

Mode choice in Freight Transport in New Zealand: Findings of a Revealed Preference (RP) Survey of Shippers

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ABSTRACT

Freight transport mode choice decisions have important implications for business and society as a whole. Freight mode choice decisions depend on transportation demands and logistical activities as well as supply chain characteristics. Remarkably little research has been done on modelling freight demand in New Zealand (NZ), due to the great heterogeneity of firms and to questions of confidentiality and reliability of data. Freight demand characteristics, such as the attributes of the shipper or consigner, the attributes of the commodities to be transported, and the spatial attributes of shipments, strongly influence mode choice. We use a Revealed Preference (RP) survey to explore the relative importance of different transportation service attributes based on a sample of 176 companies across a range of industries in NZ. The results show several distinct types of transport mode choice behaviour within the sample and how the preferences for timeliness, cost, accessibility, restitution, customer service, and suitability vary between industry groups and business types. We also discuss seven factors that may influence or hinder use of rail or shipping by companies in NZ as transport modes for domestic and international shipments. The outcomes from the RP survey will be used for designing a stated preference (SP) survey, to develop a comprehensive mode choice model for freight transport in NZ.

1 INTRODUCTION

Transport management is one of the most important aspects of supply chain management. Transport acts as a physical link between customers and suppliers, enabling the flow of materials and resources.

Market globalization and the development of service economies have increased the demand for reliable, flexible, cost-effective, timely, and seamless freight transport services. The National Freight Demand Study (NFDS) reported that freight transport demand (tonne-kilometres) in NZ has grown by more than 32% during the last decade, and is expected to grow about 70% between 2005 and 2020 (Richard Paling Consulting, 2008). The Ministry of Transport expects the strong growth of freight movements to continue, with a 100% increase by 2040. Concurrently, the modal share of road transport has increased significantly and is expected to increase further in the coming years. In addition, with rising fuel prices and growing awareness of the challenge of global climate change, innovative policies and technologies are being proposed for reducing the negative impacts (i.e. congestion, pollution, etc.) of dependency on road transport.

The major players in freight transport networks are the shippers, who generate the demand for transport, the carriers, who supply the transport services for moving the demand, and both national and local government, who provide the physical transport infrastructure. Few studies have attempted to explore the relationship between mode choice decision making and the logistics characteristics of shippers in NZ. Recently, transport researchers have attempted to develop freight demand models to understand the causes of the recent declines in rail and coastal shipping and the rise in road freight movements. However, none of these studies has performed analysis at the disaggregate level and investigated the underlying behaviour of the individuals who actually make the mode choice decisions.

This study aims to identify the relative importance of factors affecting the decisions of shippers selecting transport modes. The Rockpoint (2009) study found that the present trend is that NZ shippers strongly prefer road transport where and when there is emphasis placed on reliability. In this study, we introduce 'timeliness' as a service factor to capture issues related to transport reliability, including both the expected delivery time and the variability of the delivery time.

In 2008, the NZ Government re-purchased the rail freight business with the intention of upgrading rail infrastructure to support more freight moving by rail. Additionally, NZ's domestic sea freight strategy was launched in May 2008 to increase the share of inter-regional freight carried by sea from 15% to 20% by 2020 and to 30% by 2030. Despite the efforts of the NZ Government and its transport agencies, NZ shippers still have several negative perceptions of transporting goods by rail and sea. We also tested seven factors that may influence or hinder use of rail or shipping by companies in NZ, as transport modes for domestic and international shipments.

1.1 Research Objectives

The objective of this paper is to explore how the preferences for the various service attributes influence freight transport mode choice for three business types and nine industry groups. The results from a revealed preference (RP) survey of NZ shippers are analysed. At the same time, this study also aims to explore factors that may influence or hinder use of rail or shipping by companies in NZ as the transport mode for domestic and international shipments. As globalization increased, the competitiveness of internationally traded products

is greatly influenced by various factors, which affect the overall logistics cost. Therefore, this study included logistics cost analyses for two business types, manufacturers and wholesalers/retailers. The study tries to answer the following questions;

- What service attributes do shippers use to select transport mode(s)?
- Which attributes are most and least important to shippers?
- What are the shipper's perceptions of rail and sea shipping?
- What is the use of owned road fleet and/or contracted carriers? What is the nature of the relationships with carriers?
- What are the differences in the logistics costs between manufacturers and wholesalers/retailers?

1.2 Background

1.2.1 Review of Literature

According to McKinnon (1989), the allocation of freight among transport modes, often called mode choice, has been one of the most controversial topics in the field of transport logistics. This is because many mode choice decisions are not always based upon a full and rational appraisal of options available, nor does a commercial approach take into account the full cost of each mode or modal service, especially with respect to external costs related to safety and environmental impacts.

The choice of transport mode has a direct impact on the efficiency of logistics channels and system (Banomyong and Beresford, 2001). Each transport mode possesses different characteristics, and different strengths and weaknesses. Depending on the mode chosen, the overall performance of the logistic system will be affected (Liberatore and Miller, 1995). The transport decision-maker chooses the transport mode within a logistic system, and depending on the requirements, uni-modal, combined, multi-modal or integrated transport logistics will be utilised. It is important to recognize the impact of the decision-maker's perception on the mode selection decision.

