Annex 4
Win-win company policies in food logistics systems

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CONTENTS

1 INTRODUCTION

This document discusses company policies that could help reduce the environmental and social impacts of food logistics systems and which do not have adverse effects on other aspects of sustainability (e.g. economic benefits). The policies discussed include:

- Outsourcing of transport / shared user services
- Computerised vehicle routing and scheduling (CVRS)
- In-vehicle IT and telematics
- Strategic models concerned with the physical supply chain
- B2B e-commerce and freight exchange systems
- Return loading
- Factory gate pricing
- Fleet management and driver training
- Vehicle engines and fuels
- Grocery home delivery

The company policies list above can help to reduce the environmental and social impacts of food logistics systems in several different ways including:

- Reducing empty running
- Improving vehicle time utilisation
- Improving vehicle fill
- Improving fuel consumption rates
- Reducing CO_2 and other pollutant emissions

Empty running, vehicle fill, vehicle time utilisation and increases in maximum permissible gross vehicle weight are presented in Annex 2 (Factors driving food miles) and have not therefore been discussed in detail in this document.

Finally, a number of issues and trends in transport logistics may act as a barrier to reducing food miles, or offset the benefits of the other policies discussed. These are presented at the end of the Annex.

2 OUTSOURCING OF TRANSPORT / SHARED USER SERVICES

Since the early 1980s, there has been a substantial increase in the proportion of food movement handled by outside contractors (McKinnon, 2003). Where these contractors have been able to provide a 'groupage' or shared user service to several clients, levels of vehicle utilisation have generally been improved, reducing the ratio of vehicle-kms to tonne-kms. Much of the transport of food and drink product, however, has been outsourced on a dedicated basis to particular clients, limiting the opportunities for load consolidation. For example, in recent years most large UK food retailers have contracted out between 50 and 100% of their transport requirements to logistics service. The vast majority of this work is done on a dedicated basis in client-liveried vehicles. In recent years, however, retailers have been relaxing restrictions on the use of these dedicated vehicles become more willing to share vehicle capacity. This has increased the opportunity for rationalising the movement of food.

Shared user operations can be organised in several different ways. In some cases, goods are taken to RDCs for consolidation with other customers' loads as part of a multi-drop operation. In other cases, such as the Securicor example below, the operation involves the direct delivery of a customer's goods with the distribution company using the vehicle for another job near the point of delivery if there is no return load. In some cases, such as the JRL example below, two or more distribution companies may share their vehicle and warehousing capacity to provide tailored solutions for a single customer.

Examples of shared user include the services offered by Securicor Omega Logistics which operates 70 shared user distribution centres (or as they prefer to call it 'multi-user'). They have a fleet of more than 2,000 vehicles and make extensive use of IT applications to manage the network (Securicor Omega Logistics, 2003). Further examples of shared services and outsourcing are provided in the boxes below.

Example of shared user services: NET Logistics (Wincanton, 2000)

NET Logistics is Wincanton's shared-user distribution initiative, which provides customers with the opportunity to improve vehicle utilisation and reduce costs by sharing vehicles with other companies. NET Logistics uses a transport management system, known as DCSi.Logistics, that helps to managing vehicle movements centrally within the operation, including those of sub-contractors. The system provides NET with greater visibility of the entire shared-user distribution network it is operating and thereby provides opportunities for efficient utilisation of the transport capacity. The system is also able to communicate with in-cab computers and WAP technology. It also incorporates an event manager function, which monitors the status of consignments and alerts the transport planners of any potential difficulties in the plan. The system was introduced in 2000.

Example of outsourcing and sharing resources: Joint Retail Logistics (JRL)

Joint Retail Logistics (JRL) is an initiative in non-food retail. It has brought together the combined resources and skills of two logistics providers to whom logistics activities are outsourced with the use of information technology to reduce environmental impacts and at the same time achieve more efficiency and better service to customers.

JRL is a joint venture between Exel and Tibbett & Britten. It has resulted in these two competing logistics service providers being able to work together to provide unified service to Marks & Spencer. The objectives of JRL were:

- To maximise efficiency in the general merchandise transport operation while maintaining current service criteria.
- To appoint a single contractor to manage the general merchandise transport, with responsibility for the total transport supply chain between supplier and store.
- To build on current environmental initiatives and ensure that Marks & Spencer continues at the forefront of minimising the environmental impact of its transport operations.

