wealth, and a fast-growing population. Minerals, coal and fuel remains the largest import volume category, accounting for around 40% of imports.

As demonstrated in Figure 12, minerals, coal and fuel remain the largest import volume category, accounting for around 40% of imports. This is followed by demand for foodstuffs which has fluctuated in volume over the past 10 years.

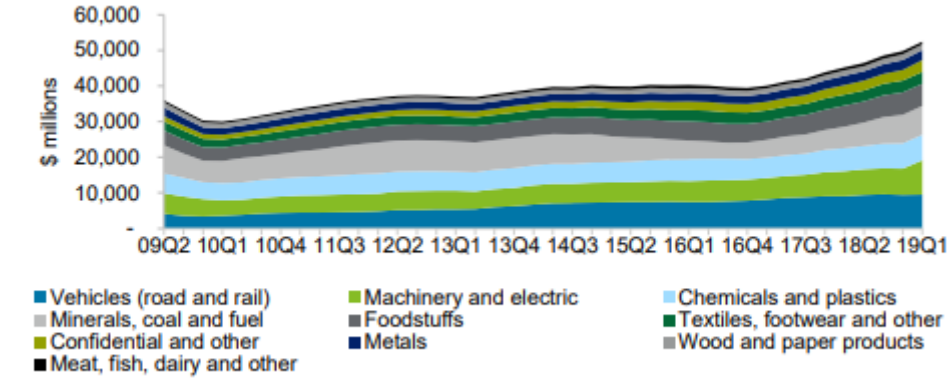
In terms of value, vehicles are the highest value import and have continued to increase over the past ten years. Machinery and electrics are the second highest value import into New Zealand and have grown slightly more than vehicle imports and population growth in New Zealand.

Figure 12: NZ sea imports by volume



Source: FIGS, Deloitte analysis

Figure 13: NZ sea exports by value



Source: FIGS, Deloitte analysis

3 Freight Industry Megatrends

There are four key megatrends that, together, will have the biggest impact on the industry over the next 30 years

The purpose of this section is to unravel the megatrend landscape for the global freight and logistics sector for the next 30 years.

While undertaking a comprehensive assessment of the impact of COVID 19 on the sector is not part of the scope of this report. However, the pandemic is, and will continue, to have a major impact on the sector in the short to medium term. Several themes are emerging as the key areas of impact on the sector, these include:

- Disruption to international supply chains (as countries moved into lockdown) has highlighted the risks "off-shoring" and the need to consider future diversification of supply chains. Even prior to the COVID pandemic a move away from supply from China to countries like Mexico and Vietnam was emerging (due to lower relative wages), this trend is now likely to accelerate
- The freight and logistic sector is considered an essential industry (to ensure supply of food and other commodities) – as such the sector has had to very quickly adapt systems and processes to ensure workers and customers do not become exposed to the virus. This has included specialised training and the implementation of control measures such as the adoption of digitisation of documentation and contactless payment and communication systems. All accelerating pre-COVID trends
- COVID 19 has prompted the even faster adoption of e-commerce, requiring shorter delivery times, smaller consignment sizes, more warehousing (often smaller) and closer to the homes of consumers
- The almost total collapse of the passenger air industry has exposed the reliance of some supply chains on the cargo carrying services of passenger aircraft. For example, the export of high value seafood, and the importation of pharmaceuticals – to resolve this issue the New Zealand government is supporting over 70 weekly international cargo flights
- The medium- and longer-term financial outlook for sector operators is unclear due to the volatility in freight volumes and additional cost of catering for the COVID requirements.

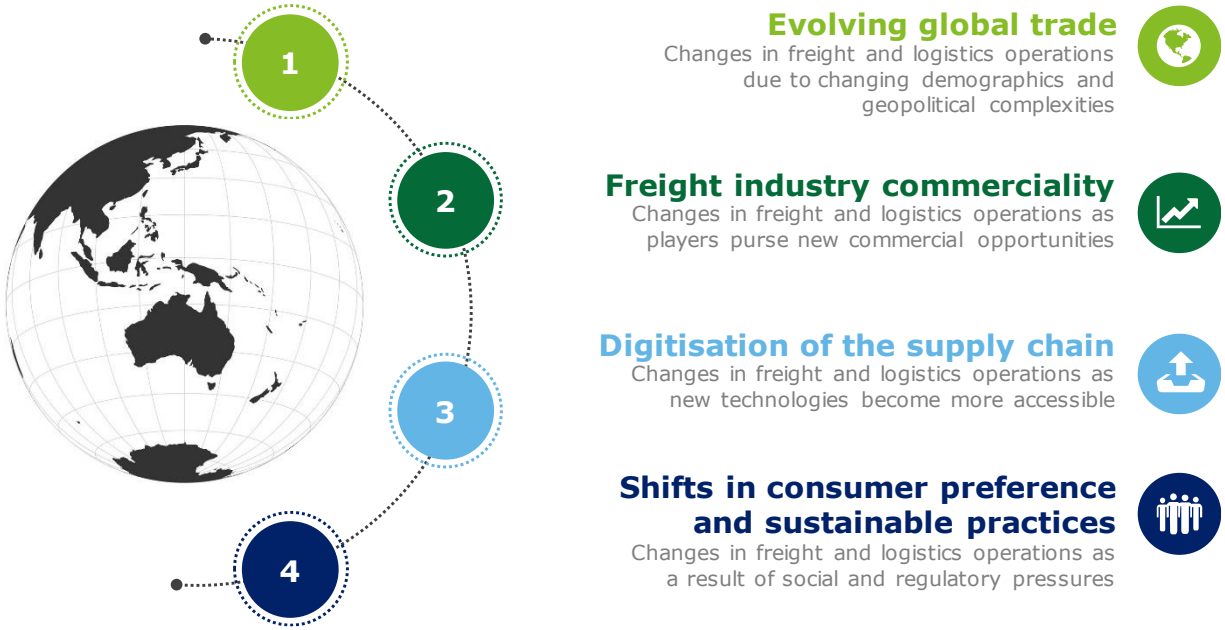
These themes and trends continue to emerge as the response to pandemic changes and it is not yet clear what medium and long term impacts these factors will have on the global freight and logistics sector in general and New Zealand specifically.

The traditional freight and logistics sector is changing, driven by economic, demographic, technological and sustainability drivers. The number of trends that will influence the sector over the next 30 years is immense given the time horizon and speed at which change is now taking place.

However, it is expected that four key megatrends will jointly influence the outlook of the industry the most; evolving global trade, freight industry commerciality, digitisation of the supply chain, and shifts in consumer preference and sustainable practices.

The following section details each megatrend.

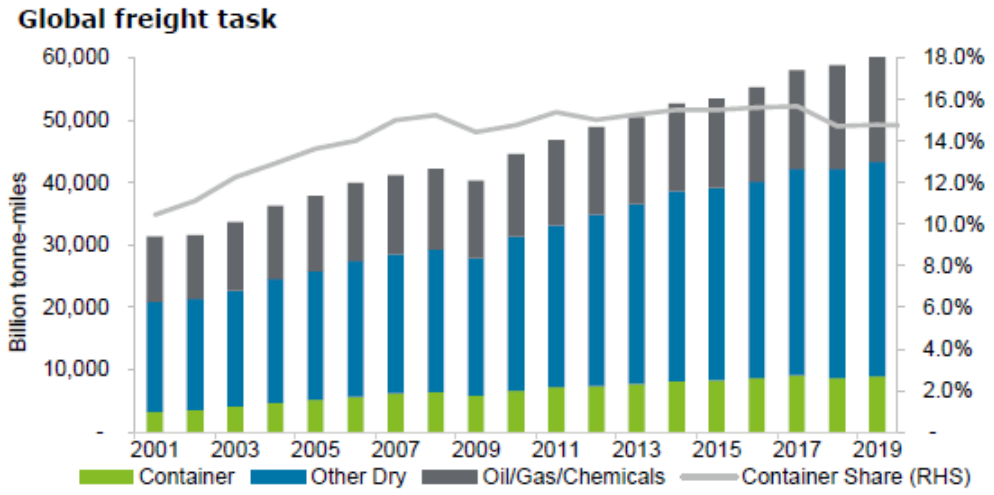
Figure 14: Key megatrends in the freight and logistics sector



3.1 Evolving global trade

The Global freight trade task has doubled this century with growth witnessed across all freight sectors. Figure 15 highlights the growing global freight task over the last 20 years.

Figure 15: Percentage growth of the global freight trade



Source: The shipbuilders association of Japan, adapted by Deloitte for the 2020 New Zealand Ports and Freight Yearbook

Two key drivers of global trade growth and change include:

- A changing, growing and increasingly urban worldwide population
- Geo-political complexities leading to a shift towards national protectionism.

It is expected that global trade will continue to increase, and demographic trends will offset any political destabilising factors and barriers, growth in global trade may exceed growth in worldwide

goods production. In the longer term increased global trade will continue the development of truly global citizens.

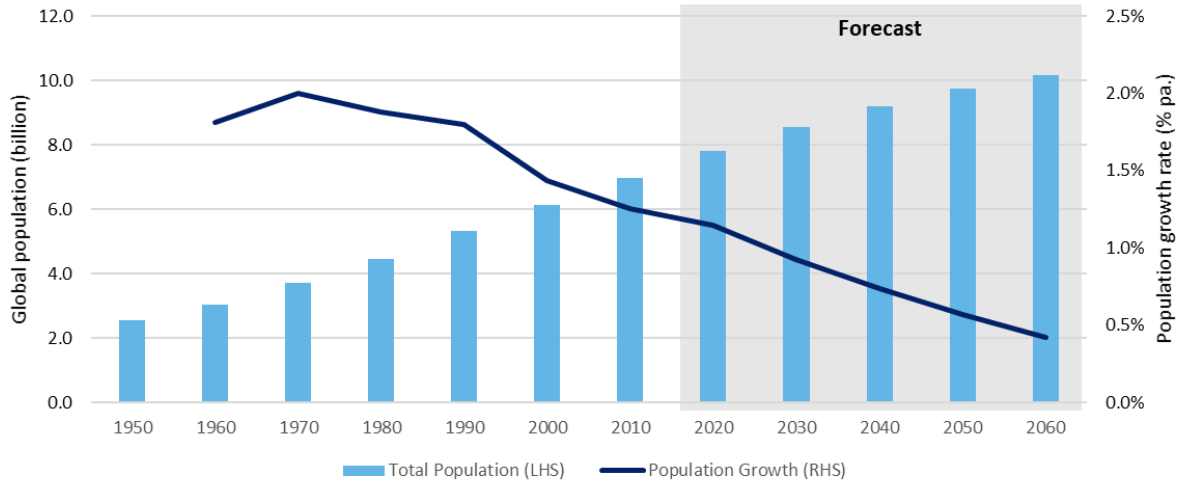
3.1.1 Demographics

Demographic factors including population growth and increasing worldwide urbanisation will continue to fuel changing supply and demand for freight movements and result in shifting economic centres and flows of trade. The search for lower production and labour cost will result in changes in key freight routes. Areas of low-cost production will require imports of raw materials which will be converted into exports.

Growing, Aging Population

Worldwide population is expected to increase although at a slower growth rate than has been previously witnessed, see Figure 16. The United Nations 'World Population prospectus 2019' forecasts that worldwide population will increase by 30% to reach 10 billion before 2060. However, this large increase represents a diminishing rate of worldwide population growth, with the average annual growth rate over the next 30 years estimated to be 0.7% per annum, down from 1.3% per annum witnessed over the previous 30 years.

Figure 16: Population growth



Source: 'World Population Prospectus', United Nations 2019

The growth in population will be driven primarily through substantial growth in Africa (accounts for 66% of worldwide population growth over the next 40 years) and continued growth in Asia (28% of total growth). By contrast, European population is forecast to decrease in size. Table 3 outlines the forecasted change in population growth across various regions.

Table 3: Region population growth

Region	2020 population (forecast, bn)	2060 population (forecast, bn)	Increase in population (bn)	Increase (%)
Africa	1.34	2.90	1.56	116.7%
Oceania	0.04	0.06	0.02	44.4%
North America	0.37	0.44	0.07	19.1%
Central and South America	0.65	0.77	0.11	17.4%
Asia	4.64	5.29	0.65	14.0%
Europe	0.75	0.69	-0.06	-7.9%
Worldwide	**7.79**	**10.15**	**2.36**	**30.2%**

Source: 'World Population Prospects: the 2019 Revision', United Nations

By 2060, it is forecast that over 80% of the world's population will be located in Asia and Africa, requiring a significant investment in new and existing social and transport infrastructure which will result in a drastic shift in global freight supply and demand trends. Key shipping and freight movements between traditional freight routes, such as between Europe and the NAFTA, will play a less prominent part within the global supply chain as new origin and destinations for goods emerge due to changing supply and demand pressures.

