



Improving the Efficiency of Regional Supply Chains

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Abstract

Currently in Australia there are many initiatives being undertaken to more effectively engage Australia's regional capability in the international economy. Improving the efficiency of industry supply chains is one method.

FDF Management Pty Ltd recently examined a Victorian region which has the potential for economic gains to flow from improvements in freight transport. The study explored the feasibility of using contract-logistics arrangements to handle more of the freight generated by the Region. Contract-logistics was defined to include carriage and storage for the entire supply chain. Recognising that many of the large enterprises in the area use contract logistics, the study focused on small to medium size manufacturing and agribusinesses moving palletised loads, often in less-than-truck-load quantities.

The findings were influenced by interviews with freight shippers and freight carriers to characterise the task. Using FDF's *FreightInfo*™ to provide the control-totals and regional freight flows were assembled into a regional 'freight-matrix'. This matrix covered the origin, destination, commodity-type, pack-type, mode, logistics arrangements and tonnages.

The study indicated to all parties the level of commercial opportunities available. For suppliers of logistics' services, the study produced information on the regional market relevant to the appraisal of business plans.

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Introduction

The Victorian Government established Regional Forums to provide advice on rural and regional policies. The North Eastern Regional Forum (covering the shaded area in Figure 1) identified freight as an 'area where significant gains to the regional economy could be achieved'. It consequently sought advice on ways in which the freight needs of the Region might be met in a more efficient manner. In particular, the Forum wished to assess 'the role that third party logistics providers could play' and 'the advantages, disadvantages and financial viability ... of having them manage/coordinate the entire supply chain.' FDF Management Pty Ltd was engaged to undertake this work.

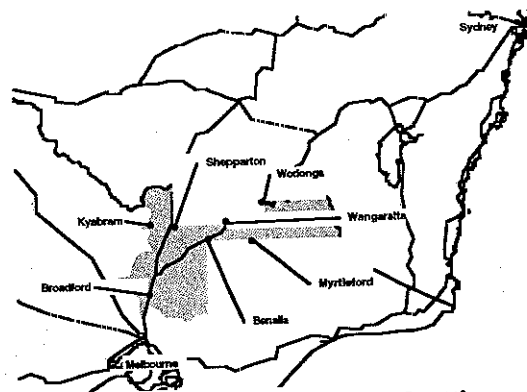


Figure 1 North Eastern Victoria in the regional setting

Study aim

The overall aim of the study was to establish the *prima facie* case, if one exists, for contract logistics operations in the Region to suit the needs of small to medium sized businesses. Ultimately this will be settled not by this study but by the commercial decision of the contract logistics providers themselves. This study indicated to all parties whether or not the idea is worth pursuing by:

- drawing the attention of logistics providers to prospects in the Region,
- generating much of the information that a logistics provider would seek in assessing whether or not to become involved,
- galvanising and coordinating responses by local participants, and
- demonstrating commitment by local participants.

Study tasks

The study was conducted in two stages. The tasks in stage 1 were:

- to undertake a preliminary assessment of the North Eastern Region's transport needs to ascertain the role third party logistics providers could play [and] the advantages, disadvantages and financial viability ...
- to develop a preliminary freight matrix and
- to perform a pilot study ... to test the validity of the freight matrix ...

The tasks of stage 2 were:

- to undertake a more comprehensive assessment of the possible role a third party logistics provider could play... and the advantages, disadvantages and financial viability of these providers managing the entire freight supply chain and
- to 'complete the freight matrix.'

What is a 'third party logistics provider'?

As the study focused on the possible role of logistics providers, some definitions and explanations are provided below. Third party logistics providers could include contract logistics providers, hire-and-reward carriers or freight forwarders. Shippers can, of course, conduct the entire operation in-house.

Contract logistics is at one end of the contracting-out spectrum, where virtually all the logistics tasks are carried out by a specialist operator. These tasks include transport, intermodal operations (that is, organising the transfer of the consignment from one mode to another), basic storage, and ultimately complete management of the logistics operation including, sometimes, warehousing and distribution. Under this option, the contract logistics company, not the shipper, largely decides where and how to hold inventory, but does so in such a way as to satisfy the shipper's requirements.