Benefits of JRL to date include:

- Greater efficiency in operation – savings in km run of 11%. Number of tractors reduced by 26% (trailer requirements down 8%).
- Reduced congestion at distribution centres and at delivery points for stores (i.e. in the high street of towns and cities).
- Delivery to store vehicles also able to handle reverse logistics of packaging and handling media.

In JRL, Exel has been responsible for providing technologies that would optimise the distribution system in an integrated fleet approach, involving back-loading and use of drivers across all of their working day, and the use of vehicles over a 24-hour period. The five technological applications implemented by Exel in JRL are:

- A web-deployed MTS host system to track an order from source to destination
- Integrated scheduling that optimises on cost
- Integration with Isotrak's real time fleet management toolkit to control and manage multi-site fleet operations
- Project and change management control to implement the new management model
- Planning and management expertise to realise the benefits across the supply chain

The above technologies have been deployed by Exel to support the whole transport management process.

Information provided by Exel (2000)

3 COMPUTERISED VEHICLE ROUTING AND SCHEDULING (CVRS)

The use of computerised vehicle routing packages can cut transport costs and distance travelled by between 5 and 10%, depending on the quality of the previous manual load planning (Freight Transport Association, 2000). As these packages are now widely used by manufacturers, wholesalers and retailers in the food sector, they may have significantly reduced total vehicle-kms. As no general surveys have been done to establish the level of CVRS adoption in the sector or the average level of vehicle-km reduction, the net effect on traffic levels is unknown.

A recent Good Practice Guide (Freight Transport Association, 2000) highlights the scope for computerised vehicle routing and scheduling (CVRS) to help business improve the utilisation of their transport resources. Use of CVRS can help reduce journey times and vehicle mileage, reduce costs and improve the reliability of delivery schedules. Although there is no information about the precise uptake of CVRS, a postal survey of 2,300 Freight Transport Association members conducted in 1998 revealed that 138 out of 600 respondents were using some form of CVRS. According to articles in the professional press it is still mainly the larger companies that use these systems although smaller firms are showing more interest (Anon, 1999).

There are two types of CVRS system: journey planners and the more sophisticated scheduling systems. Journey planners are typically used for single routes where the user decides the calls to be allocated to each trip and determines the best route and call sequence by using the journey planner. This is effective for small and relatively simple operations. Vehicle scheduling systems process information about customer locations, quantities and types of goods and match this to available vehicle capacity to produce economic routes. They can be used for daily or weekly planning and for strategic exercises. The operator can test alternative solutions and make manual adjustments where necessary.

Applications are now available that can link with mobile tracking systems and on board computers to provide 'real time' information on the location and progress of each vehicle and on road traffic conditions. Access to real time information has allowed systems to be developed which automatically re-processes data according to the latest information on the ground, reacting to changes as they happen and informing the fleet controller of the best re-scheduling and re-routing options (Matthews, 2001). However, these initiatives are still in an early stage and not all software can be used in this way.

In general, the issue of congestion is dealt with by manual intervention and by changing the flow speed on selected parts of the network or on particular links. Some CVRS systems accommodate more sophisticated intervention than others and can allow travel speeds to be varied for certain links at different times. This allows operators to consider the viability of alternative solutions but relies to a large extent on the knowledge of the planner/scheduler.

Examples of the transport and financial benefits of one CVRS system (Paragon) are summarised by the company as follows: "Substantial transport efficiency savings are being achieved leading to a fast return on software investment, often in a matter of months. Safeway, for example, delivering grocery products to its nation-wide store base, has reported an 18% fuel reduction. Magnet Joinery, involved in retail and home delivery, cut transport cost by 20%. Watson & Philip, a leading food wholesaler, reported a 13% cost reduction. Wavin Building Products, Woodward Foodservice, Henkel and Thames Valley Foods all reported transport cost reductions between 15 and 20%. Domino's Pizza has also reported savings amounting to thousands of pounds per week, and BOCM Pauls, distributing animal feed from its regional feed mills to farms reported an overall transport cost reduction of £250,000 per year on a 40-vehicle operation in the South East" (Nockold, 2001).

Paragon has also been used to achieve more efficient routing and order volume smoothing through the week for the food wholesaler Cearns & Brown. This has resulted in their nation-wide distribution operation fleet size being reduced by 13% and has reduced delivery kilometres per pack by 14% (Paragon, 2003).