In addition, due to decreasing fertility and increasing longevity, the world population will also undergo a shift in population age. Almost every county will experience an increase in the population of older persons and by 2050 16% of the worldwide population will be over the age of 65, increased from 9% in 2019[5]. An aging population poses significant challenges and transformation opportunities for nearly all sectors including labour markets and the demand for goods and services.

Urbanisation

There will also be a trend towards urbanisation of the world population, ratcheting existing pressure on scarce land resources and transportation linkages. By 2060 it is expected that over 60% of the world's population will live in urbanised locations[6], a 50% increase from the current proportion of urbanised population. A large factor in this growth is the increasing urbanisation of China that is expected to continue.

3.1.2 Geo-political complexities

Historical international trade agreements have helped facilitate growth in global trade, however increasing political uncertainty and economic imbalances have created an increasing protectionist view on global trade. Recent geo-political developments which are shifting the global perspective on trade include:

- Multi-year trade tensions between the US and China, two of the world's economic superpowers. In general, trade wars are now seen as one of the biggest risks to the global economic outlook. Where globalisation had been the dominant theme in recent decades, the past couple of years have seen a rise in 'decoupling' of global economies. Increasing political uncertainty[7]

[5] 'World Population Prospects: the 2019 Revision', United Nations

[6] Worldbank, based on United Nations 2015 data and United Nations 'The World Cities (2018)'

[7] 2020 Ports and Freight Yearbook. Accessed at https://www2.deloitte.com/nz/en/pages/finance/articles/new-zealand-ports-and-freight-yearbook.html

- One of the main political threats remains Brexit, which has added significant uncertainty to Europe's economic outlook, which was already weak. While the EU and the UK currently remain in a transition single bloc for market and customs purposes until the end of 2020, a new trade deal will need to be negotiated between the UK and EU
- COVID-19 has unimaginably impacted countries worldwide including slashing GDP figures and warping reliance on freight and logistic networks, while changing the way countries view global trade. It is too early to comprehend the lasting implications of COVID-19, but it is expected to permanently change the way society operates with a subsequent impact on freight networks.

To counteract the changing power and economic balance, larger countries are undertaking steps to secure their position in future global trade networks. A key example of protectionism in the freight sector is the BRI being undertaken by China (see case study below)

Case Study: The Belt and Road Initiative

As part of its foreign policy and economic strategy, China is undertaking the BRI to improve and secure their connectivity with the world and future trade networks, through the financing and construction of a network of road, rail, airports and ports across Asia, Oceania, Europe and Africa. This is designed to improve connectivity and economic flow amongst these regions and help secure China's access to raw materials and labour markets, further impacting the changing nature of global trade.

The goal of the initiative is to build six economic corridors across the globe, with 'belt' overland networks connecting Asia and Russia, and the 'road' sea and port routes connecting the belt network to the globe. Originally the BRI emphasised:

- Deepening social and cultural exchanges
- Forging infrastructure and facilities networks
- Enhancing financial cooperation
- Coordinating development policies
- Strengthening investment and trade relations.

There are varied global views regarding the BRI. Supporters of the initiative believe that it provides much needed infrastructure and the accommodating economic aid to countries without the financial means to finance the works themselves.

Critics of the initiative have criticised the BRI as purely serving China's own interests and mainly as a strategic program with questions surrounding the long-term purpose of the BRI for China. On an economic front there is concern that China is using its massive financial power to dominate smaller economies and obtain long-term control of key strategic infrastructure through offering undesirable terms on their loans.

Source: 'China's One Belt, One Road Initiative', Parliament of Australia

3.1.3 What does this mean for the Global Freight Sector?

Population increases focused on Africa and Asia will continue to drive growth in the freight sector but will force supply chain networks to shift geographically to meet the changing supply and demand patterns for goods. Furthermore, an aging population that is becoming more urbanised will additionally impact supply and demand of various good. The freight sector will witness increased trade flows due to these demographic changes, however it will need to remain flexible and aware of potential opportunities to align more closely with global transformations. In addition, the expansion of freight transportation network capacity will need to closer align with the changing import and export forces created through demographic, wealth and political trends.

The implications of geo-political changes on the freight network will need to be monitored in the future. Historically, the relaxation of trade restrictions between countries has fed growing international freight networks and enabling greater global citizenship. Yet, recent shifts including

trade wars and changing political and economic power has resulted in countries adopting a counteractive protectionism approach to global trade.

3.2 Freight industry commerciality

Ongoing price pressures generated by a globally evolving freight and logistics industry is forcing the sector to adapt. In response, there has been a two-fold focus within the sector; chasing scale and volume whilst improving operating efficiencies, all with the end goal of improved and sustainable profitability.

3.2.1 Chasing Scale

Scale and its associated economic benefits to the freight industry has been pursued through:

- Alliancing and horizontal collaboration across the freight sector
- Increasing shipping vessel sizes
- Aggregating supply chains through expanding commercial hinterlands.

Alliance and horizontal collaboration

Over the previous decades, there has been a consolidation of capacity amongst the largest shipping companies. In early 2016, the twenty largest shipping companies controlled approximately 86% of global container shipping, an increase from 56% in 1990 and 26% in 1980[8] (with the three largest shipping companies currently supplying 40% of the global fleet).

Coupled with the increasing market capacity share held by the largest suppliers, there is a growing trend of horizontal collaboration (or alliancing) in the freight industry, in the continued quest for scale to alleviate pressures on margins. This is most prevalent in the shipping industry, where the following three alliances collectively control 80% of global containership capacity, 90% of Trans-Pacific trade and 96% of Asia-Europe Trade[9]:

- The Alliance
  - Ocean Network Express
  - Hapag-Lloyd
  - Yang Ming.
- 2M
  - Maersk
  - Mediterranean Shipping Company.
- Ocean Alliance
  - OOCL
  - Cosco Shipping
  - CMA CGM
  - Evergreen.

Alliancing arrangements include slot chartering and vessel sharing between alliance members, allowing the members access to a larger number of services while potentially improving the utilisation of their vessels without investing significant capital. Similarly, horizontal collaboration is occurring within other elements of the freight supply chain, with ports operators around the world undertaking joint projects and mergers.

While there are clear economic and operational advantages for major shipping lines to form alliances, the scale and bargaining power of the alliances creates imbalances within the sector as ports feel pressure to reduce rates for services and invest in new infrastructure to remain commercially attractive.

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[8] 'The impact of five mega trends on the container industry, white paper – The Port of Rotterdam, 2019'

[9] 2020 Ports and Freight Yearbook. Accessed at https://www2.deloitte.com/nz/en/pages/finance/articles/new-zealand-ports-and-freight-yearbook.html

It is unclear whether the largest shipping companies will see continued value in alliancing and horizontal collaboration if they continue to grow their share of market capacity and undertake ongoing acquisition of smaller shipping companies.

Increasing vessel sizes

At a shipping industry level, ship sizes continue to increase as shipping lines chase the economies of scale that are provided by larger capacity vessels. Increasing ship sizes provide operators cost efficiencies for fuel, labour and emissions. The increase in maximum container vessel capacity over the last 15 years equates to a 7% annual increase, with the largest TEU capacity ship capable of carrying over 23,500 TEU.

The chase for scale has created two distinct ship size categories, the large ships (larger than 8,000 TEU) which are utilised on high demand international routes (east – west trades) and the smaller ships (less than 4,000 TEU) which operate (north – south trades) as feeder ships that service smaller and regional ports, see Table 4 below.

Table 4: Container ships on order, January 2017 TEU capacity

TEU capacity	Number of vessels	% of total TEU capacity on order
0 – 3,999	239	15%
4,000 – 5,999	9	2%
6,000 – 7,999	1	<1%
8,000 – 11,999	53	18%
12,000 – 15,999	60	26%
>16,000	62	38%

Source: Adapted by Deloitte from Drewry, Container Ship Fleet Forecast and Maritime Economic Assessment, 2017

There are a range of wider industry costs that accompany the increasing ship sizes. As the ships get larger there is a need for the supporting infrastructure to proportionally increase in scale. Larger ships need deeper and wider channels and shipping lanes, larger and stronger berth faces and bigger cranes. In addition, there is a flow-on effect for the other elements of the freight supply chain including higher peak workflows, faster handling requirements to meet terminal dwell times and enough storage and handling capacity.

In addition to the wider infrastructure implications and accessibility issues, there is a reducing economy of scale as vessel size continues to increase requiring a minimum utilisation rate for financial viability.

While the current industry trends suggest shipping lines are continuing to pursue larger capacity ships, the industry is also aware that there might be a ceiling to the growth of ship sizes in the future.

Expanding hinterlands

Vertical integration of land side supply chains is constantly redefining the boundaries of port hinterlands. Development and investment in land-based supply chains (inland/dry ports, rail, road and even coastal/inland shipping) changes the commercial hinterland of ports and therefore shipping access to production and demand for goods.

In an increasingly competitive sector, the connection to hinterlands is becoming more and more crucial for ports. To maintain a competitive advantage over their existing hinterland, ports and the local land side supply chain, need to ensure there is an efficient and affordable network available

to handle port import and exports. By providing a better commercial offering to regions in other port's hinterlands, ports are able to increase their commercial reach and, in the process, increase their commercial attractiveness to shipping lines.

3.2.2 Improved Operating Efficiency

The freight and shipping industry are also looking to improve operating efficiency through:

- Containerisation of cargo
- Use of varying fuel types.

Containerisation of Cargo

The containerisation of cargo has steadily increased since the first container ship was built in the 1950's with the containerised cargo representing over 15% of the total global freight task in 2017[10]. Containerised cargo presents several operating efficiency benefits when compared to bulk and break-bulk cargo[11], including;

- Time and labour savings: most of the improvement related to significant time and labour savings is achieved by avoiding the need to manually break bulk to load and offload general cargo ships that could take up to several days. This results in general cargo ships spending less time shipping cargo and more time incurring costs at port, by contrast to a shorter time in port for a significantly higher capacity container ship
- Reduced warehousing costs: cargo that had been warehoused before loading onto and off general cargo ships can be placed inside containers for storage, which avoids the need for dedicated warehousing
- Enabled intermodal transport: standardised containers simplified the transfer to and from ships to other modes of transport such as road or rail.

Due to the supply chain operational benefits of freight containerisation and the continued growth of worldwide population it is expected that containerised trade will continue to grow into the future.

Fuel types

Fuel cost is a significant determinant in the economies of scale achieved by larger ships. The bunker fuel price has historically been extremely volatile based on a series of unexpected supply shortages or periods of increased demand.

The shipping industry is also facing a step change in bunker fuel composition as the International Maritime Organisation (IMO) has regulated the requirement for use of low sulphur fuel. This regulation is expected to drive up the cost of low sulphur fuels, reducing profitability of the sector during this time. Further discussion regarding low sulphur fuel and other alternative fuels is included in Section 3.4.

3.2.3 What does this mean for the Global Freight Sector?

In the never-ending pursuit of improved and sustainable profitability, the freight industry will continue to attempt to capture increased scale, market share and volume. In parallel, the industry will continue to place downward pressure on costs with the aim of achieving cost and operational efficiencies.

Chasing scale of operations through horizontal collaboration and increased loadings will continue. Alliancing is already prevalent and well established in the shipping industry and this model may be reflected in other elements of the freight transport network. A focus for ports will be increasing their commercial hinterland through improved and more time and cost-efficient land transport

[10] 2020 Ports and Freight Yearbook. Accessed at https://www2.deloitte.com/nz/en/pages/finance/articles/new-zealand-ports-and-freight-yearbook.html

[11] 'Containerised trade trends and implications for Australian ports, a report for the Port of Newcastle. January 2019' https://www.parliament.nsw.gov.au/lcdocs/other/12148/HoustonKemp-report---Containerised-trade-trends-and-implications-for-Australia-31-Jan-2019.pdf

networks. The larger capture of import and export volumes results in greater port commercial attractiveness for shipping and subsequent scale of throughput. It can also provide more incentive for shipping lines who are cognisant of operating efficiencies such as utilisation and fuel costs.

By contrast, ongoing increases in vessel size will mean increasing costs for the wider freight network to scale their infrastructure to facilitate the increased intensity of larger vessels and freight volumes.

3.3 Digitisation of the supply chain

3.3.1 What is the technology and innovation trend?

The freight and logistics sector is increasingly reliant on data to support decision making and streamline processes. This data is being used to power new innovations – some physical (e.g. automation and robotics) and some online (e.g. smart contracts).

This transition is known in the industry as digitisation and is being implemented at and increasing rate to all stages of the supply chain.