These options are presented diagrammatically in figure 2 below.

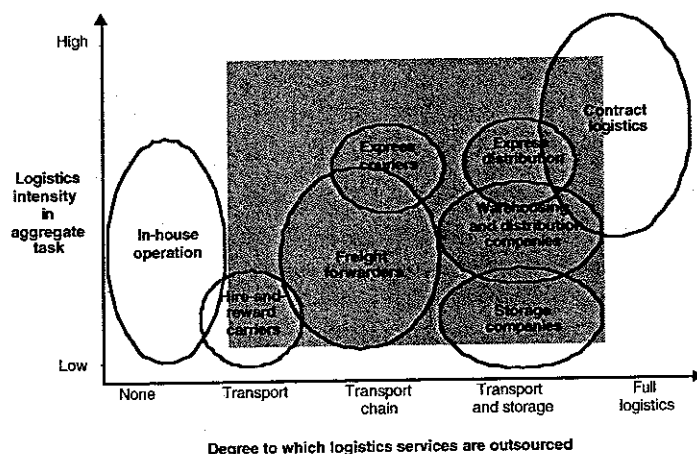


Figure 2 Types of logistics operation, classified by scope and type of services provided

Supply chain efficiency and performance

Within the study we were seeking the best method for performing the logistics operations of the North Eastern Region. By 'best' we mean a bundle of performance

measures comprising cost and level of service. Underlying our approach is a basic model of supply chain performance (figure 3). Logistics performance depends on (1) the type of logistics operation, (2) the characteristics of the freight flows to be handled, and (3) the relative importance that the shippers place on the various aspects of performance.

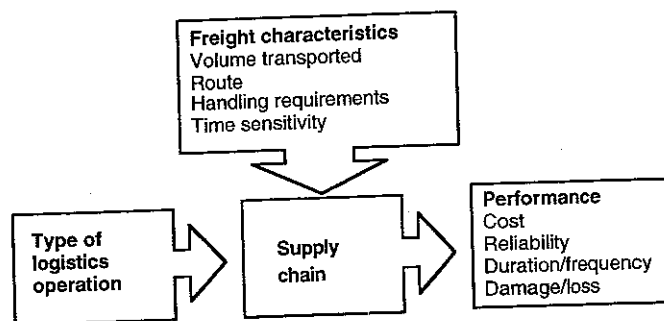


Figure 3 How the mode of logistics operation affects supply chain performance

Currently most shippers in the Region have 'dedicated' logistics arrangements; that is, they make their own, typically using one or more contract carriers on a firm-specific basis. This generally works well where consignments are in full truckloads (FTL) and are to be moved on a predictable schedule to a single destination. Under these circumstances, carriers are usually able to operate efficiently because they can schedule their vehicles so that most of their capacity is used most of the time.

Load factors

Ideally, carriers would like to perform point-to-point runs (figure 4 panel 1). This provides the highest possible level of service to the shipper as there is no need to wait for load consolidation, and no risk of loss or damage during transshipment. But point-to-point runs are inefficient for LTL consignments. In such cases, it may be preferable to consolidate loads, either through multiple pickups (figure 4 panel 2), or consolidation at a truck terminal (figure 4 panel 3). This allows larger trucks to be employed to capacity for most of the haul, which is cheaper per tonne-km than the alternative of using smaller or partly-laden trucks. These options tend to favour the larger carriers as it can be demonstrated that the likelihood of his finding suitable loads for consolidation depends largely on the volume of freight carried. Besides raising load factors, the use of contract logistics can reduce transaction costs—that is, the cost of arranging a haul—particularly where the load is LTL and the destination is not served by any of the local carriers.

Improvements in productivity due to increases in backloading and through transaction administration improvements may be possible with the use of contract logistics.