Meanwhile, another CVRS system, Optrak, has been used to reduce home delivery mileage by 23% for one company. In addition, driving hours were reduced by 14%, and the total cost by 15%. Optrak was also used to analyse the operation of a nationwide distributor of home improvements products. The system produced results that reduced mileage by 15%, drivers' hours by 13%, used 12 fewer vehicles, and reduced the running costs by 14% (Matthews, 2001).

Example of CVRS: Woodwards Foodservice (FTA, 2000)

Woodwards has 5,500 customers and makes up to 1,200 deliveries per day during peak periods. Woodwards decided that it was necessary to change from manual routing and scheduling for its vehicle fleet to a computerised system. Paragon software was selected, and was implemented at one of their depots in north Wales.

An interface was used to link Paragon to the warehouse management, order processing and stock control systems already being used. This made it possible for Paragon to be run during the late afternoon to schedule and route deliveries for the next day, these schedules are then passed to the warehouse during the evening for picking. Implementing this routing and scheduling system has resulted in the following benefits for Woodwards:

- Reduced daily vehicle mileage by 10%
- Reduced the fleet from 30 to 25 vehicles
- Reduced planning time to create the delivery schedules
- Increased picking/loading productivity by 50%
- Balanced load sizes more evenly to enable the work to be shared out more efficiently

4 IN-VEHICLE IT AND TELEMATICS

Many larger freight operators have placed a growing importance on information systems over the last decade. For many smaller and medium-sized operators it will be necessary to improve the internal information systems of the firm in order to operate efficiently in a highly competitive market.

Telematics applications available in the freight sector include (TransportEnergy, 2003a):

- Vehicle and driver data
- Vehicle tracking
- Trailer tracking
- Text messaging
- Paperless manifest and proof of delivery
- Traffic information
- On-board navigation

Mobile Data Communications (MDC) equipment allows a transport operator to monitor the position of a vehicle and can enable the base and driver to exchange messages. This in turn means that the efficiency of road freight operations increases and better quality information can be provided to the transport operator's customers (e.g. providing information about precise arrival times). As well as tracking vehicles, some companies also use systems to track the flow of consignments within their network so that they can keep customers informed of progress.

A consequence of the dramatic increase in the use of technology has been the increased complexity of in-vehicle or in-cab equipment. For example, in order to exchange messages via a satellite link it is necessary to have an on-board computer. The computer can also be used to record many details of the journey as well as to monitor vehicle performance and load condition.

IT systems are also widely used to assist with distribution network planning, vehicle routing and scheduling, for fleet management and driver safety purposes and for efficient vehicle loading.

Table A4-1 shows the telematic systems used by fleet managers to help minimise the impact of traffic congestion.

Table A4-1: Telematics systems used by fleet managers to minimise the impact of congestion

Telematic system	Proportion of fleet managers using this approach (multi-response)
Messages flashed on a screen above/on side of road	38%
Traffic news on broadcast media	30%
Traffic information on the internet/mobile phone	19%
CD-rom/internet based route planning	12%
In-cab route finder/congestion warning device	6%
None of these	4%

Notes: the results are based on a survey of 200 freight transport fleet managers.
Source: Lex Transfleet, 2001.

If improved information and communications systems are implemented successfully then the following benefits can be expected:

- better vehicle productivity
- improved time-keeping
- reduced fuel consumption
- reduced mileage (in the case of on-board navigation especially for multi-drop work)
- higher levels of customer service

Typically, the smaller the operator, the fewer IT applications they are likely to consider critical to their business operations. If a company has only one or two trucks then a computerised vehicle routing and scheduling package will have limited use.

In general, IT applications will yield bigger benefits and have more appeal to those operators with:

- complex operations
- a high number of transactions
- wide ranging responsibilities for supply-chain management

Inevitably these complex logistics services will tend to be the province of the larger operator. However, in many cases, medium-sized firms are likely to be in competition for this business and may well also consider the scope for using IT to significantly enhance their competitive position.

Examples of the benefits of telematics systems include (TransportEnergy, 2003a):

- Exel achieved a 7.2% reduction in fuel use at its Bawtry depot after introduction of an Isotrak system for in-cab communication and information telematics. The system helped Exel to identify vehicle engine idling (due to cold cabs which was overcome by fitting heaters in cabs) and particular driving styles that were not fuel efficient (which was addressed through driver training).

- Tesco has achieved fuel savings of 4-5% as a result of introducing the Isotrak in-cab communication and information telematics system. This is equivalent to a saving of approximately £2 million for the company.

