

# BUREAU OF TRANSPORT ECONOMICS

## LOGISTICS IN AUSTRALIA A preliminary analysis





**Bureau of Transport Economics** 

## LOGISTICS IN AUSTRALIA A PRELIMINARY ANALYSIS

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## FOREWORD

This Working Paper presents the results of preliminary BTE work on logistics in Australia. It is the first part of a longer-term project on logistics. The Working Paper develops a framework for analysing logistics in Australia, and examines several issues raised by the Secretariat for the Freight Transport Logistics Industry Action Agenda.

The BTE gratefully acknowledges the information and other assistance provided by industry and government agencies.

The study was undertaken by Kym Starr and Alistair Nitz, under general supervision from Joe Motha, Deputy Executive Director.

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Bureau of Transport Economics Canberra October 2001

## **EXECUTIVE SUMMARY**

This paper presents the results of preliminary BTE work on logistics in Australia. It draws on the BTE's experience and expertise in the transport sector, and also incorporates information on logistics from sources such as a literature review.

## BACKGROUND

The performance of the logistics system has a major impact on cost structures, revenues, service quality, and competitiveness in Australian industry. Logistics activities have been evolving rapidly in response to changes such as globalisation, general industry restructuring, new production processes, and technological advances.

Many firms, government agencies and joint industry/government bodies are developing programs to improve logistics performance in Australia. The initiatives include the Freight Transport Logistics Industry Action Agenda.

This paper develops a broad framework for analysing logistics activities. It also examines three priority issues identified by the Secretariat for the development of the Action Agenda—the economic significance of logistics in Australia, the extent of integration, and the dimensions of a full economic study.

#### SCOPE OF LOGISTICS

Logistics is broadly defined as the activities required for the movement and handling of goods and materials, from inputs through production to consumers and waste disposal. It includes associated reverse flows such as product and equipment returns, and recycling. Some of the major logistics activities are transport, storage, procurement, inventory management and packaging.

Figure 1 provides an overview of logistics in Australia. It incorporates logistics services, and the information systems and infrastructure/resources that are used to provide the services.

In this paper, logistics is described as a system or set of activities rather than an industry. This reflects the essential nature of logistics, which is a series of interdependent activities performed by firms from various industries.

#### FIGURE 1 COMPONENTS OF LOGISTICS IN AUSTRALIA





The BTE estimates that the gross value added of logistics activities in Australia was around \$57 billion in 1999-2000. This was equivalent to 9 per cent of GDP, which represents a substantial proportion of economic activity in Australia. The figures are lower-bound estimates and are very approximate, as they are based on limited data and indirect calculations. They do not include flow-on effects to other industries that provide inputs for logistics services (e.g. production of packaging materials or transport equipment).

## **COMPONENTS OF LOGISTICS**

Logistics services can be considered in terms of five major groups of activities:

- production processes (production flow management, inventory management, packaging, order processing, demand forecasting);
- materials and other inputs (procurement, materials management);
- transport and storage;
- product support (parts and services); and
- reverse flows and disposal (product/equipment returns, recycling, waste).

The provision of these services is heavily dependent on reliable and timely information flows. The basic components of these flows, which facilitate the integration of related logistics activities, include:

- sales and delivery (e.g. sales information and forecasts, track and trace);
- inputs (e.g. materials, order placement); and
- export/import documentation (particularly customs and quarantine).

The development of e-commerce has significantly increased the capabilities and lowered the costs of information systems. Internet-based approaches are providing firms with new mechanisms to interact with customers and suppliers, and to re-engineer business processes.

The infrastructure and resources used to provide logistics services comprise:

- human resources (managerial and operational);
- financial resources;
- packaging materials;
- warehousing (land, buildings, plant and equipment);
- transport (e. g. pallets, containers, vehicles, terminals); and
- communications facilities, equipment and software.

## **BUYERS AND PROVIDERS OF SERVICES**

The users (buyers) of logistics services include organisations in the mining, agriculture, manufacturing and service sectors. Many users are located in Australia, but overseas buyers have a major role in purchasing services (e.g. shipping) for Australian exports.

Users of logistics services range from small businesses, which in some cases are fragmented and uncoordinated, to large firms. The presence of multiple buyers and suppliers of services may contribute to difficulties in coordinating activities and optimising logistics performance.

There is significant variation, between industry sectors and between firms, in arrangements for the supply of logistics services. This variation reflects factors such as differences in the number of participants and in access to technical knowledge and economies of scale.

The providers of logistics services can be considered in terms of users' in-house operations, and four categories of external providers:

- contractors/specialists (e.g. airlines, road transport owner-drivers);
- brokers/agents (e.g. customs brokers, freight forwarders);
- multi-service logistics operators; and
- integrated logistics providers.

Increased outsourcing of logistics activities has facilitated the growth of external providers. The strategies of these providers have included expansion through mergers, acquisitions and partnerships/alliances. Many larger users of logistics services are reducing the number of external providers that they use. Major providers typically operate some services and also coordinate the activities of various contractors.

The Australian Competition and Consumer Commission (ACCC) has stated that competition among transport and logistics providers is fierce. However, for some logistics-related services, there are only small numbers of major operators.

Cost analysis provides an important input into logistics decisions. However, logistics activities may also enhance a firm's revenue (e.g. through a premium price for a product delivered in excellent condition). These activities should therefore be analysed in terms of their impact on both revenues and costs.

## **INTEGRATION**

Logistics activities are a potential source of competitive advantage for many firms. Components of performance include order cycle times, on-time delivery, transit times, and product condition on delivery.

The operation and performance of the logistics system is often analysed in terms of chains (e.g. supply chains). A chain is a series of interdependent logistics activities (involving major stages between inputs and disposal) for a particular product. It is based on coordination and cooperation between various logistics service providers (and users of the services).

The essence of effective chain management is integration—combining individual logistics activities into a whole that functions seamlessly and provides good performance. Effective integration within each chain requires:

- adequate infrastructure;
- good information flows between service providers, between service providers and users, and between users;
- effective coordination mechanisms and dispute resolution procedures; and
- incentives for each service provider to promote the performance of the total chain.

Market forces provide some incentives to coordinate activities along and between logistics chains. Options to promote integration include in-house provision of services, single providers of multiple services, partnerships and alliances, chain leaders, and collaboration/voluntary cooperation.

Australian studies over the last decade indicate that logistics activities do not constitute an integrated industry. Changes recommended in the studies have included a greater awareness of chain management, better information flows, and improved communication between logistics chain participants. The studies have also identified specific logistics issues (e.g. unavailability of uplift space, inflexibility in quarantine arrangements) that adversely affect the competitiveness of Australian exporters.

Some of the factors which limit integration are probably industry-specific (e.g. fragmented structures and independent attitudes of chain participants). Broader factors such as incompatible information systems and inadequate infrastructure are also contributing factors.

## **FUTURE RESEARCH**

The BTE's future research on logistics will be affected by the nature of emerging policy issues that require Government attention, and the availability of data. The level of competition in the provision of services is an area of major interest.

Detailed analysis of structure, conduct and performance would require substantial time and resources. This reflects the wide range of logistics activities, the large number of issues typically covered in a full economic study, and limited availability of data.

It therefore seems likely that future research should focus on either broad overviews of logistics activities or detailed analyses of specific issues. Such studies could include the size and other characteristics of major parts of the logistics system, the adequacy of logistics infrastructure, and the impact of major operating strategies (e.g. mergers/takeovers) on chain performance.

The available data on logistics activities are mainly limited to transport and some related activities. Any detailed analysis of logistics in Australia will therefore require the collection of additional data. This is likely to be a resource-intensive task.

## **CHAPTER 1** INTRODUCTION

Logistics can be broadly defined as the activities that are required for the movement and handling of goods and materials. It covers processes involving inputs, production, distribution, consumption and waste disposal (e.g. packaging). Examples of the major activities include transport, warehousing, order processing and inventory management.

The performance of the logistics system has a major impact on the Australian economy. It affects the cost structures and revenues of Australian producers, their competitiveness in areas such as delivery times and product quality, and the responsiveness of producers to consumer requirements.

Many firms are involved as users or buyers of logistics services. For example, the retailing operations of Coles Myer incorporate the delivery of goods and services from over 13 000 suppliers (Coles Myer 2000, p. 1).

There are no comprehensive data on the providers of logistics services in Australia. However, the number of firms involved in these activities is substantial. For example, the operation of the Port of Fremantle involved the provision of logistics-related services by more than 140 organisations in 1998-99 (BTE 2000, p. 90). Australia's 70 commercial trading ports are just one component of the logistics system.

Some of the larger Australian providers of logistics services, and their activities, include:

- Toll Holdings—freight forwarding, transport, inventory management, wharf cartage, container handling, order placement and tracking, warehousing, contract distribution, packaging design/fabrication, contract packing, recycling;
- Linfox Transport—supply chain design and management, warehouse design and management, inventory management, distribution centre management, freight transfer/consolidation, transport management, freight forwarding;
- Mayne Logistics—supply chain management, transport services, warehousing, inventory management, fleet management, contract distribution, wharf-related services, international courier services; and
- Australia Post—mail services, small parcel delivery, home market delivery, services for business customers in the e-commerce market.

Overseas operators (e.g. Danzas AEI, Exel, EGL Eagle Global Logistics) also have significant activities in Australia.

Various industry associations represent the interests of firms involved in the transport component of logistics (e.g. road transport, shipping, rail transport, ports, freight forwarding). Other organisations with members involved in logistics activities include the Australasian Production and Inventory Control Society (APICS), the Australian Institute of Purchasing and Materials Management (AIPMM) and the Australian Institute of Packaging. The Logistics Association of Australia (LAA), with a membership of 2 500 individuals throughout Australia, covers a range of providers and users of logistics services. However, no single organisation represents the views of all participants in the logistics system, as it is defined in this paper.

The recent development of the logistics system, in Australia and overseas, has included greater outsourcing of activities that were previously undertaken inhouse. For example, a 1997 study found that more than 69 per cent of Fortune 500 manufacturers used some form of external logistics service (Bade and Mueller 1999, p. 79). External operators may provide benefits such as:

- lower costs;
- improved service quality;
- better integration of activities;
- enabling management to concentrate on their core competencies and the firm's core business;
- global capabilities; and
- capital expenditure savings and working capital reductions.

The level of logistics outsourcing varies between countries. A study of 14 European countries concluded that, on average, 26 per cent of distribution services were provided by external operators in 1998 (Rushton et. al. 2000, pp. 58-59). The proportion for individual countries ranged from 12 per cent to 38 per cent. Current industry research reportedly indicates that outsourcing of logistics activities is relatively low in Australia compared with other countries such as the UK (TDG Logistics 2000, p. 3).

In a particular country, the level of outsourcing generally varies between industries and between logistics activities. For example, a survey of North American companies with outsourced activities indicated that outsourcing ranged from less than 10 per cent in some areas (e.g. customer service, order processing) to around 60 per cent for warehousing, outbound transport and freight bill auditing/payment (Smyrlis 2000, p. 44).

## **RECENT INITIATIVES**

Since the early 1990s, industry and governments have placed a major emphasis on improving logistics performance. These initiatives have reflected the impact of factors such as globalisation, technological advances, and the need to improve the international competitiveness of the Australian economy.

Many Australian firms have been developing and implementing strategies to improve their logistics performance. Approaches have included upgrading of in-house facilities (e.g. distribution centres) and increased use of external providers. Industry has also been involved in initiatives to consider issues on a wider basis (e.g. sea and air freight councils).

The Commonwealth has coordinated various efforts to assess the adequacy of logistics activities, identify problem areas and develop solutions. State governments have implemented programs to address specific logistics issues.

Broader bodies have brought together representatives of the Commonwealth, the States and industry. Government and joint government/industry organisations dealing with logistics issues include the:

- Integrated Logistics Network, a grouping of Commonwealth and State/Territory government officials with a mission to improve the quality and efficiency of the services used by shippers to get their products to market (domestic or overseas);
- Australian Freight Council Network, an informal network of State/Territorybased sea and air freight councils which develop practical solutions to logistics problems;
- Supermarket to Asia Council, with a mission to grow Australian food sales to Asia and increase the number of exporters, using a structure that includes Supermarket to Asia Ltd and the Transport and Logistics Working Group;
- Australian Transport Council (comprising Commonwealth, State/Territory and New Zealand Ministers responsible for transport issues), supported by the Standing Committee on Transport and the National Transport Secretariat.

There are various linkages between individual organisations (e.g. joint meetings, circulation of progress reports). The Integrated Logistics Network and the Australian Freight Council Network regularly conduct joint meetings, and have also coordinated studies on issues such as cold chain logistics mapping and re-engineering, export reefer containers, and national food export monitoring.

Several Commonwealth agencies support logistics initiatives through activities such as programs to improve practices and performance, the provision of secretariat services, preparation of background papers and briefings, and coordination of studies on specific issues. These agencies include the:

- Department of Transport and Regional Services;
- Department of Agriculture, Fisheries and Forestry Australia;
- Department of Industry, Science and Resources; and
- National Office for the Information Economy.

Some of the programs that are directly relevant to logistics activities include the Value Chain Management Program, the Information Technology Online Program, and the Food and Fibre Chains Programme.

## ACTION AGENDA

In May 2000, the Commonwealth Government announced that an Action Agenda would be developed for the Australian freight transport logistics industry (Anderson 2000).

Action Agendas are a Commonwealth program supported by State/Territory Industry Ministers. They are used in a range of Australian industries to build partnerships between industry and government, with the objective of removing impediments to growth and capitalising on opportunities. The key elements include identification of future opportunities, strategic analysis of competitive position, identification of required changes, and development of action priorities and responsibilities.