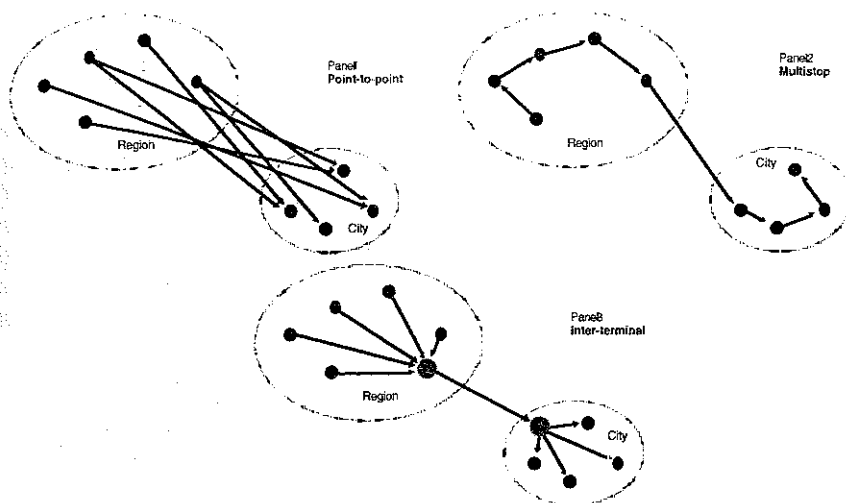


Figure 4 Transport options for outbound freight

Methodology

In undertaking the work, FDF interviewed shippers and carriers in North Eastern Victoria to better understand the issues being faced. As the study was designed to focus on the requirements of the freight customers, discussions were primarily with the users rather than the carriers. Meetings were organised with agribusinesses, manufacturers, road and rail carriers, local government and an internet service provider. The potential respondents were selected from industry sectors sampled from an electronic yellow-pages telephone directory. The interviews involved both structured and unstructured questions, covering 65 enterprises and were conducted in 15 regional centres. Where possible the enterprises selected included both the largest and smallest from each industry group. Interviews were also conducted with freight forwarders and exporters in Melbourne and in Wagga, as Wagga is within the freight catchment area. All respondents were both helpful and supportive of freight logistics improvements. The survey respondents provided information on both their inwards and outwards flows which was used to construct the freight database.

The freight database

The data requirements required for the study were embodied in an electronic database (figure 5). The contents of the database came from FDF's FreightInfo™ database, and from the survey of freight shippers and carriers in the Region.

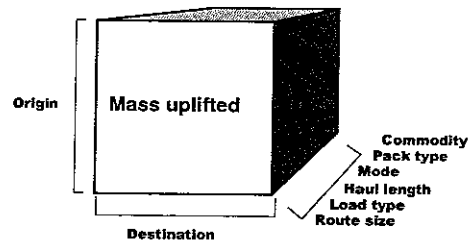


Figure 5 Structure of the freight database

The database structure is described as follows:

<i>Variable</i>	<i>Coding</i>
Commodity	FreightInfo commodity classification
Pack type	Bulk, bin; Bulk, loose; Bulk, tank; Container; Pallet; Pallet, chilled; Pallet, hazardous
Mode of transport	Road; Rail
Haul length	Long; Short
Load type	Mainly FIL; Mainly LIL; Local
Route size	Thick; Thin; Local
Mass uplifted	Tonnes; kilotonnes
Origin/destination	
FreightInfo zone	ABS Statistical Subdivision
Region	NE Victoria; Eastern Riverina; Sydney region; Melbourne region; Other
Study area	In; Out
Centroid	Major town in zone
Longitude	Longitude of zone centroid
Latitude	Latitude of zone centroid
Industry sector	Agribusiness; Agriculture; Mineral processing; Mining; STM; ETM; Retail; Wholesale

Note: 'Mainly FIL' loads are long-haul loads that are normally moved in full truckloads; 'Mainly LIL' loads are long-haul loads that are normally moved in less than full truckloads; and 'Local' loads are all short-haul loads. 'Thick' routes are long hauls commencing or terminating in the Melbourne region (including Geelong) or the Sydney region (including Newcastle and Wollongong); 'Local' routes are all short hauls (that is, commencing and terminating within the Region); and 'Thin' routes are all other long hauls

Population and economic base

The Region's population is dwarfed by those of Melbourne and Sydney (figure 6). As a result, the economy of the Region is almost entirely dependent on these two cities for supplies of manufactured items; there is virtually no interchange of intermediate manufactures within the Region. This so-called 'colonial' economic structure is a consequence of the smallness of the Region's population, which is insufficient to support clusters of complementary industries. The number of enterprises in the Region (sourced from electronic yellow pages) was obtained and similarly plotted to assist in understanding the region's freight generation and consumption patterns.