5 STRATEGIC MODELS CONCERNED WITH THE PHYSICAL SUPPLY CHAIN

Logistics and supply chain modelling can be used to address issues such as (d'Este, 2001):

- Developing and testing alternative supply chain and logistics strategies, such as alternative transport and inventory options;
- Optimising supply chain and distribution arrangements;
- Optimising the number, location and size of distribution points to meet delivery deadlines and cost requirements;
- Testing the robustness of logistical arrangements to changes in scale and pattern of demand;
- Testing system velocity and reliability;
- Finding lowest cost approach to meeting required service levels;
- Supply chain capacity analysis and finding bottlenecks, weak links and system limits;
- Evaluating the impact of investment to remove capacity and service constraints;
- Evaluating cost trade-offs such as warehousing and transport, and manufacturing location and shipping costs;
- Testing synergies between products or companies to test whether overall system efficiency could be improved by combining logistics operations;
- Resource allocation.

Strategic models concerned with modelling physical distribution operations typically use information about the quantity and location of goods produced, consumed, imported and exported in order to analyse depot networks (in terms of the cost, customer service levels, and physical distribution activity associated with different depot locations and depot numbers). The box below describes the main features of one such commercially available model named CAST.

Example of strategic modelling tool: The main features of CAST

CAST is a strategic and tactical supply chain modelling tool. Designed to create a computer model of a complex distribution operation (dedicated or network), it allows strategies to be run against that model to find a least cost solution. It is used to examine depot location and the flow of product groups throughout the entire supply chain. It optimises the cost of a proposed strategy by evaluation of the full range of costs including warehousing/transhipment, MHE, stockholding, handling and transport. Modelling can be within a single country, across a group of countries, or extend world-wide. CAST includes a worldwide road network database to enable modelling of supply chains in any single country, group of countries or globally.

Isochrone Modelling - In an increasingly competitive world, the cost to serve is an essential element to consider when optimising a supply chain network. CAST uses isochrone modelling techniques to display detailed service level information in both graphical and tabular formats, to assist the user in maximising customer satisfaction within specified service level criteria.

Transport Tariffs - The ability to model a wide range of transport options has long been regarded as one of the strengths of CAST. Now a new method of costing transport tariffs has been added to allow for the approach to handling vehicle costs used in North America.

This method will also have application worldwide and confirms CAST as the most powerful tool available for modelling a transportation network.

Inventory Modelling - The stock planning model has been constructed as a time-phased simulation using industry-standard decision-making algorithms. The facility is fully integrated within the CAST network planning model and provides clear graphical results, as well as a D.R.P. table displaying period by period output. Users are able to amend all the stock planning parameters and then instantly rerun the inventory model to calculate the implications of the changes, without running the main strategy model.

Centre of Gravity Modelling - CAST features both volume and cost based centre of gravity modelling. Used in conjunction with the heuristic network and stock strategy modelling options, centre of gravity modelling is used to make facility location decisions. The new volume based centre of gravity model includes a proprietary algorithm devised by Radical's development team. Centre of gravity models can be run with fixed facility locations, according to product group, supply and demand exclusions. To save time when project deadlines are pressing, the number of iterations considered by the centre of gravity model may also be limited.

Interfaces to Routing and Scheduling Packages - Three interfaces to routing and scheduling packages are now available and more will be developed in accordance with user demand. Interfaces to Paragon, Roadshow and ArcLogistics Route are now available. This makes it possible to take the results of a 'best case' strategy developed using CAST and 'drop' the results into one of the routing packages listed above. This avoids the problems of delays, cost and potential for error involved in the manual data manipulation.

MIP Optimiser - Historically developed using a heuristic approach to modelling, CAST now includes optimiser modelling, providing users with the opportunity to use either or both techniques. Input to the Optimiser consists of all the supply and demand points with their associated volumes, costs of operating all potential depots, and the costs of all feasible flows between the suppliers, depots and delivery points. The user has the choice of requesting the optimum number of depots or a specific number of depots that achieve the lowest cost. The user can then specify that certain depots must be used. The Optimiser will analyse all the volumes, flows and costs to select the optimum number and type of depots, and their location, for a given network. The result is then input to CAST's strategy model for detailed analysis and costing.

Source: CAST, not dated., product information, http://www.radicalglobal.com/products/index.htm

J Sainsbury, the UK food retailer, use strategic distribution planning software to analyse their distribution network. They use CAST–dpm to determine the optimum number and location of Regional Distribution Centres (RDCs) for the future. The software allowed them to study where they should site future RDCs and to measure the impact of opening or closing an RDC on the rest of the supply chain. J Sainsbury have also used CAST-dpm to identify the potential locations of intermediate warehouses (CAST, not dated).