The goals of the Freight Transport Logistics Industry Action Agenda are:

- development of a seamless logistics system, delivering goods on time, in peak condition, at an agreed value;
- integration of the best available technologies to link management systems with transport infrastructure;
- achievement of nationally consistent standards and accepted codes of practice; and
- promotion of professional and accredited logistics specialists.

The Minister for Transport and Regional Services appointed an Industry Steering Committee to facilitate the development and implementation of the Action Agenda. The Committee is assisted by a Secretariat in the Cross-Modal and Maritime Transport Division of the Department of Transport and Regional Services.

At an early stage, the Secretariat concluded that there was a requirement for more information about logistics in Australia. The BTE's work program already included a major study of logistics. As a more immediate priority, the Secretariat suggested that the BTE should analyse three issues:

- Is freight logistics an integrated industry or a series of loosely interconnected industries?
- What is the economic significance of the industry (contribution to GDP and employment)?
- What are the dimensions of conducting a full economic study of the industry (known data and information gap analysis)?

The BTE consequently agreed to include these issues in the first stage of its work on logistics in Australia.

#### **OUTLINE OF THE PAPER**

This Working Paper develops a framework for analysing logistics in Australia, and examines the three priority questions identified by the Secretariat for the Freight Transport Logistics Industry Action Agenda. A draft of the paper was provided to the Industry Steering Committee and the Secretariat in July 2001.

The analysis is based on a preliminary review of Australian and international literature on logistics. The literature search particularly focussed on conceptual issues and the operation of the logistics system. Attendance by BTE officers at a major Australian logistics conference and exhibition, and visits to five major logistics operations, provided additional information.

The paper covers the movement and handling of freight, which is traditionally considered in terms of bulk and non-bulk items. The recent discussion of the performance of logistics activities in Australia has generally focused on the non-bulk area.

Chapter 2 develops a general definition of logistics and identifies the major components of logistics activities. It also describes the concept of chains and outlines the role of networks.

Chapter 3 describes the major components of logistics in greater detail. It covers logistics services, information systems, and infrastructure and resources.

Chapter 4 analyses the economic significance of logistics activities. It provides estimates of gross value added, and the proportion of gross domestic product (GDP) attributable to these activities.

Chapter 5 outlines the structure and operation of logistics activities in terms of the operating environment, the users and providers of services, and competition.

Chapter 6 covers the performance of the logistics system. It incorporates an overview of total cost analysis, logistics chain management, and integration. There is also a discussion of recent Australian performance, and an assessment of the level of integration.

Chapter 7 examines future research areas and associated data requirements. These issues are primarily considered in terms of structure, conduct and performance.

Concluding remarks are presented in chapter 8.

## **CHAPTER 2 OVERVIEW OF LOGISTICS**

The modern concept of logistics incorporates activities (e.g. transport, storage) which date back to the earliest forms of organised trade (Lambert et. al. 1998, p. 5). The term was initially developed in the context of military activities in the late 18<sup>th</sup> and early 19<sup>th</sup> centuries.<sup>1</sup>

A key element of logistics, the trade-off between transport and inventory costs, was formally recognised in economics at least as early as the mid-1880s (Langley 1992, pp. 19-20). Other early writings in economics included a 1901 text on the costs of distributing farm products (Grunnet 1996, p. 28). The literature on management increasingly recognised the role of logistics from the 1950s, with Peter Drucker focusing attention in the early 1960s on the challenges and opportunities in logistics and distribution.

This chapter provides a definition of logistics. It also outlines the major components of logistics, the concept of chains and the role of networks.

## DEFINITION

The concept of logistics has evolved over time in response to factors such as changes in the business environment. Grunnet (1996, p. 32) notes that the focus was inventories in the 1950s, distribution in the 1960s, production in the 1970s, purchasing/production/sales in the 1980s, and business process in the 1990s.

A review of the literature indicates that there is no universal definition of logistics. Table 2.1 presents some recent definitions. They are based on a range of approaches including processes, functions, frameworks, flows and strategic management. There is some commonality among the definitions in terms of the concept of moving and handling goods and materials, from the beginning to the end of the production and sales process. The recent definitions typically incorporate some common activities (e.g. transport, warehousing, inventory).

For the purposes of the BTE's analysis, logistics is broadly defined as the activities required for the movement and handling of goods and materials, from

<sup>&</sup>lt;sup>1</sup> The probable origin of the term is the Greek *logistikos*, meaning 'skilled in calculating'. Military definitions typically incorporate the supply, movement and quartering of troops.

Source	Definition	Components
Council of Logistics Management	That part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers requirements	As earlier interpreted by Langley, incorporates functions such as transportation, order processing and related distribution centre operations, inventory control, purchasing, production, and customer and sales services.
Kasilingam	All functions essential to provide place and time value to a product, including all functions that are necessary to move a product from point of production to point of consumption safely and efficiently	Purchasing, inventory control, facilities location and layout, transportation and intra-facility logistics (e.g. capacity planning, warehouse design, order picking rules).
Michael Docherty & Associates	The process of strategically managing the movement and storage of materials, parts, and finished inventory from supplier, through the firm, and on to customers	Inventory (e.g. service level decisions, materials planning), information (e.g. order processing, demand forecasting), warehousing and handling (e.g. depot location, unitisation and packaging), transport (e.g. mode decisions).
OECD	Management of flows along links in various kinds of networks, in particular involving the manufacturing and trading of goods and services (business logistics)	Transport flows/systems (transport networks), material flows/systems (buyer/supplier networks), information flows/systems (communications networks), money flows/systems (financial networks).
Arthur D Little and Pennsylvania State University	The process of anticipating customer needs and wants; acquiring the capital, materials, people, technologies, and information necessary to meet those needs and wants; optimising the goods- or service- producing network to fulfil customer requests; and utilising the network to fulfil customer requests in a timely way (integrated logistics)	Transportation, facility structure, inventory, material handling, communications and information.
Coyle, Bardi and Langley	To ensure the availability of the right product, in the right quantity, and in the right condition, at the right place, for the right customer, at the right cost	n.p.
Grunnet	The overall point of view strategic, tactical and operational on the company and [its] business partners, with material flow as integrator	Supply (supplier relations, purchasing, material control, raw materials), production (buffers, production processes, personnel, components), distribution (finished goods, dispatching, warehouse, customer service), service (installation, maintenance, redistribution, disposal).

#### TABLE 2.1 RECENT DEFINITIONS OF LOGISTICS

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n.p. not provided

Sources Bloomberg et. al. (1998, p. 2). Council of Logistics Management (2001, p. 1). Grunnet (1996, p. 26, p. 73, pp.118-120). Kasilingam (1998, p. 6). Langley (1992, p. 22). Michael Docherty & Associates (1997, pp. 1-2). OECD (1996, pp.°22-23).

inputs through production to consumers and waste disposal. It includes associated reverse flows such as product and equipment returns, and recycling. Some of the major activities covered by this definition are transport, storage, packaging, procurement, and inventory management (see chapter 3).

Other terms that are used to describe logistics activities (or to extend the basic concept) include supply chains, value chains and demand chains. While the analysis of logistics has often focused on cost minimisation, the concept of chains also emphasises the potential impact on revenue (e.g. through logistics activities that enable a product to be delivered in good condition and sold at a premium price). In this paper, the general term 'logistics chain' is used to cover the various applications of the chain concept.

Logistics is best described as a system or set of activities rather than an industry.<sup>2</sup> This reflects the essential nature of logistics—a series of interdependent activities performed by firms from various industries. Some logistics activities, such as inventory control and order processing, are undertaken by firms in virtually all industries. As noted in chapter 1, a significant number of associations cover logistics activities in Australia.

## MAJOR COMPONENTS

Figure 2.1 provides an overview of the logistics system. The operation of the Australian economy is affected by local and overseas logistics activities.

For the purposes of analysis, these activities can be divided into logistics services, and the information systems and infrastructure/resources used to provide the services. In practice, the three components are closely linked.

Logistics services support the movement of materials and products from inputs through production to consumers, as well as associated waste disposal and reverse flows. They include activities undertaken in-house by the users of the services (e.g. storage or inventory control at a manufacturer's plant) and the operations of external service providers. Logistics services comprise physical activities (e.g. transport, storage) as well as non-physical activities (e.g. supply chain design, selection of contractors, freight rate negotiations).

Increased outsourcing of logistics activities, that were previously undertaken in-house, has facilitated the growth of external service providers. This trend has probably accelerated over the last decade. A recent overview of 26 major external providers of transport and warehousing services in Australia indicated that they had around 34 000 employees and operated 436 distribution centres (Supply Chain Review 2000, pp. 36-38).

<sup>&</sup>lt;sup>2</sup> Caves et. al. (1987, p. 2) define an industry as 'any collection of firms which have plants giving them the capacity to produce products with which they can compete for sales'. Another definition is 'a group of establishments engaged in the same, or similar, kinds of activity' (ABS 2000, p. 71).

#### FIGURE 2.1 OVERVIEW OF LOGISTICS





Box 2.1 lists some firms involved in logistics-related activities in Australia. They comprise a small, random sample of the thousands of firms that currently provide logistics-related services. In 1996, the National Road Transport Commission (NRTC) noted that there were 30 960 road transport fleets in the hire and reward sector in Australia, including 760 fleets of 10 or more vehicles (NOIE 1999, p. 5). Road transport is just one component of logistics.

The strategies of logistics service providers in Australia have incorporated industry consolidation and partnerships/alliances. There have been many mergers and acquisitions, with some of the recent changes including the:

- acquisition of Carpentaria Transport, Refrigerated Roadways, IPEC, Finemore Holdings, Strang Stevedoring Australia, ARN Logistics and TNT's port operations by Toll Holdings;
- merger of Westgate Logistics and the Brimac Transport Group;
- move to full ownership of MPG Logistics by Mayne Nickless;
- merger of Brambles Industries and GKN;

#### BOX 2.1 SOME FIRMS WITH AUSTRALIAN LOGISTICS-RELATED ACTIVITIES

ABX Logistics	AirRoad Logistics Support	1st Fleet
Accenture	APEX Logistics People	Australia
Allied Express	Australian Personnel Solutions	Blue Star
Brambles Industries	BHP Transport & Logistics Group	Dalton Pa
Danzas AEI	EGL Eagle Global Logistics	DHL Aus
Dawson Consulting	Expediters International	f(x) Logis
Dexion	FCL Interstate Transport Services	Glen Car
EAN Australia	Flexible Services Warehousing	Gregory
ELogistics	interBiz Supply Chain Group	K&S Cor
Exel Australia	Kagan Warehousing & Distribution	Kuehne &
EXE Technologies	Logistics Recruitment Solutions	Lang Cor
Freight Australia	Mannesman Dematic Colby	Linfox Tra
FreightCorp	National Rail Corporation	Maersk L
Logistics Bureau	New Wave Logistics (Australia)	MARC G
LOSCAM	Paperless Warehousing	Mayne Lo
Nexus-Global	RMS Transport Solutions	Mills Trar
Sinclair Knight Merz	Schaefer Systems International	P&O Aus
Strang-Tradex Group	Simon National Carriers	Retail Lo
Supply-LINQ	Specialised Container Transport	Seatons
Swisslog Australia	Sydney Ports Corporation	Star Trac
TNT Australia	United Transport Services	TDG Log
Toll Holdings	Wallenius Wilhelmsen Lines	UPS Log
Tradegate ECA	Westgate-Brimac Logistics	Wesfarm

Logistics Post Logistics ackaging stralia stics Solutions meron Group s Transport poration & Nagel rporation ansport ogistics lobal Services ogistics nsport stralia gistics Group Transport ck Express istics istics Group ers Transport

- purchase of Refrigerated Freight Lines, Liberty Cargo Group, Holyman, SSD Freight, JPC Containers and Mayne Nickless's Australian port service operations by Lang Corporation;
- acquisition of The Total Logistics Company by Exel; and
- merger of GrainCorp and Victorian Grain Services.

This process has enabled many logistics service providers to increase the range of services that they provide. For example, several freight forwarders have become multi-service operators or integrated logistics providers. The large traditional transport operators (TNT, Mayne Nickless, Brambles) have sold many of their transport businesses to focus on broader logistics activities.

## CONCEPT OF CHAINS

The operation and performance of the logistics system is often analysed in terms of chains. A chain is a series of interdependent logistics activities (involving major stages between inputs and disposal) for a particular product, based on coordination and cooperation between logistics service providers (and users of the services).

The concept of chains emphasises the close links between individual logistics activities for a particular product, and the adverse impact on overall performance from the failure of individual activities (i.e. 'breaking the chain'). For example, the competitiveness of Australian fresh fruit exporters in Asian markets reflects the performance of a large number of logistics activities, from the farms to the supermarkets in Asia. Poor performance in just one activity (e.g. temperature control at storage facilities in Australia) will adversely affect the condition (and price) of the fruit delivered to Asian consumers.

The economy may be viewed as a large number of chains, each of which can be represented simplistically by figure 2.1. Examples of chains include:

- organisation of components for the assembly of computers, and the delivery of completed systems to consumers;
- mining and export of coal; and
- movement of fruit from the orchard to supermarket shelves.

There are also links between individual chains. For example, one logistics chain may involve the stages from raw materials (iron ore, coal, etc.) to the production of steel. In turn, steel may be the first stage for several other logistics chains (e.g. production of machinery, motor vehicles, building products).

It should be noted that, for the purposes of analysis, the structure of a logistics chain may be affected by the perspective of the user or analyst. For example, a primary producer may view the chain as activities from inputs (e.g. seed, chemicals) to the processing plant. In contrast, the wholesaler may view the chain as all activities from the farm to the supermarket.