The perceptual approach assumes that the explanatory variables influencing choice are determined by the transport user's subjective perception of the situation rather than by objective measurements. This approach treats transport as a product purchased like any other product. The contributions of Gilmour (1976), McGinnis (1990), Murphy and Daley (1994), Murphy and Hall (1995) and Evers et al. (1996) are good examples of the perceptual approach.

Gilmour (1976) analysed the modal choice of distribution and transport managers for freight movement between Melbourne and Sydney. He examined the attitudes of shippers towards modal choices based upon their perception of particular modes of transport offered. He discovered that cost was the most important factor.

The shipper's decision to use a certain transportation mode is generally based on several factors. A number of studies, mostly based on surveys and data analyses, have been conducted to identify the specific service attributes often considered important in the shipper decision process.

In 1990, McGinnis identified that the transport decision is typically affected by at least six factors: (1) freight rates, including cost and charges; (2) delivery time reliability; (3) transit times; (4) over, short and damaged goods; (5) shipper market considerations, and (6) carrier

considerations. According to the study, shippers overall perceptions are more greatly affected by timeliness and availability than cost, which is often the last criterion for selecting a transport service provider.

Murphy and Hall (1995) reviewed a range of empirical studies from the 1970s to 1990s with the same factors as the earlier McGinnis study but arrived at essentially the same conclusions, that shippers value service and reliability higher than cost or any other factors. Figure 1 shows the relative importance of the six categories of factors segmented into freight mode choice studies from the 1970s, 1980s, and 1990s identified by Murphy's study. Transit time, which was the second most important factor in the 1970s, has steadily declined in importance, and was ranked fifth in the 1990s. Carrier considerations have shown steady improvement, from sixth ranked in the 1980s to second tied for 1990s.

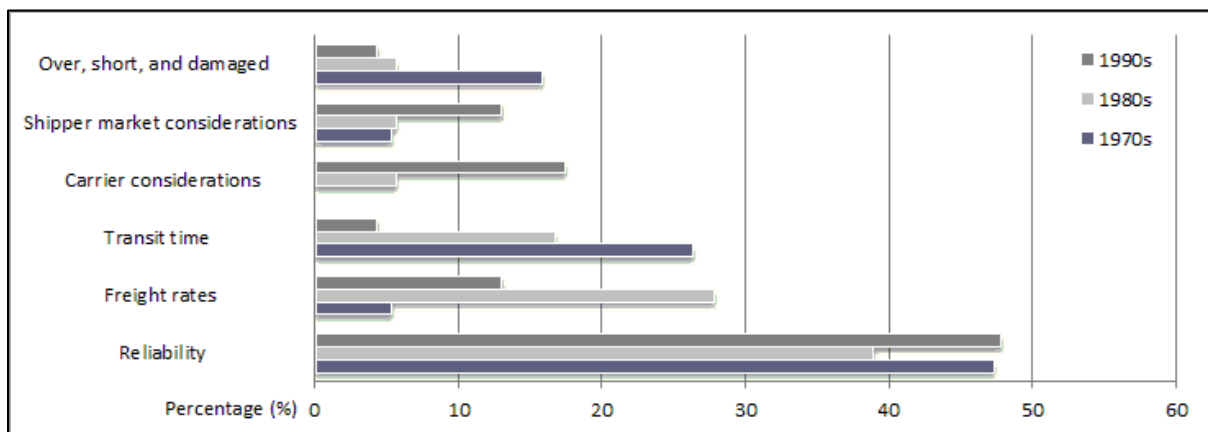


FIGURE 1. Mode Choice Perceptions 1970s~ 1990s

Decision-makers' own perception is a major input component to the decision making process in mode selection. Evers et al. (1996) found, based upon a survey of shippers in the state of Minnesota in the U.S., that this overall perception is driven largely by six perception factors. They used a questionnaire to collect shipper ratings information for three transportation modes on characteristics that included timeliness, availability, suitability, firm contact, restitution for loss and damage, and cost. These were the same factors used by McGinnis (1990) in an earlier study. Their study found that timeliness and availability are more important than the other four factors, with cost being the least important criterion.

Studies performed in the early 1990's (e.g. McGinnis (1990), Murphy and Hall (1995) and Evers et al. (1996)) shows that shippers have varying perceptions of alternative transportation modes such as road, rail, and road-rail intermodal. Research also indicated that shippers have considered the factors of rates and services important in the mode choice decision process. More recent research (e.g. Bolis and Maggi (2003)) shows that frequency and flexibility are important factors, particularly for firms operating in a JIT (Just-In-Time) context, but price, time, and reliability are also important decision factors, since the globalization of business increases the need to have effective and efficient transport.

1.2.2 Freight Mode Choice Studies in NZ

In NZ, there appear to have been very few freight transportation studies that have examined the service factors of mode choice through interviews or surveys. The first comprehensive freight movement study in NZ, the NFDS (Richard Paling Consulting, 2008), was carried out for the Ministry of Transport. The study conducted interviews and surveys with 100 key firms

across the industries. The study addressed the factors influencing freight mode choice only qualitatively, and the key factors are clearly different for different commodities. The key mode choice factors that study identified were cost, reliability, modal connectivity, restitutions, mode-to-mode transfer, customer services, environmental and sustainability issues, and some logistics issues within the supply chain. The study also concluded that the influencing factors relied heavily on the inherent value of goods, with the cost of transport being the major consideration for low value goods, and the reliability and security of delivery being much more important factors for high value goods.