6 B2B E-COMMERCE AND FREIGHT EXCHANGE SYSTEMS

At present the impact of business to business (B2B) e-commerce on transport remains uncertain. E-commerce will influence the freight transport system in two ways:

1. through online trading of food products in electronic market-places

2. through the online trading of freight capacity in freight exchanges

Figure A4-1 maps the complex inter-relationship between the growth of B2B and changes in freight traffic levels (McKinnon, 2003). A distinction is made between the online trading of commodities and logistics services. The trading of food products through e-marketplaces, such as Transora, has been reducing prices partly as a result of an intensification of competitive pressures but also through productivity improvements (see http://www.b2business.net/eMarketplaces/Major_Markets/Vertical_Industries/Food_&_Beverage/ for listing of the main e-marketplaces specialising in the trading of food products). These price reductions are likely to stimulate a growth in demand and hence increase in the quantity of food to be transported. E-marketplaces also make it easier for companies to trade with more distant suppliers and customers. This has the effect of lengthening supply lines and reinforcing the growth of tonne-km. These trends may be partly offset by a reduction in the wastage of food products and unnecessary movement of inventory. This is based on the reasoning that online trading and improved supply chain 'visibility' should improve the co-ordination of the supply and demand for foodstuffs. Overall, this is likely to moderate the increase in tonne-kms.

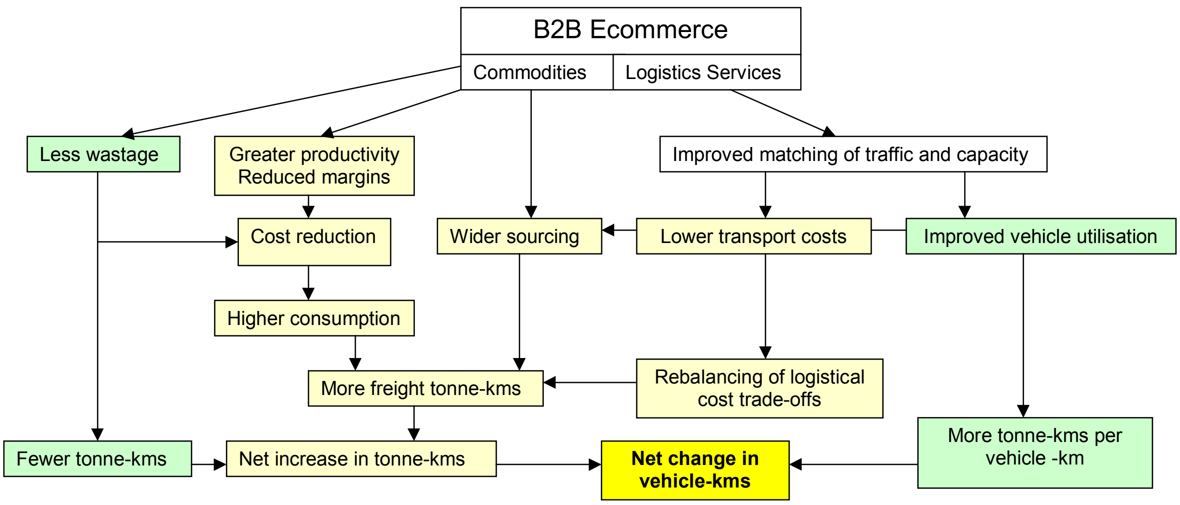


Figure A4-1: Possible Effects of B2B E-commerce on Freight Traffic Levels

The growth of online freight exchanges is likely to match traffic flows more closely to the available transport capacity. This has been demonstrated by the recent experience of web-enabled tendering in the European road haulage market. Vehicle load factors will therefore rise and the greater efficiency will be reflected in a reduction in haulage rates. This reduction in rates will be reinforced by a strengthening of competitive pressures within the e-market and some narrowing of margins. The decline in transport costs will indirectly encourage the trend to wider sourcing of products. It will also cause companies to rebalance their logistical cost trade-offs between transport, inventory, warehousing and production, promoting a shift to more centralised systems which generate more tonne-km per tonne distributed. This will reinforce the tonne-km growth associated with online commodity trading. This increase in tonne-kms, however, will not translate into a corresponding increase in vehicle-km on the ground. Improved utilisation of vehicle capacity will reduce the ratio of vehicle-km to tonne-km, mitigating the net effect on traffic volumes. It is impossible at present to quantify this net effect as it is subject to many countervailing forces whose relative strength has yet to be measured.