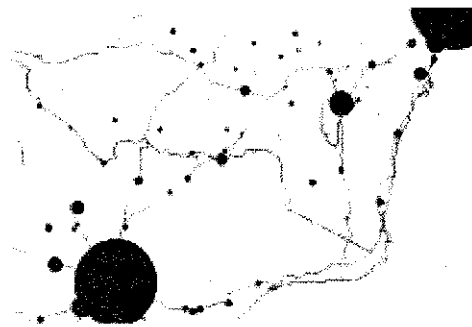


Figure 6 **Population: South East Australia, 1996**
Source: ABS

A freight overview

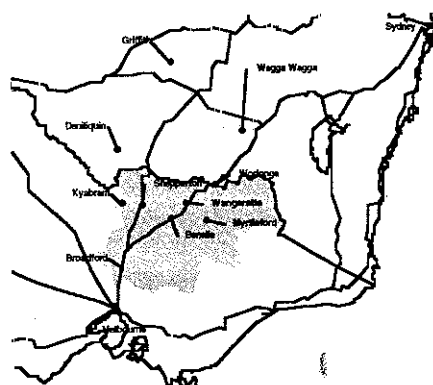
The study indicated that approximately 11.1 million tonnes of freight per annum are shipped out of the combined region of North Eastern Victoria and the Eastern Riverina, and about five million tonnes shipped in (table 1). Like most country regions, the Region is a net producer of freight; it ships out over twice as much tonnage as it ships in. This is a consequence of its economic base, which consists largely of primary production. The disparity between the mass of inbound and outbound freight makes it difficult to use backload capacity efficiently. Contract logistics providers are only likely to be interested in the Region's external flows—that is, those leaving or entering the Region, mostly destined for, or originating from, Melbourne and Sydney. Contract logistics providers excel where they can consolidate loads over long hauls, especially when there is a complicated itinerary to manage. This rarely applies to the Region's internal freight.

Table 1 Freight flows to, from and within the Region, 1996 (kt)

Origin	Destination					Total
	NE Victoria	Eastern Riverina	Sydney region	Melbourne region	Other	
NE Victoria	12 393	655	379	3 504	673	17 604
Eastern Riverina	797	16 862	2 658	1 815	2 106	24 238
Sydney region	36	332				368
Melbourne region	1 692	1 294				2 986
Other	888	750				1 638
Total	15 806	19 893	3 037	5 319	2 779	46 834

Source: FreightInfo96

Outbound freight: Nearly two-thirds of all freight leaving the Region is destined for Melbourne. Moreover, about eight times as much outbound freight is destined for Melbourne as is destined for Sydney (figure 7). This diagrammatic map is scaled to show the magnitude of the various flows including those to smaller regions. Melbourne is overwhelmingly the Region's outlet for primary products and manufactured items. This is not to say that these products are consumed in Melbourne: most would be subsequently exported or redistributed within Australia.

**Figure 7** Outbound freight from and within, the Region

Source: FreightInfo96 and NE Victoria survey

Inbound freight: Melbourne also dominates the Region's inbound freight: about half of all the freight that enters the Region is sourced from Melbourne (figure 8). Most of the rest comes from surrounding regions of Victoria and NSW, and consists mainly of primary produce for processing and transshipment on to Melbourne. Sydney is insignificant as a source of inbound freight to the Region.