#### **NETWORKS**

Table 2.1 on page 8 indicates that the OECD has analysed logistics in terms of four kinds of networks—transport, buyer/supplier, communications and financial. The extent to which logistics activities involve networks will affect the structure and operation of the system.

#### Concept

A network can be defined as a collection of nodes (e.g. locations) connected by facilities (e.g. roads) along which entities (e.g. goods) move (Button and Stough 2000, pp. 11-12). For an activity such as logistics, the key characteristics are oneor two-way connections between multiple points that include common paths. Networks can be either physical or virtual (e.g. the Internet).

Figure 2.2 illustrates two typical networks. They comprise a simple star network (e.g. distribution to local customers from a central manufacturing

FIGURE 2.2 SIMPLE STAR AND LOCAL/LONG-DISTANCE NETWORKS



Source Economides (1996).

plant) and a local/long-distance network (e.g. local collection and interstate delivery). In the simple star network, A can deliver goods to B by travelling along AS, switching at S, and then travelling along SB. This is a classic example of a two-way network. The local and long-distance network is more extensive, as it permits movement between local networks using long-distance exchanges.

## Applications to logistics

Each logistics chain involves a series of connected activities. For certain activities, many chains use common systems (e.g. the long-distance road transport network). The overall economy may therefore be viewed as a series of logistics chains, which effectively touch or intersect at certain points.

In addition, the end of one chain often connects to the beginning of another chain. For example, the processes from mining iron ore through to the production of steel might be viewed as one chain, with the transformation of this steel into machinery involving a subsequent chain.

Logistics activities have some network characteristics. Most, if not all, logistics chains incorporate network activities, such as transport and information systems. In addition, some activities undertaken in-house by users of logistics services (e.g. the operation of multiple production facilities or warehouses) would probably be classified as networks. The extent of integration of logistics activities is considered in chapter 6.

## **Economic implications**

The existence of networks potentially enables some providers of logistics services to access opportunities for cost reductions.

Economies of scope occur when the cost of producing two or more outputs together (e.g. by one firm) is lower than the cost of producing the outputs separately (e.g. by several firms). For example, a firm may be able to use common infrastructure (e.g. terminals) to provide several logistics services at lower cost than individual firms.

Economies of traffic density occur when the average cost of production declines as the amount of traffic increases between any given set of points. For example, transport operators may be able to utilise larger trucks (due to increased traffic) by setting up hubbing centres. The resulting access to economies of scale provides lower unit transport and delivery costs.

Network externalities occur when the actions of market participants affect others without compensation being paid. Shapiro and Varian (1999, p. 183) see networks as having mostly positive externalities, such as the greater number of destinations and increased frequency provided by a larger network when additional participants join. However, negative externalities (e.g. increased congestion for other road users) may occur around major facilities.

## CHAPTER 3 COMPONENTS OF LOGISTICS

This chapter presents more detailed information about the components of logistics introduced in chapter 2. It covers logistics services, and the information systems and infrastructure/resources that are used to provide the services.

## LOGISTICS SERVICES

Figure 3.1 provides an overview of logistics services in terms of five major groups of activities—production processes, materials and other inputs, transport and storage, product support, and reverse flows and disposal.

#### **Production processes**

Production processes incorporate production flow management, inventory management, packaging, order processing and demand forecasting. These processes were traditionally regarded as the core functions of a firm, and were often undertaken in-house. More recently, there has been increased outsourcing of some of these activities, particularly inventory management and packaging. Developments such as assembly in transit have led to a blurring of the distinction between producers and service providers in some cases.

Production flow management includes production planning. It also incorporates materials handling, which is 'virtually all aspects of all movements of raw materials, work in process, or finished goods within a plant or warehouse' (Lambert et. al. 1998, p. 18).

The holding of inventory facilitates access to economies of scale (through longer production runs), handling of seasonal variations in demand, and rapid response to changes in demand. Effective inventory management can improve customer service and reduce holding costs, although at some point there is a trade-off between these two aspects of performance.

Packaging is used to protect products from deterioration, damage, pilferage and tampering. Potential sources of deterioration and damage include temperature extremes, moisture, dirt, dust, light, fumes, odours, shocks, vibration and bacteria. Packaging also facilitates the safe containment of dangerous goods during storage, handling and transport. In addition, it provides standard







quantities of a product that reflect consumer requirements, contributes to marketing and promotion, and facilitates transport and storage by conforming to the requirements of equipment such as pallets and containers.

Order processing is the system through which a firm receives orders from customers, tracks the filling of the orders, and despatches them.

Forecasting incorporates predictions of future demand for a firm's output. It affects production planning, the quantities of inputs ordered from suppliers, and decisions about the amount (and mix) of products to be transported or stored in each market.

## Materials and other inputs

Procurement and materials management potentially have a major impact on the competitive position of a firm. Key issues include price, quality, reliability and availability of inputs when required.

Procurement is defined as the purchase of goods and services from outside suppliers for use in the firm's production, sales and distribution activities. It is generally undertaken by in-house staff, although the use of external operators (e.g. brokers) is common in some industries.

Greater outsourcing of logistics (and other) activities has increased the importance of the procurement function in many firms. Procurement has evolved from an operational process to a strategic activity, with a key role in managing and optimising logistics expenditure and supplier performance.

## **Transport and storage**

Transport is generally the largest single component of logistics costs (see chapter 4). Warehousing and storage are also major activities.

The choice of transport services for inputs and products is particularly affected by the distances involved. The major activities, and typical arrangements, are:

- local pick-up/delivery—mainly road transport;
- regional transport—mainly road or rail transport;
- long-distance transport—road, rail, air or sea transport, with the major mode also varying in response to factors such as cargo characteristics (e.g. unit values, tonnages) and route (e.g. domestic or overseas).

Pipelines are used for the carriage of liquids (including solid materials transformed into slurries) and gases. Applications range from transfers within production facilities to long-distance movements.

Warehousing and storage can be considered in terms of services for the production process and for product distribution. There have been major changes in the number and location of facilities in Australia since the 1980s, with the closure of many single-user warehouses and an expansion of consolidation facilities and distribution centres. These developments reflect factors such as better transport services (e.g. due to upgrading of major roads) and pressures to improve logistics performance.

## **Product support**

With the increased emphasis on service quality in many sectors of the economy, product support is a key component of many firms' competitive strategies.

Parts and service support (including installation and maintenance) can be used to enhance the attractiveness and reputation of a firm and its products. These activities are particularly important in situations where any delays or equipment down-time would impose significant costs on the firm's customers.

## **Reverse flows and disposal**

Logistics services typically have a major focus on supporting the production process and the movement of products to customers. However, reverse flows and disposal of waste (e.g. packaging) are also important activities. Reverse logistics comprises 'the handling, storage and movement of material that flows from the end customer back to the seller or supplier' (Kasilingam 1998, p. 245).

Appropriate handling of product returns assists a firm to enhance its relations with customers and to identify problems in production processes or product design. Efficient practices in equipment returns (e.g. empty containers, pallets) facilitate cost savings and adequate availability of equipment.

Many firms have developed detailed strategies for recycling and waste disposal. This reflects environmental issues, including regulatory requirements, and cost considerations (e.g. savings through re-use of off-cuts generated in the production process). Poor performance in these areas may adversely affect public perceptions of a firm and therefore weaken its market position.

Activities that maximise the value of returned products may make a significant contribution to a firm's profitability (Andel 1997, pp. 61-64). Rather than being destroyed, these products may be returned to finished goods inventory, refurbished for resale, or sold on the secondary market. Some hazardous and other wastes may be resold to other manufacturers or sent as scrap to recyclers.

## **INFORMATION SYSTEMS**

The efficient and effective operation of the logistics system depends on reliable and timely information flows, involving both providers and users of services. An information system is an electronic, paper-based or voice network that enables each participant to share operating data with other participants.

The development of e-commerce, initially involving activities such as email and electronic data interchange (EDI), has increased the capabilities and lowered the

costs of information systems. For example, EDI has enabled some firms to use electronic transmission in place of paper-based arrangements for documents such as purchase orders, invoices, consignment notes, remittance advices and customs documents. Internet-based systems are providing firms with new ecommerce mechanisms to interact with other businesses (B2B) and with customers (B2C), and to re-engineer business processes.

Figure 3.2 illustrates some basic components of logistics information flows. In practice, a logistics chain usually incorporates a variety of information systems operated by different participants (e.g. suppliers, transport operators, retailers). The flow of information along a chain is often hindered by the use of proprietary systems based on different standards (e.g. numbering for barcodes).





It should be noted that figure 3.2 provides a general overview of information flows. The provision of sophisticated logistics services typically requires specific systems for activities such as vehicle routing and scheduling, track and trace, warehouse management, generation of performance reports, and processing of payments.

The components of figure 3.2 can be considered in terms of sales and delivery, materials and other inputs, and export/import documentation.

## Sales and delivery

Ideally, information on customer requirements is incorporated in the features of a product during the design phase. In addition, comments from customers after production and sales have commenced may provide further information, which then contributes to product modifications or redesign.

Forecasts and sales data provide the basis for product orders and decisions about the volume and timing of production. The resulting production levels and delivery schedules determine the logistics services required by the firm, and must therefore be communicated to the providers of these services.

The development of e-commerce has contributed to the creation of more effective sales processes. Internet-based systems are providing firms with new mechanisms for interacting with consumers (e.g. product promotion and processing of orders).

Track and trace systems, using processes such as bar coding, provide information on the location of specific consignments between despatch and receival. The information is particularly useful for monitoring delivery performance and responding to inquiries about late or missing deliveries.

## Materials and other inputs

Planned production levels and delivery schedules provide the basis for determining input requirements and the resulting orders from suppliers. Efficient transmission of this information to suppliers is an important component of a firm's operations, as it facilitates the minimisation of inventory costs and implementation of strategies such as just-in-time (JIT) manufacturing.

The development of e-commerce has provided new mechanisms for firms to purchase inputs. For example, corProcure was established in 2000 by 14 major Australian firms to provide an Internet-based procurement marketplace. These mechanisms potentially provide benefits such as reductions in transaction and processing costs, fewer errors, faster business processes and improved information about supply options.

Tracking systems assist firms to monitor materials flows and to optimise their production processes.
#### **Export/import documentation**

Information about certain input/product movements between Australia and overseas origins/destinations must be provided to the Australian Customs Service (ACS) and the Australian Quarantine and Inspection Service (AQIS). The information is required for purposes such as barrier control, collection of customs duties, prevention of the entry of pests and diseases into Australia, and quality certification of some exports.

Various organisations are involved in the provision and processing of this information. They include shippers, shipping lines, terminal operators, customs brokers and freight forwarders, as well as the ACS and AQIS. Other agencies, such as State/Territory agriculture departments, may have related functions. Efficient transmission of information is therefore necessary to expedite the clearance of cargoes and to avoid or minimise delays. The ACS provides facilities for electronic lodgement of documentation and clearance of cargoes.

#### INFRASTRUCTURE AND RESOURCES

Figure 3.3 outlines the major components of infrastructure and resources that are used to provide logistics services. They comprise human resources, financial resources, packaging materials, warehousing, transport and communications.

#### Human resources

The delivery of efficient and effective logistics services requires highly skilled managerial and operational staff. The development of appropriate skills involves both recruitment and training. There are reportedly current, or emerging, shortages of skilled staff in various parts of the logistics system. Expenditure on training is below levels in other sectors of the economy.

Some of the organisations involved in logistics skills development in Australia include RMIT University, the Institute of Applied Logistics, APICS Institute of Education and Research, Southern Sydney Institute of TAFE, Macquarie University, the Australian Institute of Packaging, St. George College of TAFE, Central Queensland University, and University of Technology, Sydney.

#### **Financial resources**

The provision of logistics services requires financial resources for plant and equipment, other inputs and working capital. The capital costs of major facilities such as ports and rail links are substantial.

Sources of finance available to private operators (external and in-house) include leases, borrowings, and equity raisings. The public sector has traditionally been a major source of finance for infrastructure projects, particularly in the road and





Source BTE analysis.

rail sectors. The privatisation of public enterprises in logistics-related areas (e.g. airport operations) has changed the financing options that are available for some activities.

### Packaging materials

The packaging used for a particular product is determined by factors such as the product's physical characteristics, the target market, and the arrangements for transport and storage.

The major packaging materials include paper, paperboard, cardboard, wood, glass, metals (e.g. steel, aluminium), plastics and composite materials. They are used in various forms such as bags, sacks, boxes, cartons, cans, tubes, wrappings, bottles, jars, sachets, packets, drums, pails and cups.

#### Warehousing

Activities at warehouses (and distribution centres) include receival from suppliers, storage, order picking and assembly, packaging and re-packaging, and transfers between transport vehicles (i.e. cross-docking). Warehouses and depots facilitate lower production costs (e.g. by allowing longer production runs), transport cost savings (e.g. through bulk deliveries) and handling of significant changes in product demand.

Buildings may be owned by the user of logistics services, the provider of these services or other organisations (e.g. private investors or property trusts). Some of the plant and equipment (leased or owned) that may be used include racking systems, forklifts, cranes, pallet trucks, stacker trucks, order picking trucks, and side loaders.

The development of efficient warehousing incorporates optimal numbers and locations of warehouses, taking into account factors such as customer requirements/characteristics and the location of production facilities.

#### Transport

Figure 3.3 indicates that transport infrastructure includes a wide range of facilities and equipment.