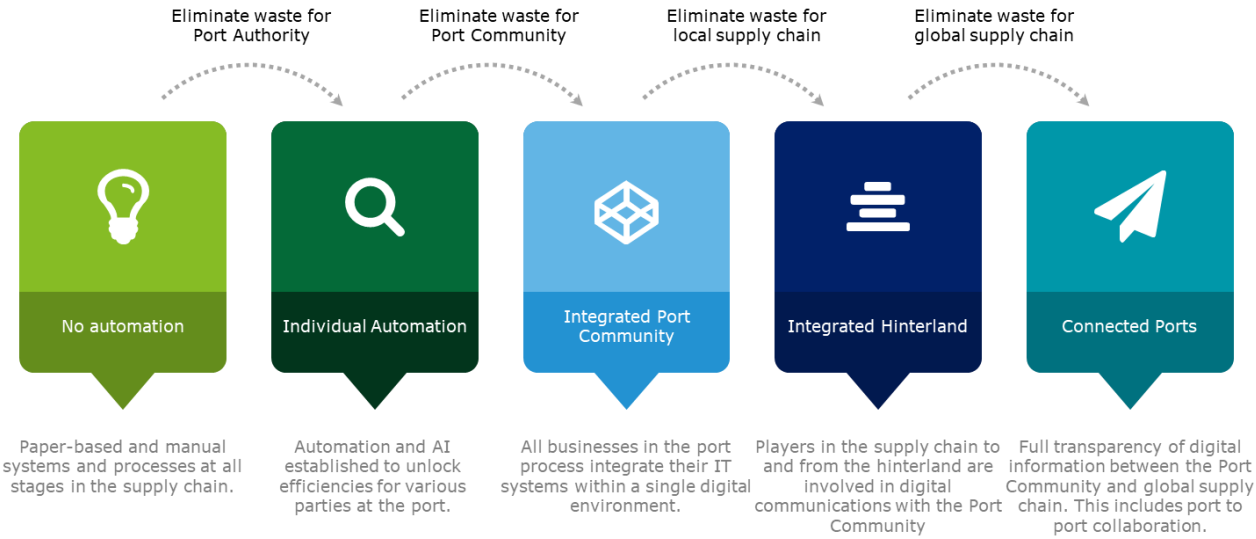
3.3.2 Digitisation

Digitisation is becoming a core component of the freight industry as players seek to increase speed, reduce costs and avoid error in the supply chain. Eventually, digitisation will provide a connected and automated logistics and port ecosystem. This will be driven by big data, information collaboration and robotic technology improvements.

Central to the rise of digitisation in the sector is the idea of "smart ports". Characteristics that can make a port "smart" are the use of the Internet of Things (IoT), Artificial Intelligence (AI), blockchain and robotics to improve processes. For example, real-time berth planning or predictive maintenance for key assets.

The Port of Rotterdam identifies four key steps in the development of smart ports and digitisation of ports and hinterlands more generally. Figure 17 demonstrates that all participants in the supply chain have a role to play – with the final stage being global connectivity.

Figure 17: Digitalisation of the supply chain



Source: Port of Rotterdam. Adapted by Deloitte.

All players in the supply chain will benefit from being globally connected. For example, in the case of a vessel delay, transparency around sailing routes and GPS tracking of cargo enables:

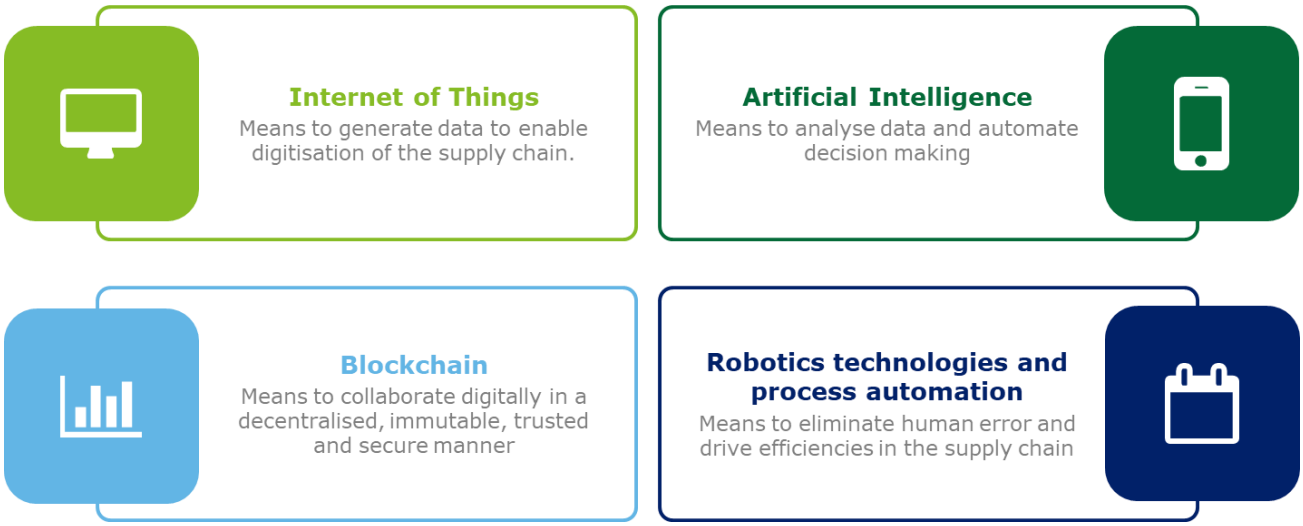
- Shipping companies to plan with greater accuracy
- Ports to make optimum use of their dock spaces
- Transport logistics companies to reduce truck movements and optimise timing of stack runs
- Warehouses to reduce gross margins.

It is not anticipated that any supply chain will reach the full maturity of a 'connected port' in the short-medium term and there will be several barriers to the change. For example, lack of structured and consistent data will make it difficult to automate processes across the entire supply chain, and ports will be required to share information with their rivals which may also create some barriers to change. However, it is likely that the scale of benefit resulting from this change will force governments and businesses to overcome these issues.

3.3.3 Key technologies driving digitisation

The key technologies that will drive digitisation of the freight and logistics sector are outlined in Figure 18. It is critical that these technologies work together in an integrated way to unlock the full suite of benefits digitisation can provide.

Figure 18: Key technologies driving digitisation



IoT

Within the sector, companies have begun implementing a range of connectivity and data-enabled technologies. The technologies collectively form the IoT. The main purpose of IoT is to link key assets (e.g. vessels and containers) and data, and is enabling the development of smart processes, using a variety of software and hardware.

IoT software and sensors are used to develop Big Data (i.e. extremely large datasets that can be analysed to identify trends and patterns) – other technologies are used to make sense of it (e.g. AI and machine learning). Data collection and analysis through IoT devices enables a data-driven approach to improve connectivity and enables other key technologies (e.g. digital twin or automation).

IoT is currently being used at all steps in the supply chain. Some of these uses are summarised in Table 5.

Table 5: Use cases of IoT

Supply chain leg	IoT use cases
Shipping	• Berthing and loading analytics • Container tracking • Cargo condition (e.g. temperature or humidity) • Smart metering.
Port operations	• Predictive maintenance of key assets • Operational improvements (e.g. traffic management or customs management).
Transport logistics	• Truck fleet activity optimised to reduce total truck kilometres • Last mile transport optimisation.
Warehousing and freight forwarders	• Inventory management • Tracking of inventory by freight forwarder and other stakeholders (e.g. client).
Production	• Remote control of plant and machinery to match changes in demand • Real-time monitoring of machinery, so that outages can be detected when they occur.

The efficiency of these new technologies will improve with better network connectivity. In fact, supporting the connectivity of a new technology ecosystem comprises one of three primary 5G use cases – the other two are capacity and speed enhancement and ultra-high reliability.

IoT will be the critical enabler for freight and logistics of the future. It will enable consistent communication between equipment that can be shared and viewed by other actors in the supply chain, to support information collaboration. This will help to identify new efficiencies in the supply chain and obtain more precise and real-time insights.

AI

Like IoT, AI is another step in the direction of digitising processes and operations. AI uses Machine Learning to analyse Big Data, including historical data, images and voice recognition.

AI seeks to identify patterns in the supply chain and predict future outcomes. For example:

- In a port environment this may include predicting the arrival time of vessels to enable greater port planning
- Importers may rely on AI to monitor reefers remotely, and increase/decrease the temperature and airflow as required
- On the landside freight logistics services may analyse historical vessel movement data to predict if a vessel is likely to arrive on schedule.

AI will also be used extensively in the development of infrastructure in the supply chain. For example, the Maritime and Port Authority of Singapore (MPA) and the port operator took full advantage of AI to test its new Tuas mega-port. Singapore developed a digital twin of the facility to evaluate layout designs and concepts and tested their efficiency on port operations.

Blockchain

Block chain is an immutable digital ledger that is commonly known for its use in financial transactions. Key characteristics of block chain technology include:

- Near real-time
- Peer to peer (you don’t need a trusted third party)
- Distributed (proof of transaction is in more than one place)

- Immutable (once the file is created it cannot be edited – this increases trust and reduces risk and fraud for transactions that use blockchain).

Blockchain is an emerging tool in supply chain management with a lot of potential. A typical supply chain includes a significant number of paper-based, bilateral transactions between stakeholders. Each party must trust one another in their willingness to communicate correct information. This can give rise to inconsistencies in information, which can then lead to error, delay and even fraud. As supply chains become more diverse this issue is set to worsen.

Blockchain-based platforms may be a critical enabler for supply chain digitisation. They could help digitise the analogue nature of the industry and establish an immutable record of information flows between supply chain participants.

There are several other benefits that blockchain technology may bring to the sector. These are summarised in Table 6 below.

Table 6: Blockchain's most value in supply chains

	Description
Extended visibility and traceability	Blockchain-based systems may provide an IT platform from manufacturing through to distribution and sale. Each block may include various forms of data for additional transparency. For example: • Ownership data (chronological list of owners) • Location data (places the material has been and where it is now) • Product specific data (attributes and performance of owners) • Environmental impact data (energy consumption, CO2 emission) • Price, quality, date and state of the product. This added visibility can provide transparency to all actors in the supply chain, including the consumer. With food safety and sustainability of products becoming a greater priority, providing the consumer with transparency around how, when and where products are sourced and processed may be a key product offering in years to come.
Supply chain disintermediation	Typically, supply chains comprise a set of bilateral contracts. Legacy practices, lack of trustworthy information and technology can lead to bottlenecks with these contracts as there is no 'single source of truth'. Blockchain technology will allow any data to be guaranteed by a whole network, rather than a single intermediary. This can reduce bottlenecks and support information flow, ultimately reducing overall transaction costs.
Smart contracts	Blockchain-based smart contracts—self-executing code on a blockchain that automatically implements the terms of an agreement between parties—are a critical step forward in supply chains, streamlining processes that are currently spread across multiple databases and systems. Smart contracts have several benefits largely arising from eliminating contract administration and manual intervention. This will be particularly helpful for supply chains that are fragmented with multiple tiers of subcontracts.

Source: Wang, Y; Han, J and Beynon-Davies, P (2018). Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. Adapted by Deloitte.

Robotics Technologies and Robotics Process Automation (RPA)

The use of robotics in the freight and logistics sector is no new concept. For example, the Port of Rotterdam implemented its first automated container terminal 30 years ago and the Port of Auckland will deliver New Zealand's first automated terminal in 2020.

The extent to which automation takes place varies from remote controlled operations to fully automated solutions. The sector is likely to see an uptake of automation in most processes in order to eliminate human error and inefficiencies, and stream-line processes.

There are several other key emerging trends that will drive robotics and AI development over the next few decades:

- **Autonomous vehicles**-Autonomous trucks are currently being tested for port yard operations and the landside freight task and are being used in several sectors (e.g. mining). Driverless vehicles will reduce labour costs and improve safety and efficiency on the road network
- **Truck platooning-** Multiple trucks operating within minimum headways using virtual towbars. Platooning is likely to be one for the first use cases for autonomous vehicles along with shared mobility public transport services[12]. The benefits arising from this technology include reduced labour costs, improved traffic safety and reduced road congestion
- **Drones-** There are many uses for small lightweight drones in the transport and logistics centre. For seaports alone, drones are being piloted to monitor road traffic in the port, provide logistical support with a birds-eye view of the port, act as security watchdogs, conduct search and rescue operations for hard-to-reach locations and identify defects in key assets
- **RPA** - Software used to automate high volume, repeatable tasks, is likely to disrupt business models in the short to medium term. RPA can bring immediate cost savings to business by reducing labour costs.

3.3.4 What does this mean for the Global Freight Sector?

Participation from all parties in the supply chain will be critical to the realisation of a digital and integrated logistics chain. There may be resistance – organisations have traditionally had little incentive to share pricing and other business information.

However, when there is participation from all parties, the port ecosystem will become a collaborative and globally connected community. Growth in global trade will be driven by data rather than size, and the benefits associated with this shift to digitisation should unlock capacity and provide better service outcomes for all actors along the supply chain.

3.4 Shifts in consumer preference and sustainable practices

3.4.1 Changes in consumer behaviour

Consumers are the ultimate end-user in the supply chain and their shifting demands and requirements have a major impact on how supply chains operate and respond to changing social and environmental norms.

The section highlights two key changes in consumer behaviour and the likely impacts on the value chain that will result. This includes:

1. Greater preference for locally produced and sustainable products
2. E-Commerce and the desire for same-day delivery services.