Rockpoint (2009) provided a better understanding of how NZ shippers choose the appropriate mode of transportation through interviewing 45 firms across various industries. The study offered a choice of five service criteria, which were product care, cost, timeliness, reliability and safety. Reliability was cited as the most important service factor followed by product care and safety. Interestingly, this study uses 'reliability' and 'timeliness' as different service factors. However, 'timeliness' often encompasses both average shipment time (variables affecting the average include standard transit times and directness of service) and variations in shipment time (reliability of service) (Evers et al., 1996). The key drivers of freight mode choice identified by the NFDS and Rockpoint studies are shown in Table 1.

TABLE 1. Freight Mode Choice Factors

Mode Choice Factors	NFDS (2008)*			Rockpoint (2009)**
	Road	Rail	Coastal	
Price	1	2	3	5
Service time, reliability and flexibility of mode	3	2	1	1,4
Modal connectivity	3	2	1	-
Security and potential for damage	3	2	2	3
Ease of intermodal transfer	3	3	3	-
Need for specialised handling	2	3	3	2
Capacity	3	2	3	-
Value-added activities in the supply chain	3	3	1	-
Environmental and sustainability issues	1	2	3	-

*NFDS(2008): the performance of each mode rated on scale from 1 'worst' to 3 'best'

**Rockpoint(2009): scale from 1 'unimportant' to 5 'highest important'

The latest freight study is the Gisborne to Napier Coastal Shipping Study (Warwick Walbran Consulting, 2010). The study focused on freight operations in the forestry industry at the regional level. The authors interviewed employees of large forestry companies and exporters, and concluded that price is the most important factor in the freight transport mode choice.

2 RESEARCH METHOD

2.1 Revealed Preference Survey

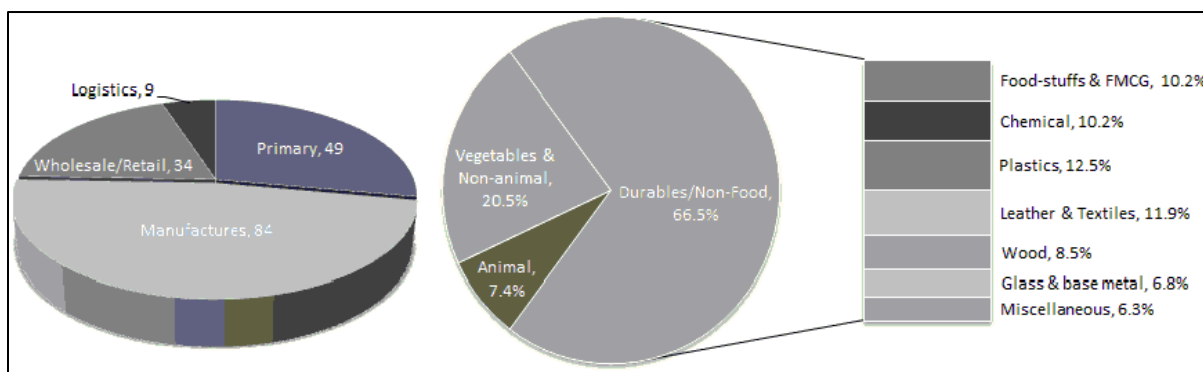
The survey for this study involved web-based questionnaires. The method is very efficient for collecting large amounts of data from a large number of geographically dispersed respondents, and assists with getting a large and representative sample. The types of questions in a questionnaire were contingency questions, matrix questions, closed-ended questions (mixed with multiple choices and binary questions) and open-ended questions.

The questionnaire was divided into two thematic parts. The first part included ten sections of general questions, to be answered by all interviewees, aimed mainly at categorising shippers and identifying transportation mode use and logistics operations. In the second part, interviewees were asked to answer only user-specific questions, which depended upon the interviewee’s business types (e.g. manufacture, wholesale/retail and logistics services).

2.2 Sampling and Data Collection

In order to assess the perception of shippers’ mode selection across the industries in NZ, industry was broken down into a number of sub-groups based on the Australian and New Zealand Standard Industrial Classification (ANZSIC). The survey sample was chosen randomly from the list of firms registered with New Zealand Stock Exchange (NZX), and firms that are members of industry associations, groups and councils. Firms were assigned to categories based on four business types, which were ‘primary/raw material providers’, ‘manufacturers’, ‘wholesalers/retailers’, and ‘freight logistics providers’. A detailed company profile (including business summary, products/services, and industry/sector information) was carefully considered prior to selecting potential survey participants. We also considered the structure of supply chains for major industry sectors. A typical supply chain consists of multiple firms, both upstream stages (i.e., suppliers) and downstream stages (i.e., distribution), and the ultimate consumer (Mentzer, 2001). Therefore, at least 10 companies were selected at each stage of the supply chain in most industries. It was assumed that the targeted sample size with a minimum 10% responding rate will yield a useful data set.