Pallets contribute to the efficient storage and transport of many non-bulk traffics (e.g. packaged groceries) by facilitating the process of unitisation. They are generally sourced from national pools of pallets, although some firms own their own pallets.

Containers are used extensively in the transport of non-bulk cargoes, particularly in the overseas trades. International containers are generally owned by leasing firms or transport operators, and are managed by transport operators (e.g. shipping lines).

Transport vehicles include trucks, locomotives and rolling stock, ships and aircraft.

Corridors are the facilities used by transport vehicles. They include roads, railway lines, pipelines, sea lanes, air corridors and associated facilities (e.g. signalling, traffic control).

Terminals comprise uni-modal operations as well as multi-modal facilities that handle two or more modes. They also include ports and airports.

#### Communications

The operation of logistics communications services requires equipment (e.g. computers, terminals) and software. It also involves transmission facilities such as the telecommunications network.

## CHAPTER 4 ECONOMIC SIGNIFICANCE OF LOGISTICS

As noted in chapter 1, the Secretariat for the Freight Transport Logistics Industry Action Agenda asked the BTE to analyse the economic significance of logistics activities in Australia. With the time and resources available for this study, the BTE was not able to conduct a comprehensive data collection exercise (e.g. a survey). The analysis was therefore based on Australian Bureau of Statistics (ABS) data and other information.

This chapter presents revenue and employment data for some Australian logistics service providers, the results of recent studies of the economic significance of logistics, and the BTE's estimates for Australia.

#### DATA FOR INDIVIDUAL OPERATORS

A major industry participant has stated that revenue from prime contract transport and logistics activities in Australia totals \$18 billion per annum (Sullivan 2001, p. 23). Toll Holdings, Mayne Nickless, TNT Australia, BHP, Linfox and K&S/Scott Group reportedly account for \$6 billion of this revenue, with another 30 operators each generating more than \$100 million per annum.

Table 4.1 presents information on revenue and employment for some logistics service providers in Australia in 1999-2000. It is mainly based on information from commercial databases and company annual reports. The operators included in the table reflect the coverage of the data that were readily accessible to the BTE. They mainly provide transport, warehousing and postal services.

The 36 logistics service providers in table 4.1 had combined revenue of around \$16.1 billion in 1999-2000. This figure mainly covers operating revenue from logistics activities in Australia, although there is also some overseas revenue. The Brambles data include revenue from the company's overseas logistics operations, but exclude revenue from some of its Australian logistics activities (pallet hire and waste management).

The figures in table 4.1 incorporate some non-logistics activities (e.g. Australia Post's banking and bill payment services), and there may be an element of double counting (due to transactions between operators in the table). Any comparison of figures for individual operators in table 4.1 should therefore be interpreted with caution.

The activities of some operators have been affected by takeovers, mergers or asset sales since 1999-2000. For example, Toll Holdings' revenue increased to \$1.6 billion in 2000-01, and BHP Billiton is restructuring its logistics activities.

#### **RECENT STUDIES**

Table 4.2 summarises some recent Australian and overseas studies of the economic significance of logistics activities. The studies typically indicate logistics costs as a proportion of sales, or gross value added as a proportion of GDP. The approaches in the studies have included surveys of individual firms and analysis of data from national statistics agencies.

There is significant diversity in the estimates. For example, the figures range from around 10 per cent to 21 per cent in Australia, and from 7 per cent to over 21 per cent in the US. The diversity probably reflects differences in the scope of logistics activities in individual countries, and variations between studies in definitions, approaches and data.

The proportion of sales or gross value added attributable to logistics activities also varies between industries in response to factors such as differences in

Company	Revenue (\$m)	Employees (no.)
Australia Post <sup>a</sup>	3°743	35°397
BHP Transport & Logistics Group <sup>b</sup>	1°382	1°904
Toll Holdings <sup>c</sup>	1°360	5°980
QR <sup>d</sup>	1°035	n.p.
Mayne Nickless <sup>e</sup>	943	n.p.
Brambles Industries <sup>f</sup>	931	n.p.
TNT Australia	814	5°665
FreightCorp	639	2°265
Linfox Transport	618	3°500
Lang Corporation	583	n.p.
National Rail Corporation	460	1°225
Finemore Holdings <sup>g</sup>	376	2°018
Owens Group	286	1°071
Australian airExpress	268	1°251
Westrail Freight	257	797
K&S Corporation	256	1°100
Scott s Transport	233	n.p.
Discount Freight Express <sup>h</sup>	230	1°510

TABLE 4.1 REVENUE AND EMPLOYMENT OF SOME AUSTRALIAN LOGISTICS SERVICE PROVIDERS, 1999-2000

TAB	LE -	4.1	(CON1	Γ.

#### ONT.) REVENUE AND EMPLOYMENT OF SOME AUSTRALIAN LOGISTICS SERVICE PROVIDERS, 1999-2000

Company	Revenue (\$m)	Employees (no.)
Co-operative Bulk Handling	214	1°303
Freight Australia	185	693
GrainCorp <sup>i</sup>	167	n.p.
Heggies Bulkhaul	139	440
TDG Logistics	92	n.p.
AusBulk <sup>i</sup>	90	n.p.
Specialised Container Transport	82	325
1 <sup>st</sup> Fleet	80	600
Allied Express	80	406
Darowa Corporation <sup>j</sup>	76	n.p.
LP International Freight Services <sup>k</sup>	73	180
Westgate Logistics	71	530
Wridgways Australia	68	n.p.
ARN Logistics <sup>9</sup>	67	n.p.
Grainco Australia <sup>i</sup>	66	n.p.
Cootes Holdings	66	400
P Cleland Enterprises	49	400
Chalmers	26	190

n.p. not provided

a. Includes some non-logistics services such as personal banking, bill payment network, retail merchandise.

 Incorporates logistics activities for BHP s steel, minerals and petroleum groups, and for external customers. Excludes logistics activities within BHP s other customer sector groups (e.g. rail activities for iron ore in Western Australia). Employment figure is for mid-2001. Revenue increased to \$1°659 million in 2000-2001.

- c. Excludes Finemore Holdings, which was acquired after 1999-2000.
- d. Coal and mainline freight only. Excludes metropolitan and regional services, tourist and long-distance passenger services, and government community services.
- Covers Mayne Nickless s Australian and Pacific logistics activities (Armaguard, MPG Logistics, Mayne Nickless Express). Does not include \$831 million of revenue from company s international logistics operations (Mayne Nickless Express Europe, Loomis Courier) in 1999-2000.
- f. As defined by Brambles Industries, transport and logistics activities cover: specialised transport, security, shipping and towage in Australia; freight forwarding, security and wagon fleet in Europe; and security in other parts of the world. Revenue figure in table does not include other Australian operations that are classified as logistics activities in this paper hire of pallets and crates (CHEP) and waste management (Cleanaway).
- g. Subsequently acquired by Toll Holdings.
- h. Now Star Track Express.
- i. Storage and handling activities only. Excludes marketing and other activities.
- j. Transport and related services only.
- k. Subsequently acquired by Australian arm of Union-Transport (Netherlands) Holdings.

*Sources* AusBulk (2000, p. 7). Australia Post (2000, p. 9). BHP Billiton (2001a, p. 36; 2001b, p. 1; pers. comm. Oct.°2001). Brambles Industries (2000, pp. 54-55). BRW (2000a, pp. 154-155; 2000b, pp. 92-99; 2001, pp.°50-76). Co-operative Bulk Handling (2000, p. 37, p. 49). Darowa Corporation (2000, p. 30). Dun & Bradstreet (2001a, pp. 1-2; 2001b, pp. 1-2; 2001c, pp.°1-2; 2001d, p. 1). FreightCorp (2000a, p. 1; 2000b, p.°1). Grainco Australia (2000, p. 7). GrainCorp (2000, p. 8). Lang Corporation (2000, p. 3). Mayne Nickless (2000, p. 5). National Rail Corporation (2000, p. 20, p. 36). QR (2000, p. 27). TDG Logistics (2000, p. 5). Toll Holdings (2000, p. 32). Van Onselen (2001, p.°8). Westrail (2000, p. 22, p. 33).

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Source	Country	Logistics resources	Comments
Hall	Australia	9.8 per cent of average selling price	Mainly comprises transport (4.3 per cent) and warehousing (4.7 per cent.
Gilmour	Australia	21.1 per cent of sales	Comprises transport (2.7 per cent), receiving and despatch (1.0 per cent), warehousing (2.2 per cent), packaging (3.2 per cent), inventory (7.2 per cent), order processing (2.0 per cent), administration (2.8 per cent).
Delaney	US	10.5 per cent of GDP	Comprises freight transport (5.9 per cent), warehousing, storage & carrying inventory (4.1 per cent) and other logistics expenses (0.5 per cent).
Davis	US	7.2 per cent of sales	Comprises transport (3.1 per cent), warehousing (1.8 per cent), inventory (1.6 per cent), order processing (0.4 per cent), administration (0.3 per cent).
Davis and Drumm	US	8 per cent of sales	Comprises purchasing, inventory control, facilities location and layout, transportation (40 per cent of logistics costs), intra-facility logistics.
Shapiro	US	>21 per cent of sales	n.p.
McDonald	Canada	7.3 per cent of GDP	Freight transport 40 per cent
Gilmour and Rimmer	Japan	26.5 per cent of sales	Transport (13.5 per cent) and packaging (13.0 per cent).
Office for National Statistics	UK	Nearly 4 per cent of gross output	Core logistics activities only.
Dept. of the Environment, Transport and the Regions	UK	5-10 per cent of business costs (freight transport element of logistics only)	Proportion can be considerably higher in some heavy industrial sectors.
Institute of Logistics and Distribution Management	UK	7.4 per cent of sales	Comprises transport (2.9 per cent), warehousing (2.3 per cent), packaging (0.3 per cent), inventory (1.3 per cent), administration (0.6 per cent).
Michigan State University	20 countries	10-15 per cent of GDP in North American, Asian, European countries	n.p.
OECD	Worldwide	16 per cent of world GDP	n.p.

TABLE 4.2	SOME ESTIMATES OF THE ECONOMIC SIGNIFICANCE OF LOGISTICS

n.p. not provided

Sources Department of the Environment, Transport and the Regions (1998, p. 1). Gilmore (1993, p. 9). Hall (1999, p. °120). HLB Decision Economics (2001, p. 2). Kasilingam (1998, pp. 5-8). Lambert et. al. (1998, p. 10). OECD (1996, p. 31). Rushton et. al. (2000, pp. °10-11). Shapiro (1992, p. 58).

product characteristics and transport requirements. For example, data for UK firms in 14 industries indicate that distribution costs range from 0.8 per cent of sales for spirits to 46.0 per cent for cement (Rushton et. al. 2000, p. 12).

The most recent estimate for logistics in Australia (9.8 per cent of average selling price) was prepared by Hall, in a cooperative research initiative formulated by industry partners, the LAA and Monash University. The study incorporated a survey of firms in various sectors of the economy.

Earlier estimates for Australia were prepared by Gilmour. His work provided significantly higher figures for the resources used in logistics activities. Gilmour's most recent figure (21.1 per cent of sales) incorporated a relatively high estimate (7.2 per cent of sales) for inventory costs.

### LIMITATIONS OF AUSTRALIAN DATA

The ABS has not attempted to estimate the economic significance of logistics activities in Australia (ABS pers. comm. Apr. 2001). Industry associations, individual operators and academics do not collect comprehensive data on these activities. However, the contribution of logistics to GDP and employment can be roughly estimated using ABS national accounts data and other information.<sup>3</sup>

The classification of activities used by the ABS is based on the Australian and New Zealand Standard Industrial Classification (ANZSIC). Logistics activities that are separately identified in this framework mainly involve:

- transport and storage (freight and passengers);
- postal services;
- courier services; and
- waste disposal services.

The ABS data do not separately identify other major components of logistics activities such as inventory management, order processing or procurement.

Another limitation of the ABS data is that the allocation of a firm's activities to an industry classification is based on the principal activity of the firm. This means that in-house logistics activities (particularly transport) are typically included in non-logistics categories. For example, the in-house road transport operations of a firm primarily involved in manufacturing would generally be allocated to the relevant manufacturing classification.<sup>4</sup>

<sup>&</sup>lt;sup>3</sup> The national accounts provide a systematic summary of national economic activity. There are three approaches to the measurement of GDP—the production approach (summing the value added at each stage of production), the income approach (summing the incomes generated by production), and the expenditure approach (summing the final expenditures on goods and services produced).

<sup>&</sup>lt;sup>4</sup> In some cases, in-house transport activities may be allocated to the transport classification if they are undertaken through a separate management unit (e.g. a subsidiary company).

#### BTE ESTIMATES BASED ON ABS DATA

Despite these limitations, ABS data provide the basis for a multi-step procedure to estimate the contribution of logistics activities to GDP and employment. The procedure is based on the freight component of transport. Table 4.3 outlines the major stages of the estimation process.

#### **Transport and storage**

Gross value added of the transport and storage sector was \$34 496 million (5.6 per cent of GDP) in 1999-2000 (ABS 2001a, p. 54). This sector comprises:

- road transport (\$11 052 million);
- air and space transport (\$5 077 million);
- water transport (\$783 million);
- rail, pipeline and other transport (\$5 593 million); and
- transport services and storage (\$11 991 million).

#### **Freight transport**

Logistics, as defined in this study, focuses on the movement and handling of goods and materials. As the ABS does not publish separate data for freight transport, it is therefore necessary to remove the passenger components from the published figures for transport and storage. Gross value added for storage activities must also be subtracted, in order to obtain an estimate for freight transport only.

The ABS provided the BTE with figures for gross value added in storage (\$1 192 million) and the passenger part of road transport (\$3 068 million).