Example of Major European Online Freight Exchange: Freight-traders.com

Freight-traders, which is owned by the Mars Group, is one of Europe's largest online freight exchange. In 2002, it transacted approximately 1 billion Euro of haulage business. It has signed up 172 consignors and 1000 carriers (Rowlands, 2003). The company's Managing Director, Garry Mansell argues that, "The newly introduced Freight-traders TM internet-based cargo matching scheme is bound to make a significant contribution to improving the environment on and around the roads of Europe" (Mansell, 2000). He believes that, "Through the reduction in the number of trucks running empty - by creating the circumstances under which carriers can locate "backload" cargoes more effectively - total truck usage is expected to be substantially reduced. Overall, the result will be fewer trucks on the road, reducing both the levels of traffic congestion and the amount of air pollution created" (Mansell, 2000).

As well as potentially resulting in mileage reductions through backloading and reduced empty running, freight exchanges also offer the potential for transport cost savings for customers. For instance Kellogg's, European Distribution Procurement Manager, Ian McCartney has said, "The reason we use Freight Traders is the ease with which it is able to collect offers from a large amount of carriers at the same time. Irrespective of any freight cost savings, using Freight Traders significantly reduces our administration costs because we are not spending hours coordinating and chasing up carriers' offers. It offers one of the most straightforward systems to use, for both shippers and carriers, available in the marketplace and offers sufficient flexibility for us to be able to easily tailor each tender as we require" (McCartney, 2002). Numico NV a leading global manufacturers of baby food and infant nutrition products has reported that it reduced its freight rates by 12% year on year - a saving worth hundreds of thousands of Euros by using a freight exchange system (Freight Traders, 2002).

7 RETURN LOADING

Since the early 1980s there has been a fairly steady decline in the proportion of road vehicle-kms run empty. In recent years the DfT has published empty running statistics disaggregated by the main type of commodity carried on the previous laded trip. This indicates that the level of empty running in the agricultural sector is significantly above the average for all road freight operations, while in the case of 'other foodstuffs' and beverages it is lower. Unlike the trend in total empty running which has been following a steady downward trend, the levels for food products have tended to fluctuate. Since 1995, however, there has been a fairly steep decline in the empty running figure for 'other foodstuffs' from 27% to 23%. This may partly reflect the success of backloading initiatives in the food sector, particularly the 'supplier collection' and 'onward delivery' schemes operated by supermarket chains such as Tesco (DETR, 1999).

Return loading is likely to increase further with the expansion of load-matching services and a growth in the reverse flow of packaging material / handling equipment. It improves the vehicle utilisation and increases the number of drops per trip, thereby helping to reduce the total vehicle fleet required (McKinnon, 1996). Improved backloading and the resulting decline in empty running is reducing the ratio of vehicle-kms to tonne-kms.

Example of return loading: Tesco (DETR, 1997)

'Supplier collection' involves Tesco vehicles travelling from the RDCs to the stores, making a delivery, and then travelling onto suppliers to collect a primary load before returning to the RDC. 'Onward delivery' involves primary distribution vehicles operated by suppliers or third party providers. These vehicles traditionally delivered goods from the supplier's depot to the Tesco RDC and then returned without a load. Tesco was charged for this unproductive work. In the onward delivery scheme, after having carried out their primary distribution trip these vehicles are used to deliver goods from the RDC to stores. They then return to the supplier's depot (stores are selected on the basis of proximity to the supplier's depot). This helps to reduce unproductive, empty mileage. Trailer conversation was necessary in order to equip the vehicles for both primary and secondary distribution.

This scheme has required that trailers can carry both pallets (primary distribution) and store cages (secondary distribution). In addition, temperature-controlled vehicles had to be able to operate as single and multi-compartment, multi-temperature vehicles.

'Supplier collection' resulted in the total mileage (primary and secondary distribution) operated by Tesco being reduced by 3 million miles. This also resulted in a reduction in fuel consumption of 1.7 million litres and fuel cost savings of £720,000, together with a 4,600 tonne reduction in CO_2 emissions.

'Supplier collection' also resulted in better vehicle utilisation in terms of vehicle fill and usage. Over a five-year period (1993-1997) the scheme resulted in a 26.5% increase in the annual volume of goods carried by each trailer, and a 20% increase in the distance travelled by each trailer. This has enabled Tesco to meet its growing goods flows without having to make a proportionate increase in its vehicle fleet.