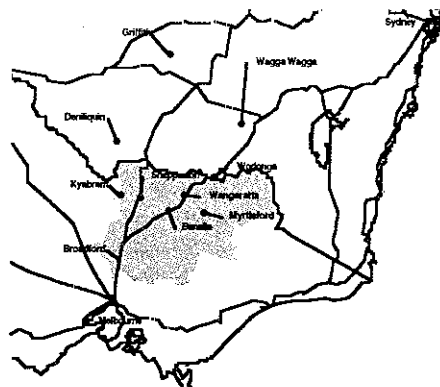


Figure 8 Inbound freight to and within the Region

Source: FreightInfo96 and NE Victoria survey

Although uneven in terms of mass, the Region's trade balance is more even in terms of value. The disparity arises because primary production is generally much less valuable per unit of mass than are manufactures. Furthermore, the Region undoubtedly imports a good many services, which possess value but little if any freight component. Of course, not all the Region's primary production is exported in raw form. Some, like petfood, is processed into a manufactured product before it leaves the Region.

Flows to, from and within the region: The Region's external flows are dwarfed by its internal flows, totalling about 30 million tonnes per annum (table 1 and figure 9). This is normal. They consist mostly of short hauls of low-value bulk commodities, mainly construction materials. Because they are generally unpredictable and because they use specialised vehicles, these flows are hard to rationalise. However, because internal hauls are short, the benefits of any rationalisation are small.

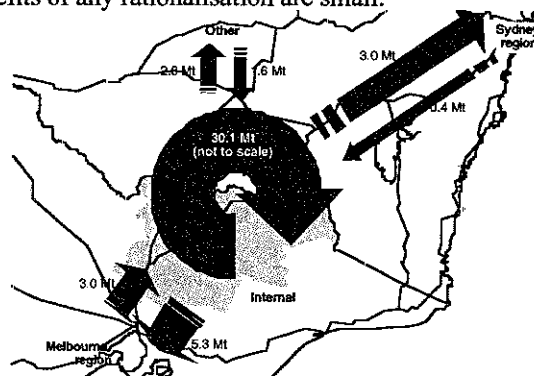


Figure 9 Freight flows to, from and within, the Region

Source: FreightInfo96 and NE Victoria survey

Transit flows. The Hume Highway runs through the Region, carrying several million tonnes of freight annually between Melbourne and Sydney. Since there is an imbalance of trade in Melbourne's favour, trucks often return to Melbourne underloaded. This

suggests the possibility of harnessing some of this space to carry the Region's excess of outbound freight, most of which is destined for Melbourne.

The scope for contract logistics

Not all kinds of freight are suited to contract logistics. We have already identified the criteria that predispose freight to handling by contract logistics. In this chapter we apply those criteria to the Region's freight flows, and in this way we estimate the market for contract logistics.

Prospectivity criteria

Handling requirements. Contract logistics reaps greatest efficiencies when all loads are strictly compatible. This requires that all use a common handling procedure. Other requirements are that no noxious or hazardous goods be included. In estimating the market for contract logistics we included only non-hazardous freight flows using the Australian standard pallet. We included both ordinary and chilled freight, provided both kinds were palletised.

Consignment size. Contract logistics benefits particularly shippers who wish to move LTL consignments. In estimating the market for contract logistics we assumed that contract logistics would capture between 10% and 50% of LTL shipments, depending on the route (see below); whereas contract logistics would only capture a flat 10% of FTL shipments, regardless of route.

Volume and route. Contract logistics is likely to be most prospective on the 'thicker', long-haul routes. On these routes, load consolidation has the biggest pay-off. Consolidation is easier on thick routes because there is plenty of LTL (and other) freight from which to build up FTL loads with little delay. Consolidation is also more worthwhile when the route is long-haul, as the fixed cost of transshipment can be spread over a bigger line-haul saving.

Time sensitivity. Consignments that are not particularly time-sensitive are most likely to benefit from contract logistics, because they can be transhipped, consolidated and warehoused en route if it is efficient to do so. In this way, they offer the contract logistics provider plenty of scope to trim costs. This is generally not possible with very time-sensitive consignments such as perishable produce and overnight parcels, which must be shipped directly. Time-sensitive goods of this kind are probably already handled by freight forwarders offering a premium service.