Component	Gross value added (\$m)
Transport and storage	34°496
Less	
Storage	1°192
Road transport passengers	3°068
Air and space transport passengers	4°722
Rail, pipeline and other transport passengers	1°734
Services to air transport passengers	946
Total deductions	11°662
Freight transport	22°834

TABLE 4.3 ESTIMATION OF GROSS VALUE ADDED IN AUSTRALIAN FREIGHT TRANSPORT, 1999-2000

Sources BTE analysis based on ABS (2001a, p. 54; pers. comm. May 2001; pers. comm. June 2001), BTCE (1995, pp. °18-69), Qantas Airways (2000, p. 27).

The BTE estimated the other passenger components using several approaches:

- air and space transport—93 per cent of gross value added, based on the proportion of Qantas passenger and freight revenue attributable to passengers (Qantas Airways 2000, p. 27)<sup>5</sup>;
- services to air transport—unpublished ABS data on gross value added (\$1 017 million) combined with the proportion of Qantas passenger and freight revenue attributable to passengers; and
- rail passengers—31 per cent of gross value added in rail, pipeline and other transport, based on the passenger proportion of railways' cashbox receipts, concession reimbursements and subsidies in 1993-94 (BTCE 1995, pp. 18-69).<sup>6</sup>

On the basis of these data, the BTE estimated that the gross value added of freight transport was \$22 834 million in 1999-2000. This figure still includes some passenger activities in the form of travel agency services and parking services. However, these activities would probably comprise a small proportion of gross value added in transport.

#### Logistics

Several studies (e.g. Davis and Drumm, Institute of Logistics and Distribution Management, Hall, Davis, McDonald) have indicated that transport comprises around 40-45 per cent of total logistics costs. A US survey provided a figure of 46 per cent, and a European study concluded that transport typically represents 41 per cent of total logistics costs (Rushton et. al. 2000, pp. 10-12). While lower and higher proportions have been reported in other studies, it seems reasonable to use a primary figure of 40 per cent in the analysis of Australian logistics.<sup>7</sup>

Combining the figures of \$22 834 million (gross value added in freight transport) and 40 per cent (freight transport share of logistics activities) results in an estimate of around \$57 billion for logistics in Australia.<sup>8</sup> This figure, which covers bulk and non-bulk traffics, is equivalent to 9.2 per cent of GDP in 1999-

- <sup>7</sup> In the literature examined by the BTE, the highest estimate for transport as a proportion of logistics costs is 60 per cent (Canada) and the lowest estimate is 25 per cent (OECD). However, there is only one example of each of these extreme estimates.
- <sup>8</sup> The gross value added figures in this section are not directly comparable with the revenue figures in table 4.1. Relationships between value added and revenue in the BTE's port impact studies suggest that the total revenue of \$16.1 billion for the 36 operators in table 4.1 represents value added of around \$10.1 billion. Removal of the figure for Australia Post (probably included in postal services by the ABS) reduces total revenue to \$12.4 billion. This figure mainly covers transport and storage, and represents around \$7.8 billion of value added—equivalent to 34 per cent of the BTE's estimate of \$22.8 billion for freight transport.

<sup>&</sup>lt;sup>5</sup> This method provides only a very approximate estimate of the proportion of gross value added attributable to passenger activities in air transport as a whole.

<sup>&</sup>lt;sup>6</sup> This proportion overestimates passenger activities (and underestimates freight activities) for rail operations as the data do not include freight-only railways in north-west Australia. Its application to pipelines, which carry freight only, also contributes to over-estimation.

2000.<sup>9</sup> It is broadly comparable with Hall's Australian estimate of 9.8 per cent (logistics costs divided by average selling price), and is at the lower end of the overseas estimates reported in table 4.2.

The BTE's estimate of gross value added as a proportion of GDP is sensitive to the freight transport share of logistics activities that is used in the analysis. The GDP proportion declines to 7.4 per cent with a 50 per cent share for freight transport, and to 6.1 per cent with a 60 per cent share. It increases to 12.3 per cent if a freight transport share of 30 per cent is used in the analysis. The BTE's preferred figure of 40 per cent, which results in a GDP proportion of 9.2 per cent, reflects the predominant range of estimates for the freight transport share.

The results of the BTE's analysis indicate that logistics activities comprise a significant proportion of economic activity in Australia. The estimate of around 9 per cent for logistics compares with figures of 11 per cent for wholesale and retail trade, 12 per cent for manufacturing, and 12 per cent for mining, construction and utilities combined (DoTRS 2000, p. 4).

A similar (but more approximate) approach can be used to prepare an estimate of employment in logistics activities. There were 418 700 persons employed in the transport and storage sector at the end of 1999-2000 (ABS 2001b). The BTE's analysis indicates that gross value added in logistics was 1.65 times gross value added in the transport and storage sector in 1999-2000. Applying this ratio to employment in transport and storage provides a very rough estimate of around 690 000 employed persons (full-time equivalent) in logistics.

### INTERPRETING THE ESTIMATES

The estimate of the contribution of logistics to GDP (and employment) is very approximate, as it is based on limited data and indirect calculations. The reliability of the estimate is also affected by the national accounts data, which become less accurate as more disaggregated components are examined.

The GDP proportion of 9.2 per cent is probably conservative. The estimate for the freight transport component of the calculations does not include some transport activities that are undertaken in-house by firms primarily involved in other activities. These omitted activities are significant—for example, in the mid-1990s it was reported that 50 per cent of all truck-kilometres in Australia were performed by firms whose main activity was outside transport (i.e. in-house operations).<sup>10</sup> It also seems likely that some or all of the substantial rail

<sup>&</sup>lt;sup>9</sup> The national accounts cover production in Australia for domestic and export markets. Any overseas production is therefore excluded from the data.

<sup>&</sup>lt;sup>10</sup> Unpublished NRTC paper cited in NOIE (1999, p. 4). Gross value added for in-house (i.e. ancillary) road freight transport can be roughly estimated using the road freight component in the national accounts, on the assumption that this component covers external (i.e. hire and reward) operators only and that average payloads for in-house and external operators are similar. Adding this figure (\$7 984 million) to freight transport would increase the estimate

activities undertaken by mining companies in north-west Australia are excluded from the transport figures. This factor is likely to significantly outweigh the impact of the passenger activities (travel agency services, parking services) that could not be removed from the transport data.<sup>11</sup>

The estimate of the proportion of GDP attributable to logistics activities provides only partial information on their economic significance. It does not indicate the total impact on the Australian economy. This reflects the broader role of logistics as an enabler or facilitator of economic activity, and its effect on Australia's international competitiveness. Logistics activities support the operation of all other industries, and are therefore an indispensable component of economic activity.

Increased efficiency in logistics activities would potentially reduce the proportion of GDP attributable to these activities. However, this would not reflect a reduction in the importance of logistics in the broader economy, and resources could be released for use in other areas of the economy. <sup>12</sup> It might also be argued that the allocation of additional resources to logistics could be desirable if improved services facilitated increased output in other areas of the economy. The proportion of GDP or employment attributable to logistics activities should therefore be interpreted with caution.

The BTE's estimate of gross value added in logistics does not incorporate inputs provided by other industries. The flow-on effects to these industries are probably significant. For example, sales of packaging in Australia (i.e. domestic manufacture and imports of empty packaging) were reportedly equivalent to around 1.3 per cent of GDP in 1993-94 (Industry Commission 1996, p. 3).

for logistics as a proportion of GDP to 12.4 per cent (with a freight transport share of 40 per cent). However, this figure would be an overestimate as external operators would be expected to have higher average payloads, and the proportion of the task undertaken by inhouse operators has probably fallen as a result of increased outsourcing since the mid-1990s.

<sup>&</sup>lt;sup>11</sup> Satellite accounts prepared for the US Department of Transportation indicate that in-house transport services represented almost 40 per cent of value added in US transport in 1992, with the remainder being provided by external operators (Bureau of Transportation Statistics 1998, p. 1). Adjusting the Australian freight transport data to include an in-house component of this magnitude would increase the logistics estimate to 15.0 per cent of GDP (freight transport share 40 per cent). However, the US figures are unlikely to be applicable to Australia, as there are significant differences in the structure of the transport sector in the two countries.

<sup>&</sup>lt;sup>12</sup> One observer has noted that GDP in the US increased from US\$2.88 trillion in 1980 to US\$9.26 trillion in 1999 (Trunick 2000, p. 50). Over the same period, estimated logistics costs rose from US\$451 billion to US\$921 billion. These figures indicate that the proportion of GDP attributable to logistics in the US declined from 15.7 per cent in 1980 to 9.9 per cent in 1999.

# CHAPTER 5 STRUCTURE AND OPERATION

The logistics system has been evolving rapidly in response to the changing requirements of industry and consumers. Major developments have included increased outsourcing and strategies to promote greater integration.

This chapter describes the structure and operation of logistics in terms of the operating environment, users and providers of services, and competition.

#### **OPERATING ENVIRONMENT**

Changes in the global and local economies have had major effects on logistics activities in Australia. Improved performance, and a wider range, of logistics services have also facilitated some of these developments.

#### Globalisation

A reduction of trade barriers, growth of financial markets and improvements in information technology have contributed to a major expansion of international commerce. This expansion has been accompanied by increased requirements for logistics services, and a restructuring of services to support increasingly global businesses.

The involvement of more firms in international trade has also increased the scope and complexity of logistics activities. Movement of products in overseas markets can involve a range of difficulties (e.g. maintaining product quality), particularly in countries where logistics services are not well-developed.

#### **Industry restructuring**

Globalisation and microeconomic reform (e.g. deregulation and privatisation) have contributed to major changes in Australian industry. In particular, reduced levels of protection have exposed many local firms to increased international competition. Their responses have included a greater emphasis on logistics activities in order to improve product quality, increase responsiveness to market requirements, and reduce costs.

There have also been significant changes in industry structure, with contraction of some local activities (e.g. clothing, textiles, footwear) and expansion in other

areas (e.g. tourism). This restructuring has often led to a requirement for more sophisticated logistics services.

The growth of the Australian economy has also contributed to the expansion and restructuring of logistics activities. In particular, increased levels of economic activity have provided more opportunities for the development of specialised providers of logistics services.

### **Production processes**

The introduction of more efficient production processes, partly in response to increased global competition, has required more sophisticated logistics services.

Just-in-time (JIT) manufacturing provides an early example of new production processes. The operation of production lines (e.g. motor vehicle assembly) with very low levels of inventory required smaller, more frequent deliveries of inputs and close relationships with suppliers. Any significant disruptions to logistics activities would quickly halt production, and eliminate (or outweigh) the savings from just-in-time manufacturing.

There have also been changes in inventory management. For example, the efficient consumer response (ECR) technique incorporates continuous replenishment of inventory and flow through distribution (Lambert et. al. 1998, p. 30). This enables inventory to be managed on a just-in-time basis, rather than stockpiling goods in warehouses and distribution centres.

Other changes affecting logistics activities have included total quality management (TQM), single or dual sourcing policies, transnational sourcing, increased use of contract manufacturing, assembly to order, and shortening of product life-cycles.

### Technology

Advances in technology have increased the capacity, speed and interactivity of information systems. These developments have facilitated the growth of e-commerce, the introduction of more effective services (e.g. track and trace), and the expansion of external logistics providers.

Technological change has also contributed to improvements in infrastructure and equipment, resulting in lower costs and better performance. Examples include the development of large container ships, more fuel-efficient engines, road-rail systems, packaging that increases the shelf-life of perishables, satellite navigation systems, and product tags incorporating wireless technology.

#### Infrastructure

Upgrading of national infrastructure has removed some restrictions on logistics activities, and facilitated the introduction of more sophisticated services.

The developments have included improvements to telecommunications facilities, which have substantially increased the speed and capacity of data services. Upgrading of national highways and rail infrastructure has facilitated faster and more reliable transit times.

#### USERS OF LOGISTICS SERVICES

The users (buyers) of logistics services include a wide range of organisations in the mining, agriculture, manufacturing and service sectors. For example, the provision of airline services depends on the timely availability of inputs such as fuel and equipment.

Box 5.1 provides a sample of some major users of logistics services in Australia. They include supermarket groups, other retailers, mining companies, food processors, beverage producers, other manufacturers, and suppliers of services.

Users of logistics services range from small businesses, which in some cases are fragmented and uncoordinated, to large firms. The presence of multiple buyers and providers of services in a logistics chain may contribute to difficulties in coordinating activities and optimising chain performance.

Overseas buyers (including shippers) have a major role in purchasing logistics services for Australian exports. For example, Japanese steel mills and electricity companies typically arrange (and pay for) the shipping of coal to Japan. Goods imported into Australia incorporate logistics activities that are organised by overseas producers.

Many users of logistics services have in-house operations which provide services such as demand forecasting, warehousing and inventory management.

BOX 5.1 SOME MAJOR USERS OF LOGISTICS SERVICES IN AUSTRALIA			
AWB	Arnott's Biscuits	Email	
BHP Billiton	Cadbury Schweppes	Bonlac Foods	
CSR	Coca-Cola Amatil	Coles Myer	
Ford Australia	Colgate-Palmolive	David Jones	
Holden	Department of Defence	Dell Computer	
Metcash Trading	Foster's Group	Kraft Foods	
Nestlé Australia	Goodman Fielder	Southcorp	
Qantas Airways	Johnson & Johnson Pacific	SPC	
Rio Tinto	Lion Nathan	Unilever	
Simplot Australia	National Foods	Woolworths	
Toyota Australia	Procter & Gamble Australia	WMC	

In-house logistics expertise is required to operate these services and also to effectively manage external service providers, particularly where there are multiple providers. Larger users of logistics services also manage competitive processes for appointing external service providers, typically including fixedterm contracts.