8 FACTORY GATE PRICING

One of the main developments in the UK food supply chain in recent years has been the move to factory gate pricing (FGP). This has been driven by the large supermarket chains, particularly Tesco and to a lesser extent Sainsburys. Suppliers are asked to quote prices with and without delivery costs to the retailers' RDC. Once the transport cost is separately itemised the retailer can determine if it would be able to collect the goods more cheaply either by:

1. backloading a shop delivery vehicle
2. having one of its vehicle make a separate trip
3. employing a haulier to pick up the goods

By taking responsibility for supplier collections, retailers can make more intensive use of their existing fleets (either of own account or dedicated contract vehicles). The volume of inbound supplies now governed by FGP now exceeds the excess capacity available in these fleets. Retailers are also employing hauliers to collect these supplies. Given their transport buying power, the large chains can generally obtain lower freight rates than the suppliers, cutting inbound delivery charges. As the Logistics and IT Director of Tesco explained, suppliers '…are not expert at buying and operating transport. We are. I have my own fleet to utilise and I can also buy transport on the secondary markets at good rates' (quoted in Aujla et al 2003).

This move to FGP is the culmination of a process which began in the 1960s when many supermarket chains began to extend their control back along the supply chain. Initially, this was confined to secondary distribution and involved retailers setting up regional distribution centres (RDCs) and taking responsibility for delivery from these RDCs to the shops (i.e. secondary distribution). In the late 1980s retailers began to exert more control over inbound flows into their RDCs (i.e. primary distribution): for example, requiring suppliers to channel their products through primary consolidation centres (PCCs). Over the past decade they have also increasingly used returning shop delivery vehicles to collect inbound supplies. This has been done on a fairly opportunistic basis. FGP represents a much more systematic effort to wrest control of primary distribution from suppliers. Retailers can then more effectively integrate primary and secondary distribution, mainly to improve the utilisation of vehicle capacity and cut supply chain costs.

By February 2003, Tesco had negotiated FGP arrangements with 500 of its suppliers which were collectively responsible for 30% of its inbound supplies, representing 30 million cases per annum. Sainsbury had FGP arrangements in place with 200 of its suppliers.

An analysis by researchers at the University of Cardiff (Potter et al, 2003) has suggested that, by combining FGP with the use of inbound consolidation centres, Tesco should be able to achieve a 28% reduction in the number of vehicle-kms required move supplies into its distribution centres (equating to 64,000 vehicle-kms per week).

While an individual supermarket chain, such as Tesco, may be able to cut its transport costs and traffic levels by a significant margin, there is no guarantee that across the grocery sector as a whole there will be savings. Suppliers, after all, have still to maintain a distribution system to service other smaller customers. The abstraction of the large orders to chains such as Tesco and Sainsbury is likely to reduce load factors on their remaining deliveries. No analysis has yet been done to assess the industry-wide effects of FGP on transport efficiency.

It has been suggested that the move to FGP will induce some restructuring of the food supply chain. A larger proportion of smaller retailers and catering establishments may now be served indirectly via wholesalers, rather than directly by suppliers. The Chairman of the large food wholesaler P&H McLane, for example, has stated that, 'If 40% of a supplier's distribution is removed through factory gate pricing, the cost of supporting the other 60% goes up, which is where wholesalers come in.' (quoted in Aujla et al., 2003, p.19). Suppliers are also likely to switch more of their less-than-truckload orders to hub-and-spoke pallet-load networks.

Another possibility is that by cutting retailers' inbound transport costs, FGP will encourage the trend to wider sourcing of food products. The upward trend in food tonne-kms may then be reinforced. If this is accompanied by improved loading of vehicles, at least those serving the large supermarket chains, the net effect on lorry traffic levels (measured in vehicle-kms) might still be positive in environmental terms.

9 FLEET MANAGEMENT AND DRIVER TRAINING

Fleet management and driver training can help to increase fuel efficiency and improve driver safety. Using fuel more efficiently can result in the following benefits:

- Lower costs
- Improved profit margins
- Reduced emissions
- Improved environmental performance

Safer driving can result in:

- Fewer accidents involving goods vehicles (leading to fewer injuries and fatalities)
- Less accident damage to vehicles
- Less unproductive downtime for vehicle repair
- Reduced insurance premiums
- Improved resale vehicle values
- Reduced running costs (in terms of maintenance and tyres costs)

The UK government has been actively promoting fleet management and driver training programmes for several years. It has been estimated that fuel management programmes are likely to result in fleet-wide fuel saving costs of approximately 5% (Fuelwise, 2001).