Quantity of freight moved

All freight. In all, about 47 million tonnes of freight are moved annually to, from or within the Region (table 2). However, most of this is unsuited to contract logistics. It

consists of bulk commodities such as construction materials and various agricultural products that are moved in full truck loads in specialised vehicles, or by rail. Contract logistics, with its sophisticated load matching capabilities, offers no particular advantage for loads of this kind. Instead, they are best carried by specialist carriers on point-to-point runs.

Pallets: About six million tonnes of freight are moved annually to, from or within the Region on pallets (table 2). This freight is in principle suitable for movement by contract logistics as it only requires standard handling procedures and can normally be stored and consolidated with other pallets (chilled pallets are an exception). Although only a small proportion of the Region's freight is palletised, palletised freight constitutes a larger share of long-haul freight; and it is on the long hauls that contract logistics is most beneficial.

LTL consignments. About half a million tonnes of palletised freight are moved annually to, from or within the Region in LTL consignments (table 2). It comprises roughly 1% of all freight in the Region, and 10% of palletised freight. This freight is very prospective for handling through contract logistics since it benefits from load consolidation.

Thick routes: Of the palletised LTL freight, over 200 000 tonnes travels along 'thick' long-haul corridors: 71 000 tonnes destined for Melbourne or Sydney (mostly Melbourne), and 152 000 tonnes originating from Melbourne or Sydney (mostly Melbourne). Of all freight, this is most likely to be handled by contract logistics, since the potential benefits are greater, and the costs lower, than for any other type of freight. (table 2)

Table 2 Freight flows to, from and within the Region, 1996 (kt)

Table 2

Freight flows to, from and within the region, 1998-1999

Origin	Destination					Total
	NE Victoria	Eastern Riverina	Sydney region	Melbourne region	Other	
All freight						
NE Victoria	12 393	655	379	3 504	673	17 604
Eastern Riverina	797	16 862	2 658	1 815	2 106	24 238
Sydney region	36	332				368
Melbourne region	1 692	1 294				2 986
Other	888	750				1 638
Total	15 806	19 893	3 037	5 319	2 779	46 834
Pallets						
NE Victoria	756	44	244	817	288	2 149
Eastern Riverina	103	949	737	199	319	2 307
Sydney region	36	269				305
Melbourne region	591	213				804
Other	263	128				391
Total	1 749	1 603	981	1 016	607	5 955
Pallets, LTL						

NE Victoria	49	14	6	34	60	163
Eastern Riverina	25	16	16	15	68	140
Sydney region	0	18				18
Melbourne region	92	42				134
Other	42	13				55
Total	209	103	22	49	128	511

Source: FreightInfo96. Note: Apparent errors in addition are due to rounding.

Estimated market for contract logistics

Although contract logistics offers most to palletised LTL freight on thick, long routes, it benefits other kinds of palletised freight as well. We estimate the total market for contract logistics to be 713 000 tonnes annually (table 3 and figure 10). For this estimate we assumed, conservatively, that contract logistics would capture the following market shares for palletised LTL freight only:

- 50% of freight on the main trunk routes to and from Melbourne and Sydney,
- 25% of freight on other long-haul routes, and
- 10% of freight on all other routes.

For palletised FTL freight, we assumed that contract logistics would capture a flat 10% of the volume on all routes. If we assume that the freight is carried on semi-trailers with an average payload of 20 tonnes, this volume of freight amounts to about 140 one-way trips every working day.

Table 3 Estimated market for contract logistics, by origin and destination (kt)

Origin	Destination					Total
	NE Victoria	Eastern Riverina	Sydney region	Melbourne region	Other	
Mass uplifted (kt/yr)						
NE Victoria	76	4	27	96	38	240
Eastern Riverina	10	95	80	26	42	253
Sydney region	4	34				38
Melbourne region	96	38				134
Other	33	15				47
Total	218	186	107	121	80	713
Of the above - full truckloads						
NE Victoria	15	1	5	19	8	48
Eastern Riverina	2	19	16	5	8	51
Sydney region	1	7				8
Melbourne region	19	8				27
Other	7	3				9
Total	44	37	21	24	16	143

Source: FreightInfo96 and FDF assumptions. Note: Apparent errors in addition are due to rounding.