Some major users of logistics services in Australia organise their activities on a regional basis. For example, Lion Nathan operates its outward transport and distribution activities through Linfox (Queensland), Toll Holdings (New South Wales), Gregory's Transport (Victoria), Scott's Transport (South Australia) and Wesfarmers Transport (Western Australia). Woolworths has traditionally organised its supermarket buying/marketing and transport on a State basis, but has recently moved to central buying for most products and to a zone basis for transport/distribution (Woolworths 2000, p. 13; Corbett et. al. 2001, p. 10).

#### **PROVIDERS OF LOGISTICS SERVICES**

The provision of logistics services in Australia involves thousands of in-house and external operators. There is significant variation, between industry sectors and between firms, in arrangements for the supply of services. The variation reflects factors such as differences in access to technical knowledge, economies of scale and financial resources, and in requirements for specialised equipment and infrastructure.

Figure 5.1 presents an overview of the provision of logistics services in Australia. The providers can be considered in terms of the users of these services (i.e in-house operators) and four categories of external, or third party, logistics operators<sup>13</sup>:

- contractors/specialists;
- brokers/agents;
- multi-service logistics operators; and
- integrated logistics providers.

In practice, the classification of a particular external provider is not always clear-cut, as there are often similarities between operators in adjacent categories. For example, a freight forwarder (included in the broker/agent category) typically arranges multiple services, which is also a characteristic of a multi-service logistics operator.

<sup>&</sup>lt;sup>13</sup> Some analysts classify all external providers as third party logistics operators, while others restrict the term to the more integrated providers. More recently, some industry participants and observers have defined third party logistics operators as organisations that focus on transport and warehousing, with the term Fourth-Party Logistics Provider (4PL<sup>TM</sup>) being applied to operators with high levels of technology and a focus on materials, systems, production and sales.





Source BTE analysis.

Figure 5.1 indicates that there are also links between providers of logistics services in different categories. For example, contractors/specialists such as road transport owner-drivers provide services for many brokers/agents, multi-service logistics operators and integrated logistics providers.

Many larger users of logistics services are reducing the number of external providers that they use. Major providers typically operate some services and also coordinate the activities of various contractors.

Some external providers specialise in the handling of certain traffics. Examples include temperature-controlled traffics (e.g. P Cleland Enterprises), explosives (e.g. Helidon Carrying Company), chemicals (e.g. United Transport Services), grain (e.g. GrainCorp) and motor vehicles (e.g. Prix Car).

As noted in chapter 1, the use of external operators to provide logistics services may generate benefits such as lower costs, global capabilities and capital expenditure savings. External operators may also enable the managers of a firm to concentrate on their core competencies and the firm's core business.

### **In-house providers**

In-house provision of logistics services may be an attractive option for firms that have relevant skills. The potential benefits include:

- direct control of core activities—e.g. production processes, procurement, materials management, and parts and service support;
- good information flows, that are uninterrupted by external intermediaries (e.g. drivers dealing directly with a firm's retail customers are able to provide managers with first-hand information on retailers' perceptions);
- better integration of activities in some cases;
- greater flexibility and responsiveness in some cases;
- access to specialised equipment in quantities that are too small to be attractive to external service providers;
- avoidance of transaction costs with external providers; and
- high visibility (e.g. delivery vehicles painted in firm's colours and logo).

The users of logistics services are major providers of these services in various areas of mining, manufacturing and retailing. For example, large oil companies traditionally operated their own shipping fleets, operated storage facilities, controlled the sales outlets, and undertook marketing activities. Arnott's Biscuits operates its own warehouses, and uses its own vehicles for 50 per cent of long-distance transport in eastern Australia and for metropolitan deliveries.

Some in-house providers also operate as external service providers for other firms. For example, BHP Billiton operations account for about 75 per cent of the annual tonnage handled by BHP Transport and Logistics Group, with the remainder coming from other organisations (BHP Billiton 2001b, p. 1).

### Contractors/specialists

A contractor/specialist is an organisation that undertakes a small number of closely related logistics activities, involving narrow interactions with each buyer of its services. Examples of these service providers include:

- couriers;
- some major rail operators;
- suppliers of pooled pallets;
- airlines (freight operations); and
- road transport owner-drivers.

Contractors/specialists may provide cost savings and/or superior services by applying specialised skills. Aggregation of traffic from multiple users potentially enables them to access economies of scale and network economies that would not be available to users operating their own services. Differences in working conditions or the cost of capital may also provide cost advantages. Contractors/specialists range from owner-operators, who have cost advantages in some activities (e.g. long-distance road transport), to large operators.

Some contractors/specialists have been increasing the coverage of their logistics activities by acquiring or establishing related businesses. For example, AusBulk (grain handling and storage) has participated in a bid to acquire Ports Corp SA (port management).

#### **Brokers/agents**

A broker/agent provides advice (e.g. on customs requirements or freight rates) and arranges various logistics activities that are usually focussed on a specific sector (particularly transport). Examples of these service providers include:

- traditional freight forwarders;
- custom brokers; and
- warehouse brokers.

Brokers/agents have specialised skills (e.g. knowledge of shipping schedules and freight rates) but offer a wider range of services than contractors/specialists. For example, freight forwarders coordinate activities such as the booking of space, preparation of documentation, customs clearance, and pick-up and delivery of cargoes. They are particularly important for smaller shippers selling into export markets.

#### **Multi-service logistics operators**

A multi-service logistics operator provides logistics services at several stages of logistics chains. The services are coordinated with each user's operations. There is significant variation in the mix of activities undertaken by individual operators. Multi-service logistics operators typically focus on closely-related physical activities, such as transport and warehousing. They may provide some coordination and enhancement of chain performance using their information systems, but do not manage a range of services across a chain. These operators range from organisations with a variety of loosely-connected activities to operators that provide a limited number of well-coordinated services.

Lang Corporation (incorporating Patrick, Liberty Cargo Systems, Holyman, Cargolink and RFL) probably provides an example of a multi-service logistics operator. The company's activities focus on transport and warehousing. They include stevedoring, coastal shipping, rail transport, port cartage, freight forwarding, customs inspections, warehousing and distribution, container packing and unpacking, fumigation and container maintenance.

### Integrated logistics providers

An integrated logistics provider is an organisation that provides logistics services across major parts of logistics chains. There is a high level of integration (strategic and operational) through comprehensive sharing of information with users.<sup>14</sup>

These providers typically manage major parts of logistics chains for firms such as large manufacturers. They have specialist skills and equipment, and integrate various activities to provide 'complete logistics solutions'. Their contributions include supply chain design, capital assets, management, maintenance, and information systems.

An integrated logistics provider may improve the performance of a chain by identifying and contracting appropriate service providers, aggregating traffic, redesigning processes and optimising the logistics chain. Its operations typically incorporate sophisticated information systems that provide capabilities such as vehicle routing, scheduling, track and trace, warehouse management and performance reports.

TNT Logistics' European operations reportedly provide an example of integrated logistics activities (Critchley 2001, pp. 138-139). The company's services for Fiat in Italy include inbound transport and receival, consolidation/deconsolidation, order management, inspection, central and regional warehousing, line feeding, scheduling of pickings, packaging and

<sup>&</sup>lt;sup>14</sup> An integrated logistics provider has some similarities with a Fourth-Party Logistics Provider (4PL<sup>™</sup>). A 4PL<sup>™</sup> is defined as 'A supply chain integrator who assembles and manages the resources, capabilities, and technology of its organization with those of complementary service providers to deliver a comprehensive supply chain solution' (Bade and Mueller 1999, p. 79). While a 4PL<sup>™</sup> (typically a consulting firm or information technology specialist) controls other logistics operators on behalf of its clients and is the centralised point of contact, an integrated logistics provider (as defined in this paper) may also supply infrastructure and be the operator of some services (e.g. transport).

protective treatment, packing/checking/sorting/labelling, outbound transport, and management of dealers' claims.

Industry sources have indicated that Danzas AEI (e.g. computers) and Exel (e.g health care and pharmaceutical products) are among the integrated logistics providers operating in Australia. Their activities include management of inbound and outbound transport, warehousing, inventory, packaging and rework services.

Many integrated logistics providers had their origins in freight forwarding or road transport, and then expanded into other logistics activities. There are some similarities with multi-service logistics operators. However, integrated logistics providers have a broader range of activities that extend beyond physical activities such as transport and warehousing (e.g. to inventory management).

### **COMPETITION**

Preliminary information on market structure suggests that there is significant variation in the level of competition within the logistics system. For example, one major operator reportedly holds 80 per cent of the primary market for pallet and crate pools in Australia. In contrast, there are many operators in the road transport industry.

In announcing its decision not to intervene in the proposed acquisition of Finemore Holdings by Toll Holdings, the Australian Competition and Consumer Commission (ACCC) stated that competition among transport and logistics providers is fierce (ACCC 2000a, p. 1). The reasons include relatively low barriers to small-scale entry and the countervailing power of customers. The Commission noted that large customers control substantial volumes of business, and have the option of using either in-house services or contractors. Small carriers have access to a large number of small logistics service providers.

There have been several convictions of operators in the express freight industry for breaches of the *Trade Practices Act 1974* (ACCC 1996, p. 1; ACCC 2000b, p. 1; TPC 1994, p. 50). The activities have included:

- a long-running price fixing cartel (1994);
- misleading or deceptive conduct, involving a practice of representing that goods would be transported by air when they were actually sent by road (1996); and
- attempts to implement collusive tendering arrangements (1998).

The presence of networks and synergies may affect the level of competition in logistics activities. Any economies of scale or scope associated with networks or synergies will potentially enable some providers of logistics services to achieve cost savings. Competition may be adversely affected if a small number of larger operators are able to use the associated cost advantages to prevent entry by other operators.

## CHAPTER 6 PERFORMANCE

The performance of the logistics system has a major impact on costs, service quality and competitiveness in Australian industry. Greater exposure to international competition has contributed to pressures for better performance.

Prior to the 1980s, the logistics strategies of individual firms were focused on cost reduction. However, logistics activities are now seen as a potential source of competitive advantage and revenue enhancement. Major users of logistics services generally attempt to optimise performance in areas such as:

- order cycle times;
- on-time delivery;
- order fill rates;
- transit times;
- order status information;
- condition of product when delivered;
- billing accuracy; and
- costs.

The requirements of individual firms are heavily influenced by the performance of competitors' logistics operations, particularly in export markets and in domestic markets open to competition from imports.

This chapter considers performance issues in terms of total cost analysis, chain management, integration, and recent Australian performance.

#### **TOTAL COST ANALYSIS**

Lambert et. al. (1998, p. 24) note that 'the primary goal of logistics in any organization is to support the organization's customer service goals in an effective and efficient manner'. A firm developing a logistics strategy should therefore first identify the desired performance levels (e.g. order response times). This decision will incorporate aspects of the firm's broader competitive strategy, such as the price/quality positioning of its products.

There are often several alternative strategies that can be used to achieve a firm's logistics objectives. Any change in a major component of a logistics operation will typically affect other components, and therefore total logistics costs. A firm

should aim to minimise the total costs of achieving its desired performance levels.

Figure 6.1 illustrates the trade-offs for a firm that is evaluating the most efficient number of depots for its operations. In this example, storage costs and information system costs generally increase in direct proportion to the number of depots. Long-distance transport costs and inventory costs increase at declining rates. In contrast, local delivery costs decline, since an increase in the number of depots reduces the average distance for local delivery.

In this example, the optimal arrangement is six depots. This provides the lowest total distribution costs, reflecting the most efficient trade-off between long-distance transport, inventory, storage, information system and local delivery costs.

#### CHAIN MANAGEMENT

Total cost analysis provides an important input into the logistics decisions faced by many firms. However, the concept of chain management also emphasises the potential contribution of logistics activities to a firm's profitability through revenue enhancement. In particular, efficient delivery of products (e.g. fruit) in good condition often enables the supplier to obtain a premium price and to maximise its revenue. Logistics activities should therefore be analysed in terms of their impact on both revenues and costs.



FIGURE 6.1 ANALYSIS OF TOTAL DISTRIBUTION COST

Source Rushton et. al. (2000, p. 123).

Optimal logistics performance depends on effective management of the overall chain. As each chain generally involves multiple service providers, a firm needs to ensure that each provider supplies the required services and that services are effectively coordinated. Building long-term relationships and collaboration between chain participants are key parts of this process.

In a competitive market, a logistics service provider will generally attempt to achieve its own objectives (e.g. earnings) and meet its clients' performance requirements. However, in some cases this may impose additional costs on other parts of the chain and adversely affect overall performance.

For example, a service provider may minimise its costs by allocating a client's products to road transport services that were previously underutilised. This strategy will potentially reduce transport costs and charges, but may also result in less frequent deliveries or more variable delivery times. The client will incur additional inventory and storage costs if it wishes to maintain consistent availability of its product for customers. These additional costs may outweigh the savings in road transport, thereby increasing total logistics costs.

### **INTEGRATION**

The essence of effective chain management is integration—combining the parts (individual logistics activities) into a whole (the chain) that functions seamlessly and provides good performance (e.g. transit times). It is particularly important to ensure that the activities within each chain are well-coordinated. Effective integration requires:

- adequate infrastructure;
- good information flows between service providers, between service providers and users of logistics services, and between users;
- effective coordination mechanisms (e.g. contracts, regular consultation) and dispute resolution procedures; and
- incentives for each service provider to promote the performance of the total chain.