The survey was pre-tested and reviewed by academics and target survey recipients prior to the full mail out. Invitations to participate were next sent via email to a sample of 1900 NZ based companies in August 2011, with 176 shippers replying and completing all or almost all of the survey. Not all respondents provided answers to all questions, hence the number of responses will not sum to the total sample size in all instances. Of the 176 shippers who responded, 109 were categorized as ‘non-perishable durable product’ shippers while 67 were classed as ‘perishable food product’ shippers. Figure 2 shows the distribution of survey respondents between the business types within the supply chain and the nine product types from major industries.



*FMCG: Fast Moving Consumer Goods

FIGURE 2. Distribution of Survey Respondents among Business Type and Product Group

3 RESULTS

3.1 Freight Movement by Mode

3.1.1 Mode Shares by Business Types and Product groups

The questionnaire for this study distinguished between four different transport modes (road, rail, air, and sea) and two types of destinations (domestic and international).

Not surprisingly, regardless of product groups or business types, the most widely used mode of freight transport by NZ shippers is road transport, followed by sea, air, and rail. Figure 3(a) shows that mode shares change with the volume of exports. When the volume of exports increases, modal shares of non-road modes gradually increase, mainly in sea and air. Primary/raw material providers are the highest road transport users by type of business, with the road transport share being 11% higher than for manufacturers (Figure 3(B)).

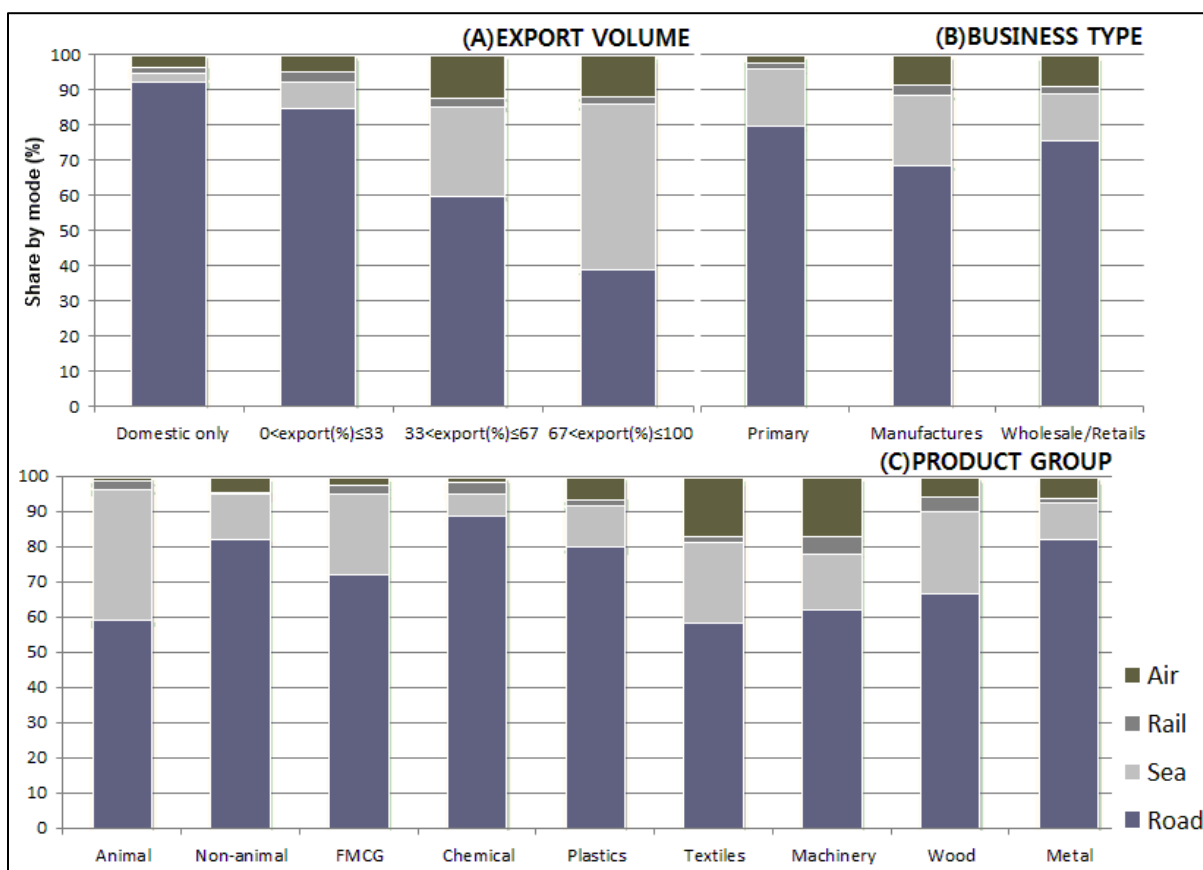


FIGURE 3. Mode Shares by Export Volume of Firm (A), Business Type (B), and Product Group (C)

Figure 3(C) shows a strong dependence on road transport in the product groups of chemical, base-metal/glass, plastics and non-animal food. As demonstrated in Figure 3(C), nearly 40% of animal products and 25% of wood products are moved by sea. This is understandable since NZ exports large volumes of wood, wood products, and animal products. Using rail for distributing products to domestic destinations is very limited over all product groups. However, relatively high proportions of leather/textile products and machinery/mechanical equipment products are moved by both sea and air, and food-stuffs/FMCG (Fast Moving

Consumer Goods) products are moved by sea as well. The survey responses also revealed that more than half of the annual productions of goods are exported.