Greater preference for locally produced and sustainable products

Section 3.1 of this report outlines recent geo-political events that suggest an increasingly protectionist view on global trade. Equally, the threat of climate change is driving green initiatives by corporate players. These trends are having significant impacts on the supply chain. For

[12] World Maritime University. Transport 2040. Truck Platooning: The Australian Case

example, protectionism may have the potential to threaten the success of the global shipping network in the future.

But what is driving this trend from the perspective of the consumer?

Consumers are increasingly becoming more eco-aware. A study conducted by NYU Stern's Centre for Sustainable Business[13] found that certain products with claims of sustainability had as much as twice the growth in demand as less sustainable options. This trend is likely to place increasing pressure on up-stream suppliers. For example, Unilever estimates that as much as 70% of its carbon emissions footprint depends on the products that the consumer chooses to purchase.

The idea of eco-aware consumers goes together with preference towards locally produced and organic products. For example, the perception is that product sourced closer to home has fewer transportation emissions associated with it.

Increasing concerns of food safety also have a large part to play in the social trend towards locally produced product. This has been driven by events such as the toxic milk power scandal in China and the horsemeat scandal in the UK.

Given these concerns, consumers are paying more attention to the source of the products they are consuming, and its environmental footprint. This means that consumers will increasingly want to know when, how and where the products are sourced and transported to them. It will also make all other actors in the supply chain reconsider how they are providing their services.

E-commerce and the desire for same-day delivery services

E-commerce has given consumers the ability to locate and buy what they want, when they want it. It has provided consumers with options to select, buy and receive goods and has fuelled an expectation for speed and flexibility.

However, maintaining the delivery speeds we have today amid rising global parcel volumes will be an enormous throughput challenge. This challenge is not only due to the rise in e-commerce, but also the growth in urbanisation and consumers' gain in purchasing power driving demand particularly in metropolitan areas.

New logistics models will be required to satisfy the speed, flexibility, cost and transparency expected of the new-age consumer when it comes to delivery, and in reducing the bottlenecks across the movement of goods. For example, retailers will need to bring inventory closer to the consumer - facilities such as Urban Consolidation Centres (UCC) can support faster delivery times and are growing in popularity in major urban centres.

The rise of online retail is also placing pressure on retailers, freight forwards and third partly logistics providers (3PLs) to deliver direct to the consumer, rather than sell in-store. This creates additional responsibilities for the supplier, such as processing and packaging orders, sorting large volumes of parcels, and unpacking shipments for final delivery to the consumer.

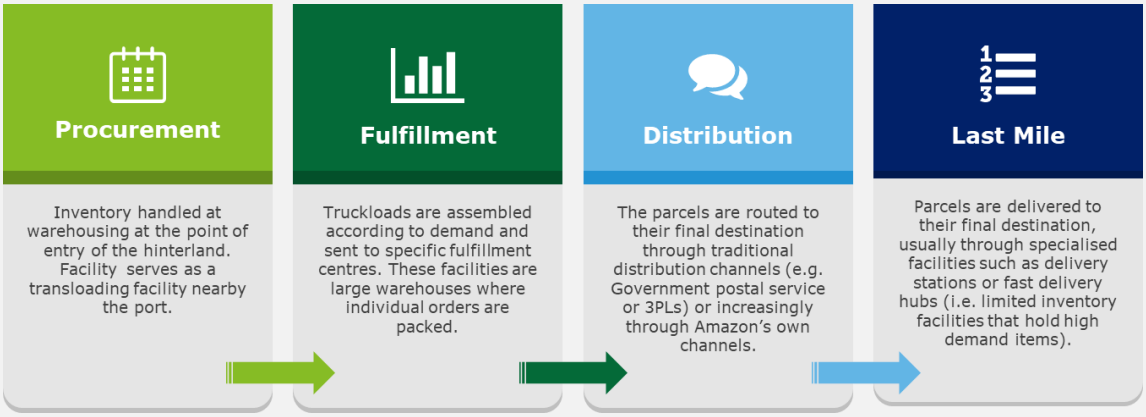
[13] NYU Stern Centre for Sustainable Business (2019). Sustainable Share Index: Research on IRI Purchasing Data

[14] Deloitte Insights: How are global shippers evolving to meet tomorrow's demand? The future of the movement of goods. https://www2.deloitte.com/global/en/insights/focus/future-of-mobility/future-of-freight-connected-data-intelligent-automation.html

Example: The Amazon model

The online retailer Amazon is central to the e-Commerce paradigm, accounting for 38% of all online retail sales in the US and 4% of total retail sales. Its logistics network challenges the standard landside supply chain – delivering to its customers in four distinct steps in the US, as shown in Figure 19.

Figure 19: Four steps of the landside supply chain in the US



Source: The Emerging Port. Inland Logistics of Amazon. Jean-Paul Rodrigue (2019).

Amazon's distribution channels are expanding rapidly as it vertically consolidates its supply chain. For example, the movement of goods from China to the US on Amazon-owned vessels in 2018 marked the completion of the world's first end-to-end shipping network[14]. This network includes:

- **Amazon ships:** Around 5,300 containers shipped from China to the US on Amazon-owned vessels in 2018.
- **Amazon Air:** Cargo airline that operates exclusively for Amazon packages. It is currently building its own $1.5b airport in Cincinatti, US and has a major presence at other US airports.
- **Amazon fulfillment:** Around the globe**,** over 185 sortation centres strategically positioned close to urban centres, over 30 million sqm of warehouse spaces, offices, retail space and data centres and over 100,000 warehouse robots
- **Amazon last mile:** Over 20,000 LCVs and drone delivery and smart-locker technology currently in development.
- **Amazon logistics:** In April 2019 it announced it was launching a landside freight shipping business, serving as a freight brokerage platform and offering services in several US states – as part of this business Amazon operates over 7,000 long-haul and short-haul semi-trucks.
- **Amazon retail:** Over 600 brick-and-mortar stores.

3.4.2 Environmental sustainability

The freight and logistics sector is still heavily reliant on fossil fuels. The growing reliance of international trade has helped make transportation the fastest growing cause of greenhouse gas emissions – for example, ship emissions alone are projected to increase as much as 250% by 2050.

Shipping

In response, the IMO has enforced a new regulation pertaining to sulphur levels in bunker fuel that took effect 1 January 2020. This regulation requires a decrease from the presently accepted global sulphur cap of fuel content of 3.5% to a substantially lower 0.5%.

It is currently unclear which direction the shipping lines will head in response to this change. Their options include:

- Install exhaust gas cleaning systems (scrubbers) on ships
- Buy compliant fuels and a higher cost
- Run on the cleaner LNG as a fuel source.

This regulation will go a long way in solidifying shipping's position as the most environmentally efficient transport for cargo worldwide. However, shipping lines will still need to implement their own measures to achieve net zero emissions. For example, Maersk announced its intention to achieve net zero emissions by 2050 – holding open the possibility for using biofuels.

Ports

The 'smart port' paradigm described in encouraging port owners and operators to combine technology and growth and innovate sustainably. Port innovation is leading to more environmentally friendly practices reducing the impact on the environment.

The European Sea Ports Organisation (ESPO) ranks the top ten environmental priorities for European ports annually, based on a survey completed by the ports' managing bodies. The trend of its results over the past 15 years is illustrated in Table 7.

Table 7: Ranking of top 10 priorities for European ports

Rank	2004	2013	2016	2019
1	Garbage/port waste	Air quality ↑	Air quality ○	Air quality ○
2	Dredging operations	Garbage/port waste ↓	Energy consumption ↑	Energy consumption ○
3	Dredging disposal	Energy consumption ↑	Noise ↑	Climate change ↑
4	Dust	Noise ↑	Relationship with the community ↑	Noise ↓
5	Noise	Ship waste ↑	Garbage/port waste ↓	Relationship with the community ↓
6	Air quality	Relationship with the community ↑	Ship waste ↓	Ship waste ○
7	Hazardous cargo	Dredging operations ↓	Port development (land) ↑	Garbage/port waste ↓
8	Bunkering	Dust ↓	Water quality ↑	Port development (land related) ↓
9	Port development (land)	Port development (land) ○	Dust ↓	Dredging operations ↑
10	Ship discharge	Water quality ↑	Dredging operations ↓	Water quality ↓

Source: ESPO Environmental Report 2019. Adapted by Deloitte.

Air quality and energy consumption have topped the port's list of priorities for the past five years. Port activity by its very nature generates air emissions. Activity from ships, trucks, trains, cars, non-road mobile machinery, rubber tyred gantry cranes, and conveyor vehicles release several pollutants into the atmosphere. This includes CO2, black carbon, NOx and PM. These pollutants are costly to world economies, particularly given ports are generally located near large cities.

Ports are finding innovative ways to monitor air quality, such as:

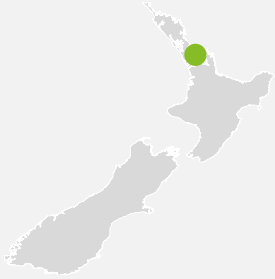
- Sensor networks at European ports that gather environmental data of different types (e.g. air quality, meteorological information, congestion at gates). This information is being used to support port decision making. For example, determining how many trucks per hour can enter and exit ports to meet CO2 targets
- Optical imaging camera systems that can measure and provide real time information about the emissions generated by ships calling at the port.

Port authorities and terminal operators are also finding ways to drive clean energy usage in and around port precincts. For example:

- Vessels idle at berth are significant emitters of nitrous oxides; one study estimated that the emissions from berthed vessels in UK ports in 2016 contributed to 2.6% of total transport sector emissions of nitrous oxides[15]. The Port of Los Angeles' AMP program seeks to reduce emissions from container vessels. AMP equipped ships can plug into shore-side electrical power rather than running idle on diesel power at berth
- The use of renewable energy to power port equipment is a rising trend. Ports of Auckland has committed to building Auckland's first hydrogen production and refuelling facility enabling port equipment, buses and cars to run on hydrogen fuel cells (see below Case Study).

Case Study Port of Auckland's Zero-Emissions Goal

Figure 20: Port of Auckland



*The Port of Auckland has a goal to be a **zero-emission** port by **2040**. It has committed to investment in **hydrogen fuel cell vehicles** to support this goal.*

With 40% of emissions in Auckland currently attributable to the transport system, harnessing alternative technologies could play a key role in meeting lower emission targets. Amongst the proposed solutions is the use of hydrogen as a fuel source, where the only by-product is water.

The Ports of Auckland, which plays a pivotal role in the national logistics network, has a goal to be a zero-emission port by 2040. To meet this target, it requires a renewable and sustainable energy source for its heavy vehicle fleet, which is difficult to power with batteries.

The Port has now committed to building Auckland's first hydrogen production and refuelling facility. The company and its project partners Auckland Council, KiwiRail and Auckland Transport, will invest in hydrogen fuel cell vehicles including port equipment, buses and cars as part of the project.

Hydrogen is seen as a potential solution to the port's energy requirements, as it can be produced and stored on site, which allows for rapid refuelling and provides greater range than batteries.

The purpose-built facility will produce hydrogen from tap water. The process will use electrolysis to split water molecules into hydrogen and oxygen, the latter of which is released into the air with the hydrogen stored for later use. Vehicles will then be able to refuel in a manner like existing CNG and LPG refuelling procedures. The project partners will provide technical support as well as purchasing hydrogen fuel cell vehicles for the project.

Landside

Critical to the sustainability of the landside supply chain in the first instance is the encouraged use of rail for freight activity. According to the New Zealand Rail Plan, every tonne of freight moved by rail produces 66% less carbon emissions compared with heavy road freight.

[15] Ricardo Energy & Environment: Study of ship emissions whilst at berth in the UK

Rail has traditionally been suited more towards high volume, bulk commodities. However, with a growing freight task and congestion in urban areas, it will become increasingly important for investment in rail freight infrastructure to promote its usage.

As for the road freight supply task - innovation and technological advances in zero emissions and automated vehicles are providing disruptive opportunities across the freight sector.

As the technology develops and operating costs of Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicle (FCEVs) continue to fall, they are becoming an increasingly viable alternative to traditional gasoline and diesel-powered heavy vehicles.

In a report developed by BITRE (Australia) in 2019, *Hydrogen as a Transport Fuel,* it is suggested that FCEVs and BEVs may serve complementary roles in freight industry. FCEVs can service heavier vehicles and for longer distances, being suitable for larger and heavier vehicle operations. However, BEVs are more cost efficient in light vehicles and short-distance applications.

The technology is well developed, with a range of FCEV and BEV trucks in development (e.g. Nikola 1 FCEVs, Tesla Semi BEVs) and the commercialisation dates of these products is proposed to be as early as 2021. Port of Los Angeles (PoLA) is leading the charge having partnered with Toyota and Kenworth to operationalise zero-emission heavy-haul prime movers (FCEVs) in the PoLA region.