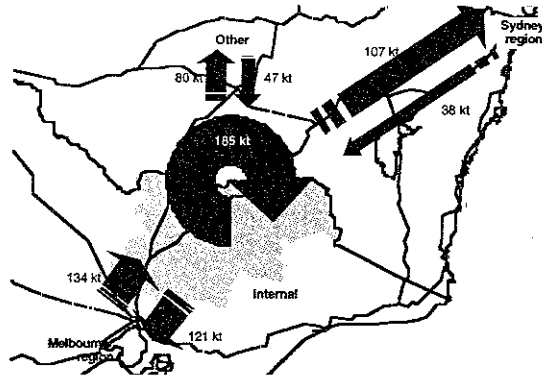


Figure 10 Estimated market for contract logistics

Source: FreightInfo96 and FDF assumptions

Market by industry / commodity group

About 90% of the estimated contract logistics market (table 4) consists of agribusiness products and simply transformed manufactures (STMs) Agribusiness products are items such as wine, which embody a significant amount of processing, but of a kind that can potentially be conducted on a small scale. STMs are items such as paper and textiles, which are produced by a recognisable plant or factory. Within the study each of the cells shown in tables 3 and 4 were expanded to provide information on commodity type.

Table 4 Estimated market for contract logistics, by type of route and load (kt)

	Local routes		Thin routes		Thin routes		Total
	Local	FTL	LTL	FTL	LTL	FTL	LTL
Pallet, regular							
Agribusiness	54	24	8	14	24	19	1
Elaborately transformed manufactures (ETMs)	10	14		0			
Simply transformed manufactures (STMs)	136	54	47	25	70	39	8
Wholesale	18	10			1		
Total	218	102	55	40	94	58	9
Pallet, chilled							
Agribusiness	56	9	24	6	10	2	1
Agriculture	2	1	2		11		
Wholesale	12	1		0		1	0
Total	70	10	26	6	21	2	1
Grand total	288	112	82	46	115	60	10

Source: FreightInfo96 and FDF assumptions. Note: Apparent errors in addition are due to rounding

Backloading issues

It is in the interests of all parties to backload as the cost of backload capacity is low. If trucks are full both ways, carriers can offer lower rates. What then is the scope for using backloading capacity in the Region's case? When we compare the regional market for contract logistics with freight in general, we see that long-haul flows are more evenly balanced (figure 10). The only substantial imbalance is on the Sydney corridor, which carries far more to Sydney than from it. On the face of it, not much can be done about this, as there exists little unfilled backload capacity into Sydney. On the contrary, there is unfilled backload capacity in the opposite direction, from Sydney to Melbourne—a result of Melbourne's dominance in manufacturing.

Communications technology

The rapid changes in communications technology will also impact on NE Victorian transport logistics. Some issues are noted below:

- A small company with a virtual presence on the internet can now effectively compete with major multinationals for the attention of a huge international market for consumers at a dramatically reduced market entry cost.
- With the new technology, customers can check product catalogues, product availability, delivery dates and status of orders placed electronically.
- Many national companies which previously had warehouses in every city, have eliminated these altogether. Products are now moving directly from the factory (point of production) to the customer.
- Besides electronically linking with suppliers and customers, transport companies are also using new technologies including bar-coding to track consignments and global positioning systems (GPS) to track trucks.
- Internet usage will require a local internet service provider (ISP). The ISP should be located in NE Victoria to avoid STD modem charges. Also the internet may be a means of displaying current freight rates and schedules, current truck availability etc.

The North Eastern Victorian freight users

It is imperative that studies of this type should involve the freight users. As noted, this study involved a comprehensive face-to-face survey of shippers - all of whom were very cooperative. They provided insights into many issues as diverse as liability, tracking freight, quality of service levels, communication technology, attitudes, airfreight and aircraft container loading opportunities, the roles of local carriers and of rail transport, opportunities of local export agents, consolidation opportunities and product to Asia. These user-views assisted in the formulation of the strategies.