Shippers were also asked to indicate the use of intermodal transportation to both domestic and international destinations. Table 2 indicates that the ‘road with interisland ferry transport’ combination is the most common in domestic shipping. There are no significant differences in the use of intermodal service between air, sea and rail within domestic transport. In exports, about 79% of shippers are using two transport modes combination which are either road with deep-sea or air, while three modes combination of with road shows only about 21%. It is also interesting that nearly 40% of the respondents say the decisions to use intermodal transportation options are made by external professionals such as freight forwarders, freight brokers or contracted carriers, while 24% of the respondents answered that the decisions are made by them (i.e. internally).

Table 2. Intermodal Use by Destination

Intermodal export	%	Intermodal domestic	%
Road + Air	22%	Road + Inter-island Ferry	49%
Road + Deep Sea	55%	Road + Air	11%
Road + Rail + Air	1%	Road + Coastal Sea	13%
Road + Coastal Sea + Air	1%	Road + Inter-island ferry + Rail	13%
Road + Rail + Deep Sea	12%		
Road + Coastal Sea + Deep Sea	9%	Don't know	15%

3.1.2 Road Transport: Own or Hired Vehicles?

The firm or shipper has a choice as to whether a carrier will be a contracted to move goods or the firm will own and use its own trucks. Nowadays not many firms set up their own private transportation operation, unless they have unique service requirements that cannot be met by common carriers. The disadvantage of having one’s own fleet is the investment in equipment, facilities, and people to operate and manage it. As demonstrated in Figure 4, all product groups of NZ industry rely heavily on contracted carriers for transporting their goods.

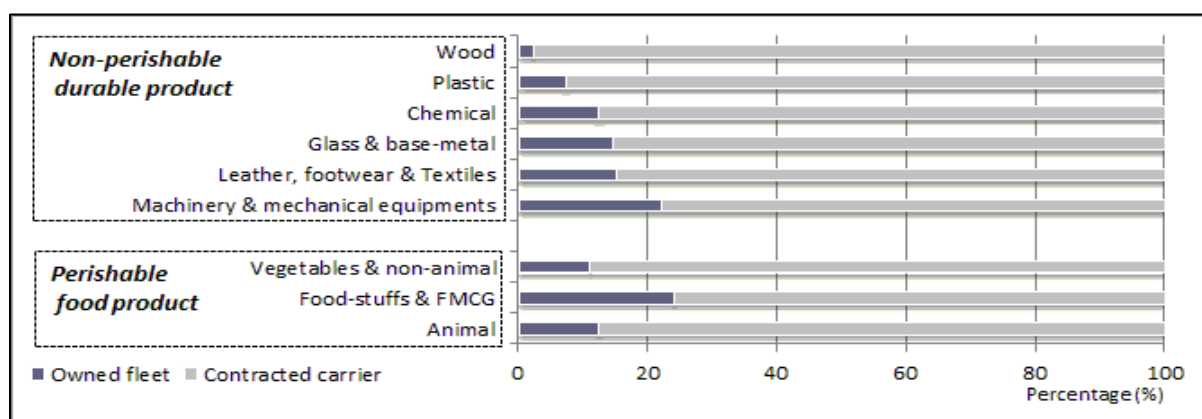


FIGURE 4. Use of Owned or Contracted Vehicles for Different Product Groups

Survey responses revealed that 86% of firms have contracts with one to four trucking companies for over 10 years. Often the shippers perceive benefits by having a longer contractual agreement with contracted carriers. When medium to long term contracts are

offered by contracted carriers, shippers can get lower freight rates. Also, some contract carriers even offer dedicated equipment for a customer and tailor service to that customer. Longer term contracts also provide some security to the contract carriers to continue to provide and even increase capacity.

Shippers tended to hire carriers for long distance deliveries. For example, one company in the food industry advised during a face-to-face interview that it has three processing/operating sites, two in the North Island and one in the South Island. This company has a fully integrated supply chain and has outsourced most of its transport services, contracting transport carriers for 'inbound receiving' and distributing product to wholesalers or retail shops around country. However, this company also operates a small fleet of five 5-tonne trucks at each site, for providing local deliveries and responding to unexpected demands or orders.

3.2 Mode Choice Preference

3.2.1 Mode Choice Service Factors

The NFDS study report (Richard Paling Consulting, 2008) stated that mode choice is a complex issue involving trade-offs between the range of attributes of alternative modes. To help identify the complexity and to quantify the effects of the attributes of alternative modes, survey respondents were asked to rank six service factors influencing the choice of mode. Those attributes were:

- timeliness (e.g. transit time, reliability of service, directness of service),
- mode availability/ accessibility (e.g. availability of equipment/mode at origin or destination point(s)),
- restitution (e.g. processing of loss and damage claim, amount of loss and damage)
- customer service (e.g. firm contact, after sale service),
- suitability (e.g. suitability for shipment size, suitability for commodity to be carried) and,
- transport cost.