The uptake of FCEVs will rely on the development of hydrogen refuelling stations on key routes. LA plans to open three hydrogen refuelling stations designed for long-haul freight vehicles to support PoLA's hydrogen program in 2020.

3.4.3 What does this mean for the Global Freight Sector?

Changes in consumer preference will always be a key driver for change in the industry. The success of the 'Amazon Model' is largely attributable to its ability to connect retailers to the consumer and the logistics promises it can make (e.g. same-day delivery). This will, however, have significant impacts on the way the sector operates, particularly in markets where this service does not currently exist. For example, warehousing will need to be closer to the consumer, which will become an increasingly important issue as urbanisation continues to rise and urban congestion worsens.

Preference towards eco-friendly and local product may threaten the global shipping industry. It will also require greater transparency of products which supports the case for technologies like blockchain.

In addition to individuals, corporations have recognised the implications of climate change and are beginning to manage sustainability not only to manage reputation but also to improve processes and pursue growth.

Sustainable practices are likely to cascade up-stream at an increasing rate as corporations pledge to only work with those suppliers that adhere to environmental standards. According to the Carbon Disclosure Project (CDP) 2019 supply chain report, over one third of suppliers are driving upstream change in their own supply chain[16]. The report also found that sustainable practices are increasingly flowing downstream, as suppliers become more mature in their understanding of sustainability challenges. New technologies (such as blockchain) will help support this transparency between parties.

It is unlikely these changes will impact supply chains structurally, or in terms of cost in the long run. For example, the fuel cost of an internal combustion engine per 100km is estimated to cost 130% more than hydrogen fuel cell technology[17]. In the short-medium term, however, it may force actors to manage existing operations more efficiently to meet sustainability goals (e.g. transport operators reducing travel times and freight movements or improving vehicle load factors).

[16] CDP – Cascading Commitments: Driving ambitious action through supply chain engagement
[17] COAG Energy Council, 2019

4 Trends in Port Ownership and Governance

This section of the report looks at current international trends in port ownership and governance, focussing on how these trends are facilitating new private sector investment in port related assets.

Key areas of focus include:

- Trends in international port ownership and governance
- Port competitiveness and operations
- Ownership and governance structures in New Zealand.

4.1 Trends in international port ownership and governance

Historically, governments have a played a major role in the ownership and operation of ports around the world. This was due to the strategic nature of ports in providing access for people and goods to populations, productive resources and territories. As significant drivers of economic activity, governments have continued to maintain a role in port operations.

Over time the role of government in port ownership and operation has gradually changed, with major reform and privatisations commencing in the 1980s and continuing to evolve to this day. Ports are a critical step in international supply chains, and by the 1980's containerised shipping was well established and facilitating the globalisation of economies and increasing volumes of trade. Ports, at this time, were proving to be major bottlenecks in supply chains due to:

- Restrictive labour practices and ineffective wharf configurations – which were based on breakbulk cargo handling techniques that needed to be adapted to meet the requirements of containerised technologies
- Centralised government control of ports – resulting in slow paced and hierarchical planning and investment processes
- Unwillingness of governments to invest in port infrastructure – due to lack of understanding of demand (resulting in over or under investing) and competing demands for funds for other government provided assets such as roads, schools and hospitals.

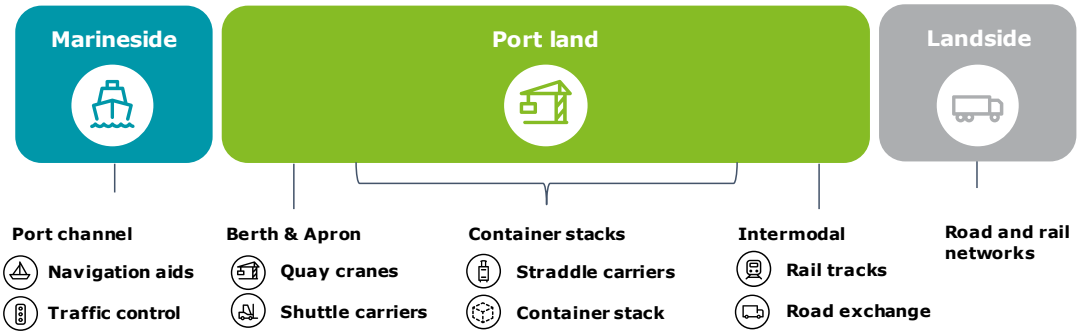
Reform of the port sector has taken place within the broader context of the increased role of the private sector providing public services. The implications of this trend within the port sector is that governments increasingly play the role of planner and regulator, whilst the private sector is the operator and service provider.

The strategic nature of ports has meant that the privatisation of ports has been facilitated through models that ensure government retains ownership of key assets over the longer term, such as port land, shipping channels, seabed, traffic control and navigation systems. These assets are often managed by government agencies such as Port Authorities.

Further facilitating private investment, governments have sold long-term concessions and leases on port assets to private operators. These operators invest in port infrastructure, such as berths, stevedoring equipment and systems, and provide commercial services to shipping lines and cargo owners.

Figure 21 shows the breakdown of key activities conducted at a port.

Figure 21: Key activities undertaken at a port



Investors in ports vary depending on the type of assets, however two predominate types of investors have emerged; companies that operate in the freight and logistic sector seeking to enhance their networks and institutional investors looking for long term, low risk opportunities.

Freight and logistics sector investors

Investors in port terminal operations tend to have their origins in the freight and logistic and shipping sectors. Investment in port operations seeks to expand their networks as service providers to the sector or as vertical integration of their existing operations. Recent examples of this type of investment include:

- APM Terminals, operates 74 terminals globally and handles approximately 40 million TEUs per annum. APM Terminals is part of A.P. Moller - Maersk group– the world's largest shipping line
- DP World is a logistic company located in Dubai, operating in 50 countries with 78 marine and inland terminals (including Australia's four main container ports)
- Hong Kong based Hutchison Ports operates ports and terminals in 27 countries (including terminals at Port Botany and Port of Brisbane, Australia). The Hutchison group also operates cruise ship terminals, airport operations, distribution centres and rail services and ship repair
- ICTSI is based in the Philippines and operates 31 container terminals in 18 countries. Its most recent development is the Victorian International Container Terminal (VICT) at Webb Dock in Melbourne
- China based COSCO Shipping Ports (part of the COSCO shipping line) operates container terminals in 36 ports in mainland China, South East Asia, Europe, South America and the Mediterranean. COSCO's most recent development is the new container terminal development at Port Chancay in Peru (a BRI project). This terminal will have a capacity of 1 million TEU per annum and is primarily targeting the fruit and vegetable trade between Peru and China.

These arrangements have had several benefits for shippers and shipping lines. These include:

- Increased competition between and within ports providing customers with more options and greater bargaining power, resulting in improved operational performance and pricing.
- International networks can offer shipping lines comprehensive stevedoring services at several ports around the world, enhancing operational performance and reducing contracting costs
- Where terminals are vertically integrated along the supply chain, customers are provided with a fully integrated transport offerings reducing interface risks and inefficiencies
- Purchasing power due to size and scale of worldwide operations reduces the cost of investment in new and upgraded infrastructure
- Information can be transferred between operations, facilitating the early adoption of new technologies and systems.

Institutional investors

Institution investors, such as superannuation funds, pension funds, sovereign wealth funds and life insurers seek long term, stable and predictable returns. Investment in establish ports provide these perquisites, as a result, institutional investors have been attracted to long-term government leases of key port assets. In Australia, for example, governments have taken advantage of this interest to divest port assets under long-term (up to 99 years[18]) concession agreements, in exchange for upfront cash payments that are then used to invest in other government assets. This has seen all the major ports on the Australian eastern seaboard 'privatised' over recent years.

- Long term lease of PoM to the Future Fund, QIC, Global Infrastructure Partners and OMERs
- NSW Ports, incorporating Port Botany and Port Kembla, is leased to a consortium of institutional investors (IFM Investors, Australian Super, Tawreed Investments Ltd and Q Super)
- Port of Brisbane is leased to a consortium of infrastructure investors including APH Consortium (formerly known as Q Port Holdings consortium), comprising four of the world's largest and most experienced infrastructure investors
- Port of Newcastle's shareholders are The Infrastructure Fund (50%) and China Merchants Port Holdings Company (50%) – a Hong Kong based port developer and operator.

Each of these port companies is responsible for the maintenance and development of the port and related facilities. While the specific port assets leased to each company varies between locations, each operator is in effect a 'landlord'. They have the rights to generate revenues from property leases for port related activities such as container stevedoring companies, commodity owners (e.g. liquid and dry bulk), and the automotive trade operators. The port companies also generate revenue from maritime activities such as berth usage and channel fees (charged to the shipping lines).

In each port a government owned Port Authority assumes the responsibility for Harbour Master services (who's role it to ensure safe and secure port operations), vessel traffic services, navigation facilities and port regulations.

Along with these privatisations, government administered pricing and operating regulations have been introduced.

[18] Lease periods range for example the Port of Brisbane lease if for a period of 99 years, whereas the Port of Melbourne lease is for a period of 50 years.

Example: PoM

In 2016 the Victorian government agreed to a $9.7b deal to lease the PoM for the next 50 years. The lease was purchased by Lonsdale Consortium, comprising QIC, Future Fund and Global Infrastructure Partners.

Under the privatised model, PoM has the rights to the port's commercial operations and assets, working in partnership with other entities to manage, operate and maintain the port, as shown in Table 8.

Table 8: Split of responsibility at the PoM

Role	Description
PoM	Acts as landlord for the port - responsible for planning, operating and maintaining the port land area and channels which covers around 505 ha.
VPCM	Government-owned entity that acts as Harbour Master and provides management of navigation of vessels within the port channels, marine pollution response, and health and safety.
Stevedores and terminal operators	Private stevedores and end users are responsible for servicing the port terminals for bulk and containers. • **Containers:** Patricks, DP World and VICT. • **Bulk:** Topside equipment owned by private entities. Other end users often pay to use existing private infrastructure. • **Automotive:** Main automotive terminal operated by MIRRAT.
Shipping lines	Shipping services provided by international and domestic shipping lines.
Pilotage and towage services	Several private operators are responsible for pilotage and towage of large vessels (greater than 35 m in length) within the Port waters.
Road and rail transport	Road and rail transport are serviced by a wide range of private operators.

Port	Marineside	Landside

PoM fees are managed under a regulatory framework overseen by the Essential Services Commission (ESC). The framework was put in place to ensure that PoM can efficiently recover its cost of services, including planning, operations, maintenance of existing assets and capital expenditure. These activities are known as Prescribed Services. These fees include:

- **Wharfage fees:** Charge for loading/unloading cargo
- **Berth hire fees:** Time-based fee for common-user berths
- **Channel fees:** Fees levied to vessels entering the port channel.

Fees that do not sit within the Prescribed Services framework include Non-Prescribed Services, such as rental agreements negotiated with tenants for access to land and facilities. These fees are periodically reviewed by the ESC. For example, the ESC is currently reviewing PoM rental amounts.

Stevedore fees are based on market rates, however, are scrutinised by the Australian Competition and Consumer Commission (ACCC) monitoring framework.

Victorian International Container Terminal (VICT)

Australia's first fully automated terminal entered the market in 2017. The VICT (a subsidiary of the Philippines-based ICTSI) has managed to win upwards of 30% market share, due to terminal efficiencies (e.g. truck turnaround times), cost efficiencies (e.g. existing relationships with international shipping lines) and better access to berths.

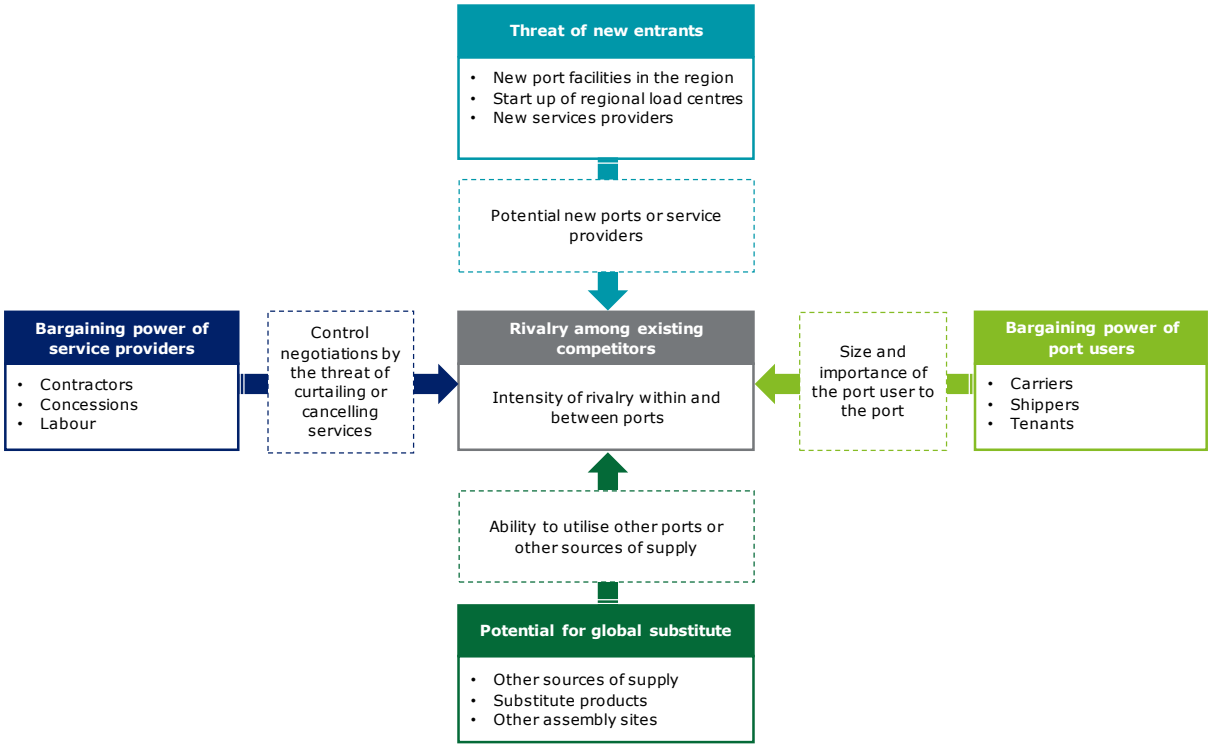
4.2 What do the industry trends mean for port competitiveness and operations?