The economy incorporates a large number of logistics chains, many of which connect end-to-end or use common systems (e.g. the road transport network). Market forces provide some incentives to facilitate connections between chains and to promote integration within each chain, as each service provider typically needs cooperation from the providers of related services.

However, there is significant variation in the effectiveness of market forces, due to factors such as differences in industry structures. Effective integration is less likely if the buyers of services are fragmented and there are large numbers of service providers. In addition, some activities that significantly affect a firm's competitiveness (e.g. aspects of distribution in overseas markets) may be beyond its direct control.

In-house operations provide one mechanism for a firm to promote the integration of logistics activities. However, increased outsourcing has led to greater reliance on external service providers. Other options to promote integration include single providers of multiple services, partnerships and alliances, chain leaders, and collaboration/voluntary cooperation. These approaches potentially create conditions that are conducive to initiatives such as improvements in information systems and intermodal facilities.

#### **In-house provision**

The users of logistics services are major providers of these services in many industries (e.g. parts of manufacturing). These arrangements reflect factors such as the core competencies of each firm, the ability to access scale economies, a preference to control key aspects of corporate strategy, and possible risks (e.g. poor performance) with external providers.

In-house providers are potentially able to coordinate logistics activities through methods including standard processes, central management directives, and service level agreements between areas of the firm. In practice, the performance of in-house providers will depend on various factors including the availability of appropriate skills and the quality of information systems.

The mining and export of iron ore from north-west Australia provides a good example of user provision of logistics services. Some mining companies operate mines, rail loading and unloading facilities, rail transport, port storage and ship loading facilities. When the iron ore is sold on a cost, insurance, freight (c.i.f.) basis, the mining companies also control ship chartering and delivery to export markets.

### Single providers of multiple services

The supply of multiple logistics services by a single external operator potentially creates incentives and mechanisms to coordinate these activities.

Integrated logistics providers are able to coordinate multiple activities by bringing them within one organisation and by using sophisticated information systems with scheduling and other capabilities. They typically build detailed relationships with users of their services. Their information systems are closely integrated with their clients' systems, and they are often involved in clients' planning activities.

Multi-service logistics operators and some brokers/agents also supply multiple services. Their information systems provide a basis for the coordination of certain logistics activities, although they are generally less extensive than the systems of integrated logistics providers. Expansion by multi-service operators into related logistics activities potentially facilitates greater integration through better information flows and common operating strategies.

It should be noted that the provision of multiple logistics services by a single operator will not necessarily improve integration. There will be little effective integration if incompatible information systems are retained within a single organisation. Integration may also be limited if a service provider operates multiple divisions (e.g. road transport, terminals, storage) which do not have the systems or financial incentives to achieve synergies through joint activities.

## Partnerships and alliances

A partnership/alliance is a formal cooperative arrangement between two or more firms, with the aim of facilitating the achievement of each firm's objectives. It may sometimes involve equity holdings. Logistics activities are affected by arrangements between:

- users of logistics services (e.g. a computer manufacturer and its component suppliers);
- users of logistics services and providers of these services (e.g. a major manufacturer and an integrated logistics provider);
- providers of logistics services undertaking similar activities (e.g. a local freight forwarder and an overseas freight forwarder);
- providers of logistics services undertaking different activities (e.g. a packaging firm and a storage/distribution firm); and
- providers of logistics services and major consultants or information technology specialists.

The creation of a partnership/alliance typically reflects the intention of the parties to develop a closer relationship. It may lead to improved coordination through mechanisms such as a better understanding of the partner's business, greater information sharing, coordinated investments and joint planning.

Examples of partnerships/alliances in Australian logistics include:

- Australian airExpress, a joint venture between Qantas Airways and Australia Post;
- a strategic alliance between Grainco Australia and AusBulk;
- a partnership between Bluegum Group (an electronics manufacturing services provider) and Danzas AEI;
- a joint venture between four State-based operators (Russell TLC Services, Westchem, Chemwest, Scott's Transport Industries) to provide a national service for dangerous goods; and
- a partnership between TDG Logistics and Qenos.

### **Chain leaders**

A chain leader is a participant in a chain that uses its influence (e.g. as a large buyer) to improve chain performance, through mechanisms such as increased coordination and a better understanding of customer requirements. Examples include major retailers, processors and commodity marketing organisations.

A chain leader may attempt to improve logistics activities in an industry (e.g. horticulture) where suppliers are fragmented and logistics performance is poor. In these industries, individual participants are unlikely to take a whole-of-chain approach. The chain leader typically has significant influence (and an incentive to improve chain performance) as it is a major buyer of output.

Chain leaders may also promote restructuring of fragmented industries through strategies that encourage consolidation of smaller suppliers. The reduced number (and larger average size) of suppliers may facilitate improved integration of the logistics chain.

#### Collaboration and voluntary cooperation

The recent literature on logistics has included frequent reference to the role of customer and supplier collaboration in improving performance. Collaboration potentially facilitates initiatives such as automated online ordering systems, which improve the responsiveness of logistics chains and reduce costs.

The key elements of collaboration include information sharing between chain participants (e.g. a manufacturer and its suppliers) in areas including production, shipments, inventory, sales and forecasts. Berger and Gattorna (2001, p. 137) note that true collaboration cuts across business unit, company and even industry boundaries. It requires high levels of information sharing and openness through, for example, shared databases.

The performance of logistics chains may also be improved by voluntary cooperation between participants. For example, port liaison committees contribute to operational and planning coordination at various Australian ports. Similarly, industry associations may support the development of common standards or procedures (e.g. consistent data formats), which in turn facilitate improved integration. These arrangements encourage the exchange of information and a more strategic approach to the coordination of activities.

### AUSTRALIAN STUDIES

Over the last decade, various studies of logistics activities in Australia have been initiated by Parliamentary Committees and government/industry bodies. These studies have often identified poor coordination/integration as a major factor impeding logistics performance.

#### **Standing Committee inquiries**

Aspects of logistics activities were considered in a 1992 report by the House of Representatives Standing Committee on Transport, Communications and Infrastructure (HORSCOTCI 1992). The Committee examined the efficiency of

the interface between seaports and land transport ('warehouse to wharf'). It concluded that participants along the transport chain operated in isolation and without regard to the impact of their actions on the overall efficiency of the chain. The Committee's recommendations incorporated initiatives to achieve improved coordination/interaction, simplified documentation, better use of EDI, and infrastructure development.

Logistics for air freight exports of perishables and time sensitive products were examined by the House of Representatives Standing Committee on Communications, Transport and Microeconomic Reform (HORSCOCTMR 1996). The Committee emphasised the need for significant cultural change among all participants in the export chain. Its recommendations included improved coordination between participants, better dissemination of information, and increased flexibility in quarantine services.

### **Studies of logistics chains**

Several studies initiated by government/industry bodies have emphasised the importance of approaching logistics in terms of total chains rather than individual activities. They have particularly involved exports of agricultural commodities.

In 1997, the Department of Transport and Regional Development published a logistics study for the Supermarket to Asia's Transport and Logistics Working Group (DoTRD 1997). The study, which was undertaken to identify weaknesses in the transport logistics chain, was based on a survey of exporters in the asparagus, broccoli, cherry and chilled beef industries. The issues covered transport (e.g. access to appropriate on-airport facilities), product quality (e.g. closer monitoring of temperature variations) and quarantine (e.g. cost, flexibility and communication).

The Transport and Logistics Working Group subsequently commissioned a study of the logistics chain for citrus fruit to Indonesia (TNT Logistics Asia 1998). The report emphasised the importance of consistent product quality and the need to improve supply chain practices. The key recommendations included better information flows, improved communication between supply chain participants, increased coordination and cooperation, and greater education of industry participants.

In 1998, the Department of Primary Industries and Energy published a report incorporating eight case studies for the Supermarket to Asia Strategy (DPIE 1998). The report identified four key characteristics of businesses that successfully operate as partners in a supply chain approach:

- chain coordination;
- customer responsive quality;
- investment in market knowledge; and

### • global market outlook.

These characteristics were considered to be key elements of the sustainable global competitiveness achieved by successful exporters. The report noted that significant work was needed to lift the overall level of Australia's supply chain management to international best practice (DPIE 1998, p. 5).

A report for Austroads, published in 1999, provided a review of freight transport chain case studies (Taylor 1999). The report concluded that cooperation, flexibility and communication in private-public partnerships fostered efficiency gains for both sectors. It also proposed consideration of intermodal advisory committees at a State level, and identified potential gains through streamlining and automating regulatory procedures and enforcement.

In 1999, the National Office for the Information Economy released a report on the use of technology and e-commerce in the Australian road freight transport industry (NOIE 1999). The report concluded that the penetration and use of technology in the industry was reasonably high, but that there was significant scope for business improvements using e-commerce. It noted that companies taking up e-commerce were finding it difficult to justify the expense, as many of the potential benefits could not be fully realised without the rest of the industry being e-commerce capable.

The Bureau of Rural Sciences undertook a chain stocktake of some Australian agricultural and fishing industries in 2000 (Peterson et. al. 2000). The report covered 15 chains in four industries. It concluded that, in some cases (e.g. commodity chains), awareness of chain management was limited. The presence of a significant chain leader (particularly a professional organisation, such as a major processor or supermarket group) led to higher chain performance. The report noted that the major factors limiting supply chain integration were the fragmented structures of some industries (e.g. horticulture) and the independent nature of many Australian producers.

A study of roads and road transport in the logistics chain was completed in 2001 (Fuller and Tsolakis 2001). The report included the results of consultations with major shippers, logistics service providers and industry associations. Shippers indicated a strong commitment to reducing logistics costs and improving service outcomes. The consultations affirmed the wide range of logistics tasks and resources, the changes occurring in the configuration of these tasks, and the mix of resources required to deliver the desired outcomes. The report concluded that an improved targeting method for investment could be achieved through a five-stage process, or through a series of stand-alone projects over a longer period with higher costs.

A study of the grocery supply chain undertaken by PricewaterhouseCoopers identified potential savings of over \$1 billion from more efficient practices and a possible reduction of over \$700 million in finished goods inventory in 1995 (ECR Australasia 2001, pp. 2-3). Improvements of almost \$300 million in

operating costs and \$300 million in inventory were subsequently achieved. However, a 1999 tracking study indicated that, with industry growth, there were still potential savings of around \$1 billion from operating cost reductions and \$750 million from inventory reductions.

### Other studies

The Integrated Logistics Network and the Australian Freight Council Network have recently been involved in a range of studies examining initiatives to improve logistics performance. The topics have included:

- cold chain logistics mapping and re-engineering;
- a national logistics framework;
- an integrated freight community electronic portal proposal;
- export reefer containers;
- monitoring of temperatures in food export shipments;
- standards for refrigerated road transport equipment;
- controlled and modified atmosphere sea freight product trials; and
- thermodynamic returnable modular packing.

### ASSESSING PERFORMANCE

The Australian studies over the last decade indicate that logistics activities do not constitute an integrated industry. Integration appears to be particularly limited in certain agricultural chains.

Some of the factors which limit integration are probably industry-specific (e.g. fragmented structures and independent attitudes of chain participants). However, broader factors such as incompatible information systems and inadequate infrastructure are also contributing factors.

As noted in chapter 3, a logistics chain usually incorporates a variety of information systems operated by different participants. The flow of information along a chain is often hindered or prevented by the use of proprietary systems based on different standards (e.g. numbering used in bar codes). This incompatibility limits the visibility of logistics chain activities to participants and therefore adversely affects integration. For example, a producer often relies on indirect information about retail sales, and is unable to obtain real-time sales information which would enable it to rapidly adjust production in response to changing market requirements.

Supermarket groups in Australia have traditionally used various standards (e.g. for bar coding) and software to manage inventory. Suppliers dealing with more than one group have therefore had to maintain several systems (Malone 1999, p. 10). Work to standardise product identification, electronic messaging and

cataloguing has been undertaken by groups including the Grocery Industry Supply Chain Committee and, more recently, ECR Australasia.

In the road transport industry, the use of proprietary systems (particularly for labelling) is reportedly a major problem for the industry and its customers (NOIE 1999, p. 10). Specific issues include a lack of standards, or multiple standards, involving different transponder technologies (wharf access) and bar coding systems.

Integration in Australian logistics activities is adversely affected by the limitations of inter-modal transfer points (e.g. road/rail, road/rail/ports) in transport networks (DoTRS 2000, pp. 15-16). These limitations partly reflect uncertainty about the allocation of overall responsibility for integration. In the case of ports and terminals, this uncertainty often reflects ownership diversity and conflicting priorities (e.g. between public and private operators).

Overseas experience also suggests that integration of logistics activities is limited. For example, in a survey of North American companies in 2000, only 57 per cent of respondents using third party logistics providers indicated that there was significant, or some, integration of the services supplied by these providers (Smyrlis 2000, p. 46).

Some Australian data are incorporated in a survey of logistics practices in manufacturing industry that is undertaken annually by IndustryWeek magazine and PricewaterhouseCoopers (Ling 2001). The survey has recently involved firms in the US, Canada, Mexico and Australia. It includes information on plant performance (e.g. cycle time, on-time delivery rate), technology (e.g. computer-aided design), collaboration and manufacturing strategies. The results of the survey reportedly indicate that there are opportunities to improve logistics practices and performance in Australia.

Various firms are currently implementing major programs to improve the integration of their logistics chains. For example, Woolworths is reportedly moving to control the movement of freight from suppliers to distribution centres, and to establish an automated ordering system (Guy 2001, p. 20; Boyle 2001, p. 24). Grainco Australia has entered into a partnership with Boeing Australia to develop an integrated e-business system that will enhance data sharing, increase efficiency and ensure effective resource management across the supply chain for grain (Grainco Australia 2001, p. 2).