The respondents were asked to rank these service attributes in order of importance, from 1 through 6, the most important item being ranked 1 and the least important being ranked 6. The results are shown in Figure 5.

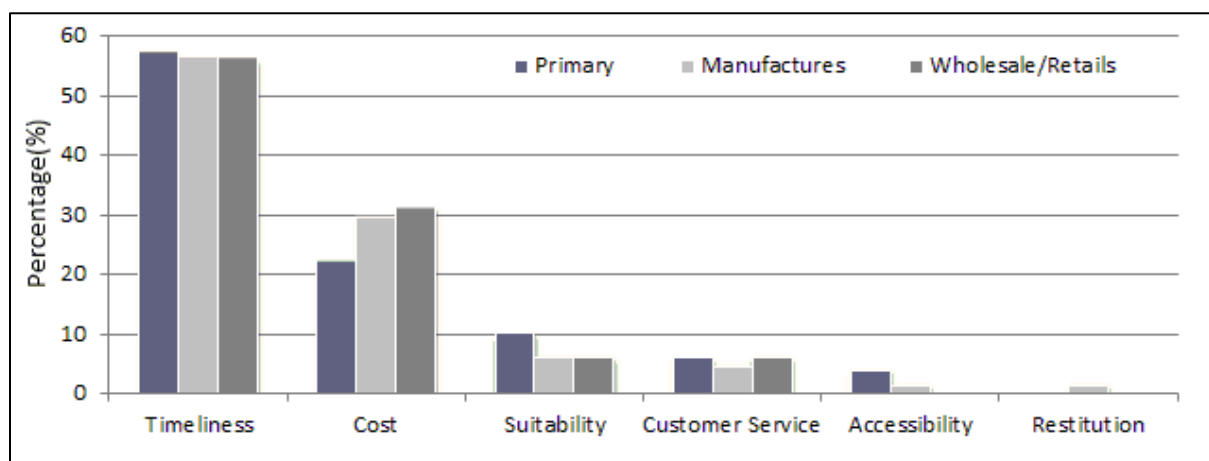


FIGURE 5. Percentage of Shippers Rating the Attribute as Most Important

As shown in Figure 5, about 57% of respondents cited *Timeliness* as the most important mode choice factor, compared with 27% for *Transport Cost* and less than 8% for the rest of factors. Cost is a more important factor for manufacturers and wholesalers/retailers than for primary/raw material providers.

Most of the product groups have a similar perceptual pattern, except for wood, which cited *Cost* as the most important factor. The unusual responses of those shipping wood is understandable given that wood products, such as logs, wood chips and timber, are relatively low-valued goods. The NFDS report identified the distribution patterns of logs and woodchips, with most logs being exported from the closest seaport in the region due to the high cost of transport and the weight of the product. A similar example can be found in a Turkish forestry industry study, which found that the transportation cost constitutes 30% of the total wood production cost, nearly twice as much as the cost of harvesting raw material (Acar et al, 2003).

TABLE 3. Mode Choice Service Factors: Ranked by Business Type and Product Group

	Timeliness	Availability / Accessibility	Restitution	Cost	Customer Service	Suitability
Business Type						
Primary/Raw Material Provider	1	3	6	2	4	5
Manufacturer	1	3	6	2	4	5
Wholesale/Retailer	1	4	6	2	3	5
Product Group						
Animal Food	1	3	6	2	5	4
Vegetables and Non-animal	1	4	6	2	3	5
Food-stuffs and FMCG	1	4	5	2	3	6
Chemical	1	5	6	2	3	4
Plastics	1	4	6	2	3	5
Leather, Footwear and Textiles	1	4	6	2	3	5
Machinery and Equipment	1	4	6	2	3	5
Wood	2	3	6	1	5	4
Glass and Base-metal	1	4	6	2	3	5

Table 3 summarizes the rank of the mode choice factors from '1' for most important to '6' for the least important service factors, for all business types and product groups. *Mode availability and accessibility* are relatively important factors for manufacturers and raw material providers, who belong to the up-stream stage in supply chains and some product groups such as animal and wood. On the other hand, customer service is a more important

service factor for wholesaler/retailer and many other product groups. However, *Restitution* and *Suitability* are less important factors for all business types and most product groups.

3.2.2 Drivers and Constraints in Modal Shift to Rail and Sea

Respondents were also asked to rank the most important constraints that discourage them from using rail and sea to carry their products. The factors offered for this question were; accessibility, service frequency, minimum load size, transport cost, transport time, transferability to/from road, and door-to-door service. As before, respondents were asked to rank the factors that may hinder their use of rail and sea in order of importance, from 1 through 7, the most constraining factor being ranked 1 and the least constraining factor being ranked 7. The results are summarised in Figure 6.