Internationally, there is strong competition between ports. Shipping lines are the key to attracting business to ports. The shipping lines set the service schedule and contract the services of the ports and the terminal operators. Frequently shipping lines will have international contractual relationships or affiliations with terminal operators, providing services in a network of ports around the world.

The World Bank, in its analysis of port reform[19], notes that competition between ports was limited in the past as port-related costs were relatively insignificant in the supply chain due to the higher costs of ocean freight and inland transport. However, with the enormous gains in productivity achieved in ocean and land freight over past decades, ports have increasingly come under pressure to improve efficiency and lower costs.

Five interactive forces that have shaped the competitive landscape of ports are shown in Figure 22.

Figure 22: Five interactive forces that impact the competitive landscape of ports



Source: World Bank Port Reform Toolkit, Module 2. Adapted by Deloitte.

4.2.1 Overview of the five interactive forces that impact the competitive landscape of ports

Rivalry among existing competitors can take the form of both inter-port and intra-port competition.

Inter-port competition is most common where competing ports have access to the hinterland of neighbouring ports. Most commonly, competition occurs at the margin of interconnecting hinterland.

[19] Port Reform Toolkit, Second Edition, Module 2, The Evolution of Ports in a Competitive World

However, the advent of 'inland ports' have increased the 'reach' of ports, where seaports develop 'inland port gates', usually combined with intermodal terminals, which has enabled aggregation of cargoes and access to more efficient rail transport services through economies of scale.

New Zealand ports frequently compete for customers in this way (see Example: MetroPort New Zealand below).

Intra- port competition also drives efficiency and occurs in ports where there is enough demand and space for multiple operators. This is a common form of port competition, for example, the ports of Brisbane, Sydney and Melbourne each have three container stevedores, and the Port of Hong Kong has four container stevedores each competing for business with the shipping lines.

In both inter and intra port competition, the shipping lines have a long history of taking advantage of these competitive tensions.

Example: MetroPort New Zealand

MetroPort was the first integrated intermodal cargo gateway in New Zealand. Established in 1999, MetroPort, was developed to support the initiation of container trade into and out of Port of Tauranga to customers in Auckland in direct competition with Ports of Auckland, which was the predominant IMEX container port in New Zealand.

At the time Port of Tauranga, a bulk export port, had invested in a container terminal with no contracted volume, an investment that was evolving into a white elephant. Port of Tauranga worked with a shipping line to relocate its port calls from Ports of Auckland, and TranzRail (now KiwiRail) to enable the cost-effective transfer of containers from MetroPort's south Auckland intermodal terminal to Port of Tauranga (over 200km away).

MetroPort is now Port of Tauranga's port gate located in the heart of Auckland's industrial belt. It is a fully customs bonded and MPI approved and is integrated into the port's planning and container control system through information technology.

Over the past 20 years MetroPort has been instrumental in increasing Port of Tauranga's share of container volumes, becoming the largest container port in New Zealand in 2016, and maintaining this position. In 2017 the Port became the first in New Zealand to handle more than 1 million TEU, in 2019 the port handled 1.23 million TEU. Meanwhile its largest competitor, Ports of Auckland, has seen volumes remain steady at just under 1 million TEU per annum over the period 2015 – 2019.

Figure 23: Aerial view of MetroPort

The threat of new entrants is enabled where existing providers are not delivering attractive services at competitive prices, enabling new entrants to come into the market. Port developments are highly capital intensive, as such, new entrants often require support from government or a foundation customer to help mitigate investment risks. There are also significant environmental challenges in the development of greenfield port facilities. New ports have a major impact on the marine and terrestrial environments due to the construction of channels, wharfs, terminals, road and rail infrastructure.

Example: PTP Malaysia

PTP is a green fields port development located in southern Malaysia near the Straits of Johor, less than 40 kilometres by road from Port of Singapore, and adjacent to the main international east-west shipping lanes. The PTP is located within a sheltered bay without tide restrictions, facilitating reduced waiting times for vessels. Its terminal depths ranging from 15 to 19 metres and 720-metre turning basin allow PTP to accommodate the biggest cargo vessels (carrying around 23,000 TEU).

Figure 24: MSC Gulsun, world's largest container ship approaching to berth at PTP

The port also has excellent landside connections (both road and rail) to Malaysia, Singapore and Thailand.

PTP is also located in the Malaysian free commercial zone - which enables goods and services to be brought into the area and further processed without incurring customs duty, excise duty, sales tax or services tax, facilitating the establishment of manufacturing enterprises adjacent to the port.

PTP commenced operations in October 1999, but it wasn't until a joint venture was formed with APM Terminals (which is owned by A.P. Moller - Maersk group) in 2020, that the port gained major volumes of containers, as Maersk commenced moving its transhipment operations from Port of Singapore.

Today Maersk, MSC and Evergreen shipping have all moved their transhipment services to PTP resulting in an average annual growth rate of 12%, so that by 2018 PTP handled 8.9m TEU.

The potential for global substitutes – refers to the potential for port users to shift to other sources of supply. For example, the development of Port Chancary will enable more efficient export of fruit and vegetables from Peru to China, potentially placing competing exports from New Zealand at risk and reducing the volumes of exports through New Zealand ports.

The bargaining power of port users – the demands of port users is having a major impact on port competition and investment. Nowhere is this more evident than the demands of shipping lines for investment in new port infrastructure to enable larger vessels, such as deeper and wider channels, stronger berths, larger quay cranes and faster ship loading/unloading services. Ports are being forced to make these investments to continue to attract the shipping lines.

The bargaining power of port service providers – the influence that port service providers can have on port competitiveness, is determined by the balance of influence or power they have within the port ecosystem. The service provider will have more influence where there are limited alternatives, and the cost of replacement is high. For example, commitment to long-term leases which give exclusive rights to operate services for long periods of time, without performance requirement, inhibit the port's ability to implement innovation and efficiencies.

4.2.2 Collaboration

However, due to these competitive pressures and the benefits of technological developments, ports are expected to increase collaboration through both vertical and horizontal integration. Horizontal collaboration is taking the form of ad hoc joint ventures, to full mergers for example the ports of Antwerp and Zeebrugge are entering the last phase of a merger, and the ports of Gent and Zeeland Seaports merged into North Sea Ports.

Ports are also vertically integrating to provide broader service offerings to the customers. A common example of vertical collaboration within ports is evidenced by the recent increase in the introduction of Port Community Systems. These are neutral and open digital platforms that facilitate automating port processes through submission of data enabling intelligent and secure information exchange between all stakeholders.

Further examples of vertical integration include where ports are providing stevedoring, storage and landside transport services.

These dynamic competitive forces mean that ports must continue to be agile and innovative to ensure they remain competitive on an international basis.

4.3 What is the ownership and governance structure of New Zealand's ports?

4.3.1 History

The New Zealand port sector underwent major reform in the late 1980's, with the enactment of the 1988 Port Companies Act and the 1989 Waterfront Industrial Reform Act.

Prior to 1988 each of New Zealand's ports were operated by individual Harbour Boards. The 1988 Port Companies Act required the old Harbour Boards to transfer their operations to limited liability companies and vested their shares in Regional Authorities – leaving ports with local government shareholders – and enabling a more commercial approach to managing the businesses. In 1989 the Waterfront Industrial Reform Act enabled port labour reform.

These changes resulted in a significant improvement in productivity. For example, the number of waterfront workers went from 3300 to 1800, and the average turnaround time for a container vessel at Ports of Auckland fell from 38 hours to 15.5 hours, even though each ship, on average, had twice as many containers as ships handled under the old system.[20]

[20] https://milfordasset.com/insights/brian-gaynor-universal-secret-of-success-fuels-port

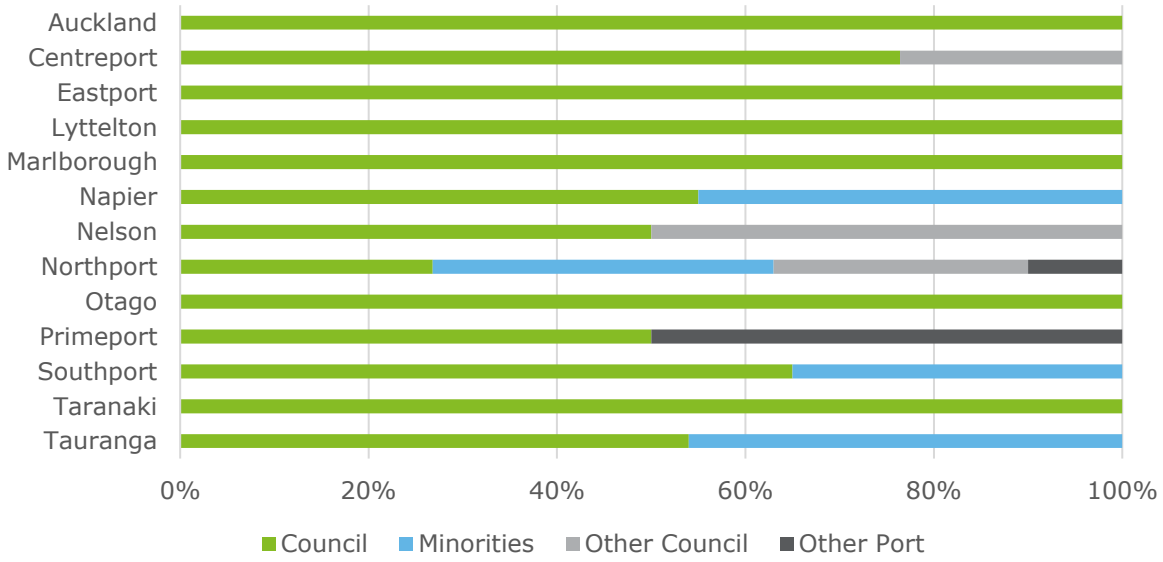
4.3.2 Ownership today

Like the international market, New Zealand port ownership is varied. There are 13 commercial ports operating in New Zealand, all of which are controlled by local government interests.

Four ports are partially privately owned through public listings on the New Zealand stock exchange (Ports of Tauranga, Napier, Northport (a subsidiary of publicly listed Marsden Marine Holdings) and Southport. Three ports have more than one council shareholder (Northport, Centre Port and Port of Nelson). Two ports have a portion of ownership by other ports (Northport and PrimePort).

Figure 25 depicts the ownership structure of key New Zealand ports.

Figure 25: Ownership structure of key New Zealand ports



Source: Adapted from Deloitte 2020 Ports and Freight Yearbook

4.3.3 Operating model

Unlike trends overseas, New Zealand's ports have not seen as strong a move to disaggregate stevedoring/cargo handling operations from the marine operations and landlord functions. New Zealand ports offer a range of services in some cases providing customers with a fully integrated service package including marine charges (towage, berthage etc), cargo handling services and storage. In other cases, these services can be disaggregated, particularly by trade.

All the ports own their container terminal assets and employ staff directly (except for Port of Tauranga which contracts most of the labour for the container terminal).

Bulk operations tend to be carried out by third party stevedores who also supply relevant equipment such as front-end loaders etc.

To demonstrate the diversity of operations, the Ports of Tauranga, Lyttelton, Auckland and CentrePort have been used as examples of differing operating models. These are summarised in Table 9.