Economic viability

Assessing the financial viability of a contract logistics service in the Region is virtually impossible without calling for real-world tenders. In this study we have indicated which market sectors are most prospective by virtue of the efficiencies they offer. At this stage, however, we cannot say whether the efficiencies will be sufficiently large to make the service attractive to shippers, and hence viable. We point out that it would be inappropriate simply to compare the charges of carriers with those of contract logistics providers. The logistics provider would probably provide a superior service in terms of delivery time and reliability; and would certainly relieve the shipper of many mundane administrative tasks.

Conclusion

The study was designed to advise on possible forms of contract logistics services for the region. The study found there are essentially three alternatives: consortia of shippers, existing carriers in the Region, or outside contract logistics providers.

Consortia of shippers. Naturally, shippers have full discretion as to whom they choose to carry their freight. However, we believe that no rational economic case can be made for the shippers' undertaking the service themselves. Rather the reverse. Contract logistics is a specialised service demanding a high degree of expertise and experience. It is unlikely that any firm other than an established specialist would possess these attributes.

Existing carriers in the region. The distinction between a carrier and a contract logistics provider is more one of degree than of kind. Hence it is possible that the larger carriers may wish to offer contract logistics services to shippers in the Region. Existing carriers in the region have an advantage over outsiders in their local knowledge and contacts.

Outside contract logistics providers. There are many contract logistics providers that supply the sort of service that the Region needs. However, whether they could do so at a price that would attract shippers is another matter. This study did not settle this question. What is needed is for the Region's shippers to communicate their needs to potentially interested parties, and to consider their offers. We pointed out that engaging an outside contract logistics provider does not in any way exclude participation by locally based carriers.

Freight broking. Though not strictly a form of contract logistics, freight broking offers some of its advantages. Freight brokers find loads for trucks and trucks for loads. In this, they compete with the transport side of contract logistics providers. The main difference is that freight brokers do not undertake to deliver the load; they are only paid to put shippers in touch with carriers. Advanced telecommunications are a useful tool in the hands of the freight broker, who traditionally was limited to the voice telephone and fax.

Other forms of electronic freight broking are possible. For instance, in the United States there is a website where carriers post details of capacity seeking loads, and shippers post details of loads seeking carriers.

Financial Viability: Assessing the financial viability of a contract logistics service in the Region is virtually impossible without calling for real-world tenders. In this study we have indicated which market sectors are most prospective by virtue of the efficiencies they offer. At this stage, however, we cannot say whether the efficiencies will be sufficiently large to make the service attractive to shippers, and hence viable. We point out that it would be inappropriate simply to compare the charges of carriers with those of contract logistics providers. The logistics provider would probably provide a superior service in terms of delivery time and reliability; and would certainly relieve the shipper of many mundane administrative tasks.

The role of government. We take the view that Government's role in the commercial sphere is to effect the provision of public goods (that is, goods that, while beneficial to society, would be provided inefficiently, or not at all, by the unfettered market). We see no role for Government as a direct player in the provision of logistics services, nor any advantage in doing so. Government's role should be limited to stimulating collective research and cooperation where they qualify as public goods because their benefits are experienced by parties who cannot be made to pay for them. Government also has a role in the provision of infrastructure, particularly where it is costly and long-lived. Government also has a role to ensure an appropriate pricing regime for the use of public infrastructure and transport assets. Beyond that, it is the task of individual carriers and logistics providers to employ the mode that best suits the task.

References

- An overview of core transport, telecommunications and utility infrastructure in the Riverina*, Riverina Regional Development Organisation, 1997.
- Business and marketing plan*, Australian Alpine Valley Agribusiness Forum Inc, April 1998.
- Goods delivered in city centres. Have we got the policy balance right?* Anthony Whiteing university of Huddersfield.
- Industrial and commercial register*, Development Albury Wodonga, Albury NSW, 1997.
- Log haulage report for North Eastern Victoria*, Softwood Industries North East, July 1995.
- National Business Bulletin*, Vol 8, No 6, September 1998.
- NRIC (1994) *Survey of truck use and loading patterns: results*, Working paper 15.
- The Prime Minister's Supermarket to Asia Council*, various publications.
- Timber industry haulage study for the South West Slopes of New South Wales*, 1997/98 update, Riverina and Murray Regional Development Boards, October 1997.