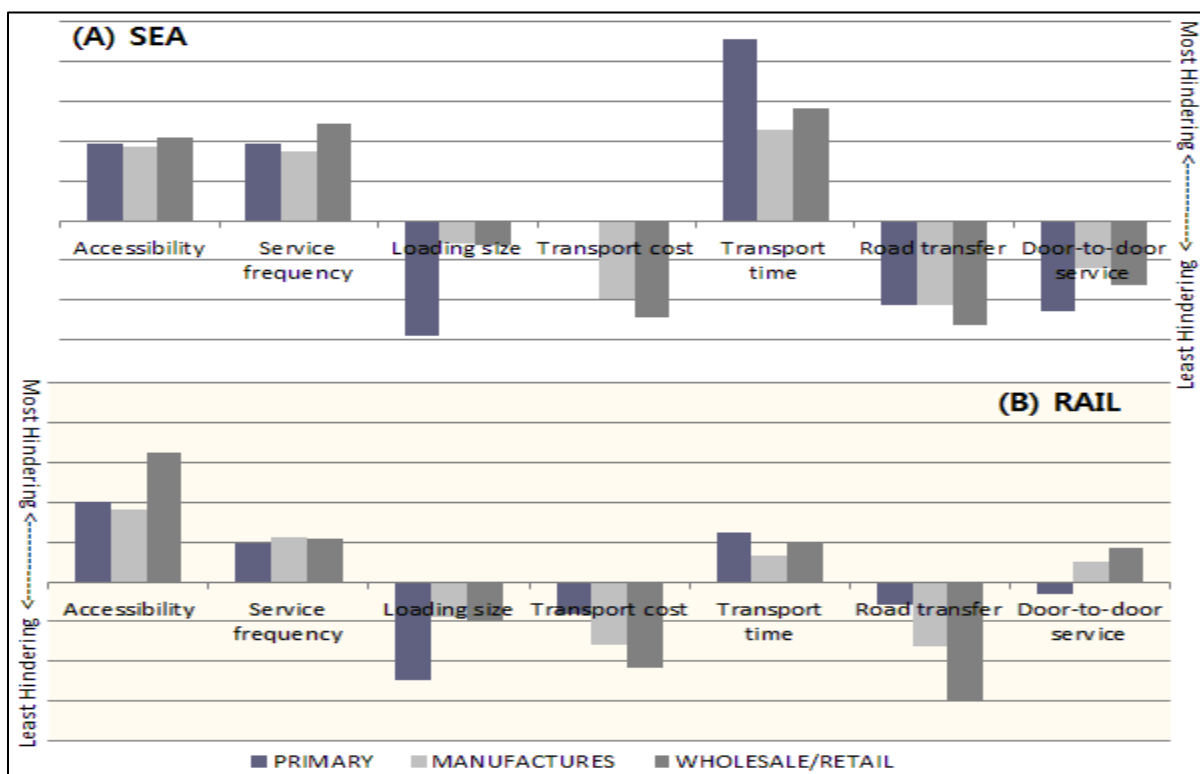


FIGURE 6. Mode Use Constraints for Rail and Sea Shipping

Figure 6 shows that respondents see, for both rail and sea, problems due to poor accessibility, low service frequency and high transport times. On the other hand, the factors of transport cost, road-rail/ship transfer, and required higher minimum load size by rail or sea did not strongly affect shippers. Rail use in manufacturing and wholesale/retail has been more negatively influenced by poor door-to-door service. The biggest concern for wholesale/retail has been poor accessibility in rail. Primary/raw material providers indicated that high transport times were the biggest barrier preventing them from using sea. In terms of service frequency and transport time factors, sea transport is more problematic than rail.

3.3 Supply Chain and Logistics Operation

The total logistics cost includes all the shipper’s costs for each option, including the inventory carrying cost, the transportation cost, and any other cost of doing business with a particular transport mode or carriers. Mode choice can be compared on the basis of the total logistics

cost incurred by the shipper. The inventory theoretic model of freight transport is a model that analyses mode choice from a total logistics cost perspective. The total cost approach has been a core principle in transportation and logistics decision making since the 1950s. The studies using a total logistics cost approach typically account for transportation and cargo handling costs, warehousing cost, inventory carrying cost, administrating cost, and all other logistics cost.

Respondents in manufacturing and wholesaling/retailing were asked to indicate their total logistics cost in percentage of turnover in 2010. The survey revealed that the costs of logistics constitutes on average 12.5% of the turnover. Figure 7 indicates that wholesalers/retailers spent more on administration and warehousing costs, while manufacturers spent 5% more on transportation and cargo handling costs.