Table 9: Container and Bulk operations at key New Zealand ports

	Port of Tauranga	Port of Lyttelton	Port of Auckland	CentrePort
Container operations	The port owns gantry cranes and employs a minority of crane drivers (~10%). Other labour is contracted out to third party providers. Straddles are all owned by the port with all drivers contracted out.	The port owns all gantries and straddles and employs all persons in the container terminal.	All crane and straddle drivers are employed by Ports of Auckland, which undertakes all stevedoring in the Container Terminal.	The port owns the two ship to shore cranes, straddles, reach stackers etc. It uses labour hire at peak times but still employs cargo handlers / drivers.
Bulk operations	The port levies marine charges and wharfage only. All the operations are managed by third party stevedores.	Labour and equipment are provided by third party stevedores.	Stevedoring in the multi cargo port is undertaken by contractors engaged directly by the shipping lines/cargo owners.	Third party stevedores run the log export / vehicle import operations.

4.3.4 Port competition

New Zealand has traditionally seen strong competition between its ports, particularly for freight generated at the margin of the port's hinterland.

Port hinterlands have been expanded with the introduction of inland ports, commencing with Port of Tauranga's MetroPort in 1999. Since then other ports have developed inland ports, for example:

- Port of Auckland has developed a network of freight hubs located in South Auckland, Mt Maunganui, Palmerston North (in partnership with Napier Port and Halls Transport) and Northgate (Waikato), in direct competition with Port of Tauranga and CentrePort. These regional hubs offer customers the ability to deliver exports to inland port gates, which are then carried by rail to Ports of Auckland for export
- Port of Tauranga has expanded its MetroPort network to include a terminal in Christchurch to feed its subsidiary PrimePort in Timaru – in direct competition with Port of Lyttelton
- Port of Lyttelton opened its Midland Port (inland port gate) in 2016 at Rolleston in mid-Canterbury to attract freight away from PrimePort.

All inland ports rely heavily on efficient rail connections to provide low cost, high volume and reliable movement of containers to and from the ports.

Furthermore, ports (both in New Zealand and around the world) are under increasing pressure from shipping lines to invest in new infrastructure to accommodate larger vessels (see Section 3). This investment may include deeper channels, stronger berth faces and larger quay cranes (which cost in excess of $20m per crane). This is placing considerable pressure on port owners who have competing demands for capital investment. Particularly for smaller ports with lower freight volumes over which to recover the investment.

4.3.5 Productivity Commission – International freight transport service inquiry

During 2011/12 the Productivity Commission undertook a thorough review of New Zealand's international freight transport. Specifically, the Commission was asked to undertake a comprehensive inquiry to evaluate the factors influencing the accessibility and efficiency in

international freight transport services, and to identify opportunities to increase the accessibility and efficiency to access these services.[21]

The inquiry reviewed all aspects of international freight supply chains including infrastructure, ownership, governance and regulations. The key focus was on productivity in the sector. The inquiry made 26 recommendations to government, and specifically highlighted five top opportunities for improvement:

1. Lifting the quality of infrastructure planning and coordination
2. Improving governance of ports and airports
3. Making competition regimes more pro-competitive
4. Building more productive workplaces at ports
5. Developing richer information.

Regarding governance and ownership of ports, the Commission argued that improvement to the current ownership and governance arrangements at New Zealand's ports would result in improved productivity. Noting that council's as owners of ports have multiple objectives (social, economic, cultural and environmental wellbeing of their communities), and councils should not try to achieve all these objectives with all their assets. Further, ports would be more productive and profitable with a narrower commercial objective and a suitable governance structure. The Commission argued that changes to the ownership of publicly owned companies can help improve governance, through increased transparency and improved incentives to perform commercially. It suggested three alternative private investment options:

- Stock market listing
- Cornerstone private shareholder
- Public private partnership.

The Commission provided Port of Tauranga as an example of a successful approach to combining public and private ownership[22].

Example: Port of Tauranga ownership structure

"The evidence to the Commission was that the Port of Tauranga approach works well for its owners and customers. Reasons offered for this were the company's mixed ownership structure (it is 45% listed on the NZX), the fact that its majority owner (the Bay of Plenty Regional Council) treats it as a financial asset to be managed according to commercial principles, and the port's contestable business model for containerised freight handling.

Stock market listing brings with it a number of important disciplines. Chief among these is that market perceptions of the company's stewardship and decision-making get reflected in the share price. Others are the regular reporting and continuous disclosure requirements which come with NZX membership. These benefits can be achieved while maintaining a majority stake in public hands."

Currently four of New Zealand's ports have minority shareholding listed on the New Zealand Stock exchange, Napier, Tauranga, Marsden Maritime Holdings (as part owner of Northport), and SouthPort. Previously both Lyttelton Port Company and Ports of Auckland have had minority listings, but in both cases the majority shareholder councils purchased the shares back.

[21] New Zealand Productivity Commission, International freight transport services inquiry, April 2012 v7
[22] New Zealand Productivity Commission, Cut to the chase, International freight transport services inquiry, April 2012

Lyttelton Port Company listed in 1996 when smaller regional council owners sold their shareholding in a public offering. The port reverted to full Christchurch City Holdings ownership in 2014 – the council claimed it gave it greater flexibility in its relationship with the port company.[2324]

Similarly, Ports of Auckland, was partly privatised between 1993 and 2005, after Waikato Regional Council sold its 20% shareholding in a public offering. Council owned Auckland Regional Holdings made a successful market bid for shares it did not own in 2005, bringing the port back to 100% council ownership. At the time some consideration was given to vesting the port land in a council entity and privatising the port operations.[25] This would have replicated common port ownership models elsewhere in the world.

The Government at the time noted the Productivity Commission's recommendations regarding council ownership and increased private capital participation, which would offer … "improved incentives for port efficiency, and the efficiency of the freight system in general". The Government noted that this is a recommendation for local authorities to consider. Further, it is was the Government's view that if the fundamentals of good governance are in place, and port companies focus on their commercial objectives, then the issue of ownership is less relevant[26].

4.3.6 Port development

Within this context New Zealand ports are continuing to invest in new assets and infrastructure. Recent New Zealand port developments are summarised in Table 10

Table 10: Recent port developments[27]

Port	Recent port development
Port of Auckland	• In the past 12 months there has been a great deal of infrastructure work at the Port to support automation, including thousands of hours of testing autonomous straddles. When automation goes live in 2020, the Port of Auckland will be the first New Zealand port to automate. • In April 2019 the Port opened its new Waikato Freight Hub and completed its first customer facility. • In July 2019 the Board approved the purchase of the world's first full-size, fully electric port tug. • The Port is also working on building Auckland's first hydrogen production and refuelling facility. The port has applied for resource consent and is in the process of procuring a supplier for the necessary equipment.
Port of Tauranga	• The Port of Tauranga has recently announced a partnership with Tainui Group Holdings to support the development of the Ruakura Inland Port in Hamilton. • MetroPort Christchurch, is now home to a purpose - built warehouse for the Port of Tauranga's associate company Coda Group. The facility allows Coda to handle Westland Milk dairy exports. • The port is also currently pursuing plans to add another container vessel berth by extending up to 385 metres to the south of the existing Sulphur Point wharves. • Tauranga's ninth container crane is scheduled for delivery in 2020.
Port of Taranaki	• The port has recently received a new tug which arrived in July 2018. The tug supported the float-off of the COSL jack-up rig in Admiralty Bay and then supported the rig's move up the coast to the Pohokura platform.

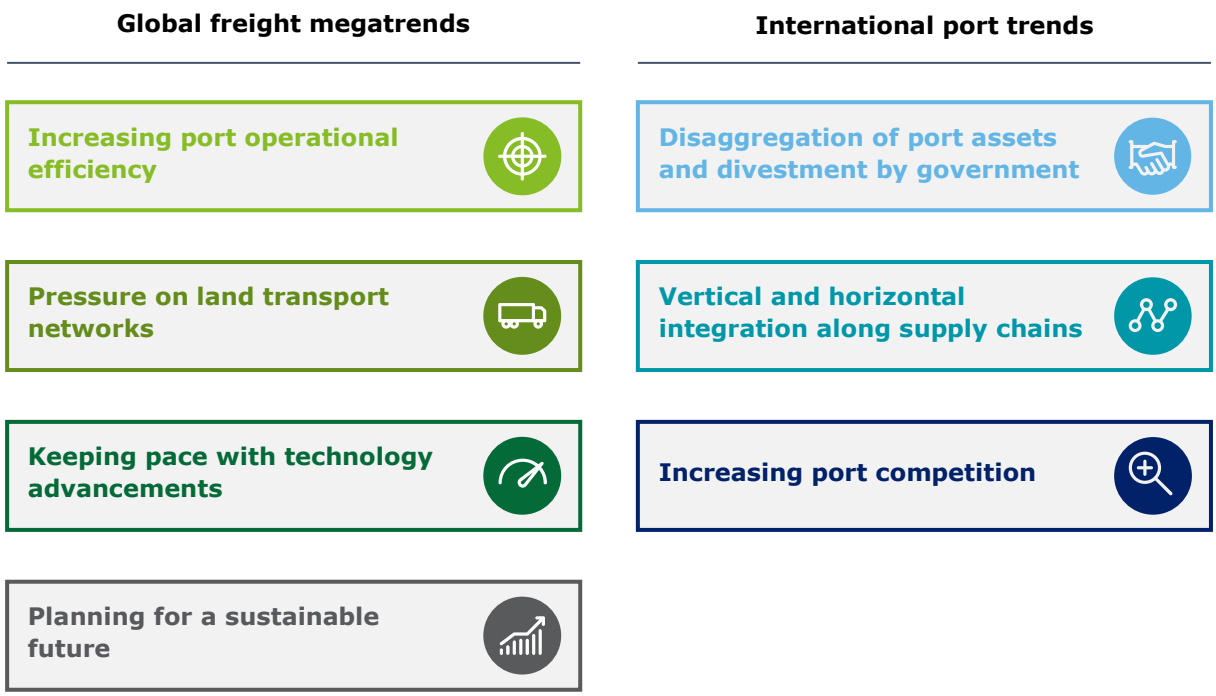
[23] https://www.stuff.co.nz/business/115104967/napier-port-lists-on-nzx-just-the-third-company-in-two-years-to-do-so
[24] https://milfordasset.com/insights/port-takeover-bid-raises-important-issues
[25] John Wilson, Short History of Post- Privatisation in New Zealand, December 2010
[26] Recommendation 10.6, Government response to the New Zealand Productivity Commission's recommendations on International Freight Transport Services, December 2012, page 8
[27] https://www2.deloitte.com/content/dam/Deloitte/nz/Documents/icp/2020-ports-and-freight-yearbook-v2.pdf

Port	Recent port development
	• The port has increased its log storage area by removing the cold store on the Blyde Terminal and repaving the area. • The port has also installed stronger bollards on Blyde Wharf as part of an ongoing port -wide replacement programme. This enables two log vessels to berth and load simultaneously.
Napier Port	• In 2019 Napier Port raised $234m through an Initial Public Offering (IPO). Of this, $110m has been retained by the port to repay debt and provide cash and debt facilities to fund, among other things, the new multi-purpose '6 Wharf'. • The new wharf will provide increased capacity to meet additional forecast demand and increase efficiency of supply chain infrastructure, construction began in February. • In addition, there is a pipeline of strategic projects to be delivered in 2020 including: 6 Wharf integration; completion of the second off -port site at Thames Street; and increased utilisation of data and technology capability.
CentrePort	• In October 2019 CentrePort reached an important milestone, finalising its insurance claims relating to the 2016 Kaikoura earthquake, for a total of value of $667m (net of deductibles). • The multi-user ferry terminal project sits under the regeneration plan and a business case was delivered in August 2019. CentrePort engaged with the project group of partners to produce a collaborative piece of work, integrating the city's needs and ensuring that State Highway 1 remains connected between the North and South Island. • The Port's demolition programme has continued to dispose of damaged and redundant assets allowing for reconfiguration and remediation work. • Clearing of the E-site adjacent to Waterloo Quay has allowed for development of a new vehicle marshalling area for the StraitNZ Bluebridge service, while the removal of the former cruise terminal has increased the bulk cargo capacity of Aotea Quay.
Port Nelson	• The port has decided to upgrade the Main Wharf North to ensure that there is a berth capable of handling larger container and cruise vessels going forward. This will take 12 months and will mean the port has a 280m berth. • The port has also approved the purchase of a new harbour tug, with a 70-tonne bollard pull, which will help with handling larger vessels.
Port Marlborough	• Port Marlborough embarked on a journey to evolve from a traditional infrastructure focused port business to a designed, sustainable operation.
Port Lyttelton	• The South Island's growing economy means Port Lyttelton requires more land to handle increasing volumes of export and import trade, primarily through extension of the container terminal at Te Awaparahi Bay. • The first stage of the Te Awaparahi Bay reclamation project is complete, with 10ha of new land created and the second stage underway to create an additional 6ha. • Additionally, a new rail siding adjacent to the Container Terminal and four new reefer towers are currently under construction to increase the capacity.
PrimePort Timaru	• PrimePort recently completed a $2m project to widen the shipping channel. • The Port took delivery of a new $8m tug in FY19. The 60-tonne bollard pull tug is a significant addition to the Port's marine fleet and will improve safety and capability as the ships the Port handles get bigger. • The channel widening and the new tug have enabled the port to handle the largest container ship calling the South Island. The Maersk Rio Class (capacity of 5,900 TEU) can now safely access the port adding Timaru as a weekly call on the Southern Star Service.