## CHAPTER 7 FUTURE RESEARCH

As noted in chapter 1, this paper forms the first part of a longer-term BTE project on logistics in Australia. This chapter examines the scope of a full economic study, and identifies potential research areas and associated data requirements.

### STRUCTURE

Market structure comprises the environmental factors that a firm considers in making its operational and strategic decisions (e.g. pricing). Aspects of structure include:

- concentration (i.e. number and size distribution) of buyers and sellers;
- product characteristics, including product differentiation;
- barriers to entry and exit (e.g. absolute cost advantages, regulatory/legal restrictions);
- pool of potential entrants;
- economies of scale and scope; and
- vertical/horizontal integration.

Structure has traditionally been viewed as an important determinant of conduct and performance. The impact of market concentration has been further analysed in the alternative framework of contestability theory (potential competition).

Earlier chapters have examined aspects of the structure of the Australian logistics system. Publicly available data are limited. Financial and operational information for some external service providers is available from the annual reports of public companies and from databases maintained by firms such as Dun & Bradstreet and IBIS*World*. However, several major logistics activities (e.g. procurement, inventory management, recycling) are not separately identified in data collections maintained by the ABS or by other areas of government, industry associations or academics.

Additional data would therefore be required for a more detailed analysis of the structure of the logistics system or major logistics activities. With the possible exception of transport, the additional data would include:

- the number and size distribution of firms;
- links between firms (e.g. strategic alliances);
- the locations of firms; and
- service and product characteristics.

Collection of these data would probably require significant resources, either for detailed surveys or to analyse partial databases and directories (e.g. industry associations' membership lists).

### CONDUCT

Market conduct describes the behaviour adopted by firms in responding to the structure of the market and other aspects of the operating environment. Conduct may also have some influence on structure in imperfectly competitive markets (e.g. the impact of mergers on market concentration). Aspects of conduct include:

- pricing practices (e.g. price leadership);
- mergers and joint ventures;
- collusion;
- predatory or exclusionary tactics;
- marketing and advertising; and
- investment in research and development.

This paper has provided some information on conduct in Australian logistics. A detailed analysis of market conduct would require data on the above aspects for individual logistics activities or for major groups of activities.

Data collection for a significant range of activities would generally be resourceintensive, as it would require analysis of the behaviour of firms and how they respond to market developments. Potential approaches include discussions with users and providers of logistics services, interviews with government agencies (e.g. the ACCC), and examination of evidence in trade practices cases. Some data may also be available from stockbrokers' reviews, which often include the results of site visits and consultations with company executives.

#### PERFORMANCE

Many firms and industries are implementing strategies to improve their logistics performance. Other initiatives, such as the Freight Transport Logistics Industry Action Agenda and the Supermarket to Asia Council, are also addressing performance issues.

Market performance incorporates the economic outcomes that flow from structure and conduct. Aspects of performance include:

• technical efficiency (i.e. cost minimisation for the chosen product mix);
- allocative efficiency (i.e. allocation of resources to the product mix that is most valued by society);
- product quality and variety (e.g. transit times);
- availability of adequate product information to consumers;
- responsiveness to consumer requirements;
- profitability; and
- innovation and technological progress.

The assessment of performance requires information on at least some of these aspects for various logistics activities. It also involves comparisons with benchmarks that indicate adequate levels of performance (e.g. costs for similar activities in comparable markets, or performance of competitors' chains).

Some information on performance is available from the Australian logistics chain studies discussed in chapter 6, and from existing studies (e.g. international comparisons) of transport activities such as coastal shipping, rail freight and airports. In addition, inquiries into shipping conferences by the ACCC and the Productivity Commission have covered the performance of liner shipping services. The IndustryWeek survey of logistics practices may also contain useful data on practices and performance in Australian manufacturing.

Consultants collect data about various aspects of logistics activities. For example, Sinclair Knight Merz reportedly has a database of 350 companies which, among other things, covers order supply costs and transport costs as a proportion of total sales (Sinclair Knight Merz 2001, p. 7). Other activities include a survey of salaries for personnel involved in logistics activities.

It appears that detailed performance data are not publicly available for a wide range of logistics activities such as warehousing, information systems, inventory management, materials handling, inter-modal transfers, and procurement. This probably reflects the prominent role of private operators (e.g. in-house teams or contractors) and commercial confidentiality issues in these activities. In addition, the markets are often fragmented, with many small operators that are not covered by common databases.

Collection of detailed performance data for logistics activities outside transport would generally be resource-intensive. It may therefore be preferable to undertake preliminary assessments of performance through interviews with, or surveys of, various users of logistics services. The more detailed analysis could then be focused on areas with reported performance difficulties.

#### COMPETITION

The level of competition in logistics activities is of major interest to industry participants and public policy-makers. Competition involves rivalry between firms producing goods or services that are close substitutes.

The scope and form of competition in a market typically has a major impact on performance (e.g. technical efficiency, service quality). Low levels of competition may be accompanied by practices such as collusive behaviour.

The assessment of competition commences with the identification of the relevant market. Aspects of market definition include the product, the geographic area, and possibly the functional level (e.g wholesale or retail). Market definition in logistics is potentially complicated by issues such as specialisation of some service providers in particular traffics (e.g. refrigerated food, motor vehicles) and issues of integration and linkages.

The factors that are typically used to assess competition in a market include:

- market shares;
- horizontal and vertical integration;
- barriers to entry and exit;
- pricing practices;
- any evidence of anti-competitive behaviour; and
- profitability (taking into account features such as market growth).

Any impact of networks, synergies or multi-market operations (e.g. activities undertaken by integrated logistics providers) should also be considered.

Comprehensive analysis of competition in logistics would require detailed data on market characteristics. Some information for particular activities is available from the trade practices inquiries undertaken by the ACCC. However, in many cases, information is not currently available from published sources, and data would need to be collected for individual logistics activities.

In view of the resources that would be required for data collection, it may be appropriate to initially focus on areas of major interest to industry participants and public policy-makers. Potential studies include the assessment of:

- competition between ports in Australia;
- the impact of mergers/takeovers, vertical integration and alliances on competition between logistics service providers;
- competition in specialised logistics activities that have high barriers to entry; and
- the effects of consolidation in the logistics system on competition in other areas of the economy (e.g. when a user of logistics services is also a major provider of these services to its competitors).

#### IMPLICATIONS FOR FUTURE RESEARCH

As noted in chapter 1, the Secretariat for the development of the Freight Transport Logistics Industry Action Agenda asked the BTE to assess the dimensions of conducting a full economic study of logistics in Australia. Detailed analysis of structure, conduct and performance would require substantial time and resources. This reflects the wide range of logistics activities, the large number of issues typically covered in a full economic study, and limited availability of data. In-house operations, which account for the majority of logistics services, would be particularly difficult to analyse as they involve transactions within individual firms.

The BTE's previous experience with transport research projects (e.g. harbour towage, general aviation, international aviation) indicates that industry studies are resource-intensive. The logistics system includes a large number of activities, and is even more complex.

It therefore seems likely that future research should focus on either broad overviews of logistics activities or detailed analyses of specific issues. Such studies could include:

- the size and other characteristics of major parts of the logistics system;
- the adequacy of logistics infrastructure, including its ability to handle projected increases in demand;
- the impact of operating strategies, such as mergers/takeovers and alliances, on the performance of logistics chains; and
- the benefits of moving from multiple bar coding systems to a more integrated approach.

It was noted in chapter 4 that the ABS data on logistics activities are mainly limited to aspects of transport and storage. It may therefore be appropriate to consider options for improving the ABS collections, particularly if there is a requirement for more accurate information about the scope of logistics activities (e.g. proportion of GDP). The preparation of transport satellite accounts would potentially provide more accurate information on gross value added in transport (particularly in-house activities). As an example of the type of approach that might be used, the Bureau of Tourism Research (BTR) has undertaken a joint project with the ABS to improve the data on tourism in Australia.

The BTE's future research on logistics will be affected by the nature of emerging policy issues that require Government attention, and the availability of data.

### CHAPTER 8 CONCLUDING COMMENTS

This Working Paper has presented the results of the BTE's preliminary work on logistics in Australia.

Logistics incorporates all activities that are required for the movement and handling of goods and materials, from inputs through production to consumers and waste disposal. It includes the associated reverse flows.

Information systems and infrastructure/resources are key inputs in the provision of logistics services. The available data indicate that logistics activities comprise a significant component of economic activity in Australia.

The performance of the logistics system has a major impact on cost structures, service quality and competitiveness in Australian industry. Recent studies have concluded that there are opportunities to improve performance. The Freight Transport Logistics Industry Action Agenda is one of the initiatives that are being used to address these issues.

The operation of the logistics system is often analysed in terms of chains of related activities. The essence of effective chain management is integration—combining individual logistics activities into a whole that functions seamlessly and provides good performance. The performance of logistics chains affects producers' revenues and costs.

Options to promote integration of logistics activities include in-house provision, single providers of multiple services, partnerships and alliances, chain leaders, and collaboration/voluntary cooperation. The effectiveness of individual strategies depends on factors such as information flows and the incentives for each service provider to contribute to the operation of the total chain.

Logistics activities do not comprise a single integrated industry. Integration is limited by industry-specific factors (e.g. fragmented structures and independent attitudes of chain participants) and by broader factors such as incompatible information systems. There appears to be significant variation in the level of integration in different logistics chains.

The BTE's future research on logistics will be affected by the nature of emerging policy issues that require Government attention, and the availability of data. It appears that the level of competition is a major area of interest. Additional data will be required for any detailed analysis of logistics activities in Australia.

# GLOSSARY

Alliance	A formal cooperative arrangement between two or more firms, with the aim of facilitating the achievement of each firm's objectives.
Broker/agent	Organisation that provides advice (e.g. on customs requirements) and arranges various logistics activities that are usually focussed on a specific sector (particularly transport).
Chain	A series of interdependent logistics activities (involving major stages between inputs and disposal) for a particular product, based on coordination and cooperation. Typical terms include supply chain, value chain and demand chain.
Chain leader	A participant in a chain that uses its influence (e.g. as a large buyer) to improve chain performance through, for example, increased coordination and a better understanding of customer requirements.
Competition	Rivalry between firms producing goods or services that are close substitutes.
Conduct	Behaviour adopted by firms in responding to the structure of the market and other aspects of the operating environment.
Contractor/specialist	Organisation that undertakes a small number of closely related logistics activities, involving narrow interactions with each buyer of its services.
e-commerce	Any form of business transaction undertaken electronically, as opposed to physical exchange or personal contact.
Economies of scale	Cost reductions that occur when the average cost of production declines as output increases.
Economies of scope	Cost reductions that occur when the cost of producing two or more outputs together (e.g. by one

	firm) is lower than the cost of producing the outputs separately (e.g. by several firms).
Electronic data interchange	Computer-to-computer transfer of standard business documents between organisations for processing, using a private network.
Freight forwarder	Agent that arranges freight transport, including services and necessary documentation, for a fee.
Gross domestic product	Total market value of goods and services produced in the nation, after deducting the value of goods and services used up in the production process, but before deducting allowances for the consumption of fixed capital. Equivalent to the sum of gross value added of all resident producers.
Gross value added	Value of output minus the value of goods and services consumed in the production process.
Information system	Electronic, paper-based or voice network that enables each participant to share operating data with other participants.
Integrated logistics provider	Organisation that provides logistics services across major parts of logistics chains, incorporating a high level of operational and strategic integration.
Integration	Combining individual logistics activities into a whole that functions seamlessly and provides good performance in areas such as costs, transit times and reliability.
Logistics	All activities required for movement and handling of goods and materials, from inputs through production to consumers and waste disposal, including reverse flows.
Multi-service logistics operator	Organisation that provides logistics services at several stages of logistics chains.
Network	A collection of nodes connected by facilities along which entities move. Characterised by one- or two- way connections between multiple points that include common paths.
Partnership	A formal cooperative arrangement between two or more firms, with the aim of facilitating the achievement of each firm's objectives.
Performance	Economic outcomes that flow from market structure and conduct.

Procurement	Purchase of goods and services from outside suppliers for use in the firm's production, sales and distribution activities.
Structure	Environmental factors considered by a firm in making its operational and strategic decisions.

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# **ABBREVIATIONS**

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACS	Australian Customs Service
AGPS	Australian Government Publishing Service
AIPMM	Australian Institute of Purchasing and Materials Management
ANZSIC	Australian and New Zealand Standard Industrial Classification
APICS	Australasian Production and Inventory Control Society
AQIS	Australian Quarantine and Inspection Service
B2B	Business-to-business e-commerce
B2C	Business-to-customer e-commerce
BTCE	Bureau of Transport and Communications Economics
BTE	Bureau of Transport Economics
BTR	Bureau of Tourism Research
c.i.f.	cost, insurance, freight
DoTRD	Department of Transport and Regional Development
DoTRS	Department of Transport and Regional Services
DPIE	Department of Primary Industries and Energy
ECR	Efficient consumer response
EDI	Electronic data interchange
GDP	Gross domestic product
HORSCOCTMR	House of Representatives Standing Committee on Communications, Transport and Microeconomic Reform
HORSCOTCI	House of Representatives Standing Committee on Transport, Communications and Infrastructure

International Cargo Handling Coordination Association
International Standards Organisation
Just-in-time
Logistics Association of Australia
National Office for the Information Economy
National Road Transport Commission
Organisation for Economic Co-operation and Development
Trade Practices Commission
Total quality management
United Kingdom
United States of America