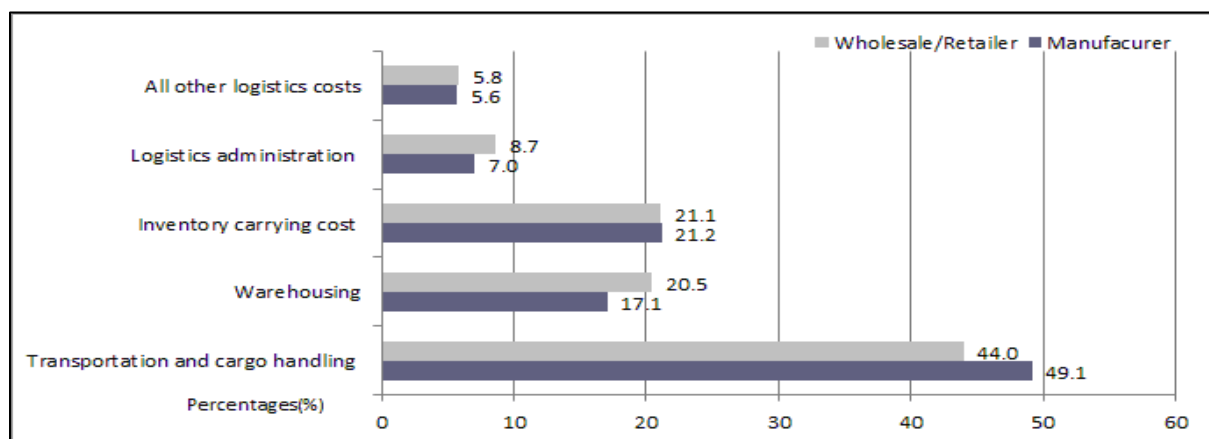


FIGURE 7. Average Logistics Cost for Manufacturer and Wholesale/Retailer

The survey responses also show that about 80% of both manufacturers and wholesale/retailers operate one or more warehouses, while only 50% of primary/raw material providers use warehouses. The popular location of warehouses operated by wholesalers/retailers was near the highway or major customers, while manufacturers favour sites near or within manufacturing facilities. For this reason, manufacturers spend more on transportation and cargo handling but less on warehousing.

4 CONCLUSIONS

This paper presents results from a RP survey of freight mode choice in NZ. The key conclusions emerge from this study are;

- (1) Regardless of product groups or business types, NZ shippers strongly prefer road transport, followed by sea, air and rail. Of the product groups, chemical, base-metal/glass and non-animal food are the highest road transport users.
- (2) NZ shippers rely heavily on contracted carriers for the distribution of goods by road transport over long distances, while operating their own road transport fleets for local delivery.

- (3) In rank order of importance, the mode choice factors are timeliness, transport cost, suitability, mode accessibility/availability, customer service, and restitution. There is increased emphasis on timeliness and cost as mode choice factors, compared with previous studies, which found the most important factors were reliability and product care. However, restitution and suitability are less important mode choice factors for most groups.
- (4) NZ shippers have several negative perceptions about transporting goods by both rail and sea in terms of poor accessibility, service frequency and transport time. On the other hand, the factors of transport cost, road-rail/ship transfer, and required higher minimum load size by rail or sea did not strongly affect shippers.
- (5) About 49% of respondents use 'road with interisland ferry transport' intermodal combination to transport freight to domestic destinations. The decisions to use intermodal transportation options to domestic and overseas destinations are made more by external professionals such as freight forwarders, freight brokers or contracted carriers than internal personnel.
- (6) Wholesalers/retailers spent more on administration and warehousing costs, while manufacturers spent more on transportation and cargo handling costs.

Although the survey has been limited to a sample of shippers in NZ and selected products groups, the results provide a useful empirical contribution to understanding the increasingly important issues of NZ freight shipper's mode choice behaviour. This study has also revealed some potential for a shift in freight from road to rail and ship.

A limitation of this study is that the lack of quantitative information about how those choosing between modes make trade-offs between conflicting objectives and factors. Future research should therefore concentrate on design and undertake a SP (Stated Preference) survey, with a view to developing a mode choice model for freight transport in NZ which will provide such information.

5 REFERENCES

- ACAR H, EKER M & EROGLU H (2003), A Review on the Wood Harvesting and Transportation Technologies in Turkish Forestry, World Forestry Congress, Quebec City, Canada.
- BANOMYONG R. & BERESFORD K.C. (2001), Multimodal Transport: The Case of Laotian Garment Exporters. *International Journal of Physical Distribution, Logistics Management*, Vol. 31, pp. 651–673.
- BOLIS S. & MAGGI R. (2003), Logistics Strategy and Transport Service Choices an Adaptive Stated Preference Experiment, *Growth and Change, A journal of Urban and Regional Policy*, Special Issue STELLA FG 1, Vol 34, pp. 4.
- EVERS P.T., HARPER D.V. & NEEDHAM P.M. (1996), The Determinants of Shipper Perception of Modes, *Transportation Journal*, Vol. 36, No. 2, pp. 13-25.
- LIBERATORE M.J. & MILLER T. (1995), A decision Support Approach for Transport Carrier and Mode Selection, *Journal of Business Logistics*, Vol. 16, No. 2, pp. 85-115.

MCGINNIS M.A. (1990), The Relative Importance of Cost and Service in Freight Transportation Choice: before and after Deregulation. *Transportation Journal*, Vol.30, No1, pp. 12–19.

MENTZER J.T. (2001), *Supply Chain Management*, Sage, Thousands Oak, California.

MURPHY P.R. & DALEY J.M. (1994), Logistics Issues in International Sourcing: An Exploratory Study, *International Journal of Physical Distribution and Logistics Management*, Summer 1994, pp. 22-27.

MURPHY P.R. & HALL P.K. (1995), The Relative Importance of Cost and Service in Freight Transportation Choice before and after Deregulation; Update, *Transportation Journal*, Vol.35, No.1, pp. 30-38

RICHARD PALING CONSULTING ET AL. (2008), *National Freight Demand Study*, Ministry of Transport, Wellington.

ROCKPOINT (2009), *Coastal Shipping and Modal Freight Choice*, New Zealand Transport Agency, Wellington.

WARWICK WALBRAN CONSULTING (2010), *Gisborne to Napier Coastal Shipping Study*, New Zealand Transport Agency, Wellington.