Port	Recent port development
	• Works on No. 1 Wharf are due for completion before the summer cruise season, with installation of five sets of on-shore storm bollards as well as renovations to piles, beams, fenders and the deck. • Planning and design are underway for pile strengthening of the North Mole Wharf, including replacement of its timber deck with concrete. • Plans to increase log storage capacity, efficiency and safety by sealing four hectares of existing log storage yard is at the design stage.
Port Otago	• Port Otago welcomed the new Rio class ships into Port Chalmers in FY19 drawing 13.5m and ceased deepening the lower harbour, levelling off at 14m chart datum. • The investment in the multi-purpose wharf extension provided additional berthing catering for the growing cruise ship arrivals whilst still servicing log and container customers. • Deepening of the upper harbour channel to 8.5m chart datum was completed to allow larger/heavier bulk ships to visit Dunedin Bulk Port. • The investment in warehousing at Dunedin Bulk Port is associated with Port Otago's support of the Harbourside project in the harbour basin.
Southport	• South Port has completed a $2.2m upgrade to the Island Harbour Cold Stores load out and load in infrastructure and installation of a new blast freezing facility. • During the year there was an upgrade of the light towers on Berth 8 and installation of new towers to Berth 5 and 3A, using LED lighting technology. • The port also completed successful dry docking and maintenance work on their tug.
Eastport Group	• Eastland Port is currently working on multi-million-dollar construction plan for a twin berth development, which will enable two 200m ships to berth simultaneously. This will allow for greater log handling and eventually containerisation through coastal shipping. • The port completed work on a new wharf side storage yard. The log yard will be able to store 15,000 tonnes of logs, meaning fewer log movements through the CBD. It has also been designed to allow for container space in the future. • Eastland Port has partnered with Gisborne District Council and other local stakeholders to create a vibrant inner harbour precinct.

5 Takeaways for the New Zealand Freight Sector

This section of the report presents the key takeaways and challenges facing the New Zealand freight sector now and in the future. The key takeaways have been identified from the analysis of the freight industry megatrends (Section 3), the trends in port ownership and governance (Section 4) and the characteristics of the New Zealand freight sector (Section 2).



5.1 Global freight megatrends

Global megatrends are likely to impact on the New Zealand freight industry in the following ways:

Increasing port operational efficiency

Global supply chain alliancing and horizontal collaboration is expected to continue occurring over the coming decades, with a strong focus in the shipping sector. This chase for scale will be further witnessed as freight organisations look to increase capacity to capture a greater market share and improve their bottom line.

In parallel, the global location and quantum of demand will also increase and change over the coming decades. Continued population growth, the majority in Africa, will result in changing demand for goods and open-up new low-cost labour resources, altering the global supply network.

As the volume and intensity of global freight movements increase, ports will need to continually adapt and invest to provide a commercially attractive proposition to the shipping lines. To remain competitive, ports will need to invest in capacity and capability, including:

- Increasing marine-side infrastructure capacity to meet the increasing vessel sizes due to fleet cascading as shipping lines purchase larger vessels and scrap smaller, less economical vessels. This investment will need to ensure channel depth and width, berth faces, and quay cranes can accommodate the larger vessels

- Ensuring that port land and operations can efficiently and cost-effectively load, unload and store goods, resulting in shorter turnaround times per vessel visit
- Investing in land side infrastructure and logistics networks to both enable efficient movement of goods and increase the competitive hinterland, in turn increasing potential throughput.

Pressure on land transport networks

As demographic changes (increasing population and urbanisation) and varying freight industry commercial imperatives impact freight flows, there will be increasing and shifting demand on the New Zealand land transport network. This will be further exacerbated through the continued rise in e-commerce and online shopping coupled with consumer desire for same day delivery. At a high level, this changing volume, location and intensity of freight movement within New Zealand may result in:

- Increased import volumes as the New Zealand's population increases, with a focus on the densely populated Auckland region. This will apply increasing pressure on the already congested road network
- Changing demand of exports, currently sourced from across New Zealand, resulting in varying pressure and potential pinch points on the national port, road, rail and warehousing supply chain.

Consideration is needed regarding the labour force that will be required to operate the land transport network. In recent times there has been a reduction in the willingness of younger people to enter the freight industry as, for example, truck and train driving work is not as attractive as alternative occupations. This trend is likely to continue in the medium term and be exacerbated by increased freight movements. However, the introduction of new technologies may alleviate some of the labour shortfall, as developments such as autonomous vehicles and platooning, are likely to change the nature of freight sector work and will require different skills.

Keeping pace with technology advancements

Digitisation is becoming a core component of the freight sector, led by industry investment to increase speed, reduce cost and avoid error. Participation from all parties in the supply chain will be critical to the realisation of a digitally integrated logistics chain allowing the port ecosystem to become a collaborative community that can participate in integrated world trade.

There may be resistance to technological advancement as organisations have traditionally had little incentive to share pricing and other business information. However, the benefits associated with this shift could unlock capacity and provide better service outcomes for all actors along the supply chain. While New Zealand to date has kept pace with technology advancement, it does not want to be left behind. This will require significant and ongoing investment to keep pace with industry standard technology.

Planning for a sustainable future

Changes in consumer preference will always be a key driver for change in the industry. Sustainable practices are likely to cascade up-stream at an increasing rate as corporations pledge to only work with those suppliers that adhere to environmental standards. New technologies (such as blockchain) will help support this environmental transparency between parties.

As more green initiative and stricter environmental policies are embraced by the sector (including the prevalence of alternative fuel sources), the New Zealand freight sector will need to plan through a sustainable lens. This may include the need for wider investment in enabling and complimentary infrastructure to facilitate sustainable changes to operations.

5.2 International port trends

Three key international trends in port owner ownership and governance are likely to impact on the New Zealand port sector.

Disaggregation of port assets and divestment by government

The international experience over recent times suggests that port ownership and operations are disaggregating and privatising. Government has tended to remain in the role of regulator and owner of strategic assets, such as land and channels. Whilst the private sector has actively invested in port operational activities, particularly stevedoring.

This has not been the case in New Zealand, where ports for the most part remain fully integrated and under local government control.

The Productivity Commission suggested that increased private ownership and governance of ports would likely improve port productivity and profitability, by focussing on the commercial outcomes for the businesses.

Overseas experience seems to bear this out as private operators continue to be attracted to investing in the sector.

This raises questions for the New Zealand port sector, such as:

- Will the lack of private investment hinder New Zealand's ability to provide competitive supply chains in the global market?
- Is council ownership of ports inhibiting investment in port infrastructure, as councils have competing needs from limited resources?
- How will councils respond as ports seek to address increased competition and the demands by shipping lines to invest in new infrastructure?

Vertical and horizontal integration along supply chains

The international trend has seen a continuation of vertical and horizontal integration along supply chains. For example:

- Shipping lines are investing in terminal operations and land side logistics operations to provide customers with seamless end-to-end service offering and as a result are securing cargoes
- Terminal operators continue to develop international networks to provide customers with global service offerings.

New Zealand has not seen this type of investment to the same extent from international shipping lines and terminal operators. While there has been some interest in investing in New Zealand ports by international terminal operators, but this has not eventuated. For example, Hutchison Port Holdings entered an agreement with Christchurch City Holdings to acquire just under 50% of Lyttelton Port in 2006, however the agreement lapsed amid the councils share buyback process[28].

In addition, long term contractual arrangements with shipping lines and exporters have been used to underwrite investment in new port infrastructure. For example, in 2014, Port of Tauranga entered a 10-year alliance with freight and logistics management company, Kotahi, which in turn had a long-term agreement with Maersk for its export volumes. This three-way agreement enabled

[28] https://milfordasset.com/insights/port-takeover-bid-raises-important-issues

Port of Tauranga to invest in upgrades to its container terminal to facilitate Maersk's larger vessels.[29]

For the most part New Zealand ports lack the scale to attract the interest of global operators.

However, ports are investing in some road-based transport, storage and warehousing and 4PL services, but generally ports are focussed on their core businesses.

Limited international integration in the New Zealand port sector may have an impact on the efficiency of New Zealand supply chains through lack of interconnectedness with international operators in the market. Scale will be critical to attracting international operators to invest in the New Zealand market.

Increasing port competition

Competition between ports is increasing both within countries and across borders. This tends to occur in three forms, by:

- Expanding hinterlands through the development of inland ports (intermodal terminals)
- New port developments within proximity of other ports – taking market share directly from incumbents
- Intra-port competition in large scale ports, with multiple terminal operators – competing for shipping line custom.

New Zealand is experiencing significant inter-port competition as, for example, the major ports of Auckland, Tauranga and Lyttelton seek to extend their hinterlands through inland ports. Intra-port competition is not evident in New Zealand as all operations on ports are fully controlled by the owners and a lack of scale may also be an inhibitor to intra-port competition particularly for container trades.

The planned long-term investment path for the rail network[30] will enhance KiwiRail's ability to provide competitive services in the land transport market, which will result in benefits to supply chains.

As ports continue to come under pressure to invest in new port infrastructure to remain competitive (such as deeper channels and bigger cranes) some may consider rationalising port activities or providing alternative services, for example acting as feeder ports to larger ports in either New Zealand or Australia. This may increase the cost to supply chains reliant on the smaller ports.

[29] https://www.port-tauranga.co.nz/delivering-step-change-new-zealand-international-trade/
[30] Ministry of Transport, Draft NZ Plan 2019

6 Next steps

This report has explored a wide range of factors which may impact New Zealand's freight infrastructure assets. It is intended that this report provide a high-level scan of elements that Infracom may wish to explore in further detail to inform the development of its 30-Year Infrastructure Strategy.

Key to developing the Strategy is to identify barriers which could impede the delivery of infrastructure and services. The examination of freight sector "megatrends" and the international trends in port ownership and governance undertaken in this report has highlighted several areas that could be pursued in more depth. Further examination and stakeholder engagement would help to more fully identify the potential impact of barriers and possible ways to address current and emerging constraints.

Government will play a key role in shaping the future, it has several levers it can use including policy, regulation and investment.

Potential barriers to the delivery of efficient infrastructure and freight services that warrant further examination include:

1) Adequacy of the method and level of public and private **investment in rail and road infrastructure** to meet the growing demands of the freight sector, particularly considering changing demographics and productive regions, and increasing competition between ports. The new arrangements for rail and road funding outlined in the NZ Rail Plan, marks a significant change in the way rail infrastructure is funded. The effectiveness of this change will require scrutiny over the medium term to ensure the anticipated benefits are realised, and that both modes continue to efficiently support freight supply chains.
2) Development of **infrastructure to support emerging "green" fuel sources**, such as electric and hydrogen propulsion systems, including distribution of new fuel types. Private sector is likely to play a key role in this sector; however, appropriate policy settings and regulatory support will be required to facilitate investment. Early examination of possible government interventions to help enable this emerging sector, may facilitate private investment in the future.
3) **Barriers to adoption of new technologies and digitisation of supply chains**, such as block chain technology and IoT. Better understanding of the enablers behind investment in these technologies may help government to identify initiatives and policy settings to encourage investment. For example, the scale of freight operations in New Zealand (road, rail and port) may inhibit the adoption of these new technologies. Likewise, lack of collaboration between freight sector operators may be reducing the benefits from digitisation of supply chains.
4) The transition of the industry from traditional operations of trains, trucks, and port equipment to new technologies such as autonomous vehicles and robotics, will require **a new type of workforce**. Forecasting the next generation of skills required by the industry, will help educators to prepare suitable training, help to identify new career paths, and encourage more people into the sector.
   Limited private ownership in ports may inhibit the sector's ability to respond to the changing demands of international supply chains, such as investment in new plant and equipment to meet the needs of larger vessels, or investment in new technologies to increase productivity of operations and provide better information to customers. Examination of the effects of port ownership models on investment, competition and supply chain efficiency will provide government with critical information in developing a roadmap for the future. Critical to this analysis would be detailed consultation with industry to gain deeper insights into the key drivers of individual business models, and how these may impact the sector.

7 Limitations

7.1 Limitations of our work

The following list reflect the key limitations of the analysis and reporting included within the Report:

1. This analysis is based on currently publicly available data, which has not been validated
2. The figures presented in this analysis are indicative at the time of writing of the Report
3. If any of the inputs and information used in the review were to change, then the outputs of the analysis and the Report findings would need to be re-reviewed.

7.2 Disclaimers

This report is prepared solely for the use by Infracom. This report is not intended to and should not be used or relied upon by anyone else and we accept no duty of care to any other person or entity. The report has been prepared for the purpose set out in our contract dated 11 May 2020 to provide financial and commercial advice services to Infracom. You should not refer to or use our name or the advice for any other purpose.