The Safe And Fuel Efficient Driving (SAFED) Standard has recently been launched by the Department for Transport (TransportEnergy, 2003b). In this scheme, the candidate's driving is initially assessed by a qualified instructor. The candidate then receives training on best practice in safe and fuel efficient driving techniques. The candidate's driving is then reassessed to record improvements in driving performance and actual fuel consumption. The final grade allocated to each candidate depends on performance in safety check and theory test exercises as well as the number of faults recorded during the day's practical driving sessions. Successful candidates receive a certificate of achievement. Trials conducted with seven different drivers of varying experience, using a range of vehicles from 7.5 to 44 tonnes maximum permissible weight, over a variety of training routes as part of the pilot phase of the SAFED project resulted in fuel savings of between 4.3% and 9.2% among these drivers and vehicles (University of Huddersfield, 2003).

The government are promoting this scheme as being of benefit to operators (in terms of reduced costs, better vehicle resale values and less disruption to operations caused by vehicle accidents), to drivers (in terms of improved confidence in driving performance and reduced stress while driving) and to the environment (in terms of reduced fossil fuel use, CO_2 and other pollutant emissions, reduced accident rates and better health and safety culture within companies).

Several facts concerning driver performance and vehicle maintenance are provided by the government in their promotion of the scheme are shown in Table A4-2.

Table A4-2: Facts about driver performance and vehicle maintenance

Topic	Fact
Braking	Smooth and progressive braking will save fuel and reduce stress on the driver, vehicle and load.
Clutch Control	Double-declutching is not necessary on synchromesh gearboxes. It increases clutch wear and wastes fuel.
Cruise Control	To maximise fuel economy, cruise control should be used whenever safe and appropriate.
Exhaust Brake	Use of the exhaust brake will contribute to smoother decreases in speed, increase the lifespan of brake linings and save fuel.
Adjustable Aerodynamics	Correctly adjusted air deflectors will save fuel.
Forward Planning	By planning well ahead and keeping the vehicle moving, gear changes will be reduced And fuel will be saved. Forward planning also helps to improve road safety.
Gear Selection	Keeping the engine speed within the green band and using the highest gear possible optimises fuel consumption.
Hazards	Use of information gained through observation gives more time to plan ahead and systematically avoid hazards.
Height of the Load	The height of a trailer or load should be kept to a minimum to reduce aerodynamic drag.
Positioning a Load	The positioning of a load, particularly on a flat trailer, can influence fuel consumption.
Skip Gears or Block Changes	The fewer the gear changes, the less the physical activity needed by the driver and the more fuel efficient the operation.
Overfilling the Fuel Tank	Overfilling the fuel tank allows fuel to leak through the breather.
Momentum	Using the momentum of the vehicle will save fuel.
Speeding	Speeding is illegal, jeopardises road safety and reduces fuel efficiency.
Plan Your Route	Effective route planning minimises the total amount of fuel used.
Low Revs, Low Noise, Low Emissions	Quiet operations produce less air pollution.
Motorways and Dual Carriageways	Use of constant speeds on motorways and dual carriageways will enable full use of cruise control, leading to less gear Changes.
Tyres	Correctly inflated tyres offer less resistance on the road, increase fuel economy, give greater stability and reduce the risk of accidents.
Vehicle Technology	Technology will only assist in fuel economy and safe and efficient operation if the driver is fully familiar with the vehicle's systems.
Weather Conditions	Derv does not burn as efficiently in bad weather due to a poor fuel/air mix and adverse weather conditions make driving more hazardous.

Source: adapted from Transport Energy, 2003b

Example of a fuel management and driver training programme: Thorntons
(DETR, 1999a)

In 1994, Thorntons (the manufacturer of chocolates, toffee and ice cream) joined a programme funded by the European Commission's SAVE programme. The aim of the programme was to develop a simple method of fuel management for goods vehicle fleets which could be readily applied in other companies. The first phase of the project involved (DETR, 1999a):

- Accurately monitoring the fuel performance of a sample of similar vehicles in the fleet
- Inform the drivers of how they were performing
- Train and encourage the drivers to improve the fuel efficiency of their vehicles
- Monitor and report the improvements

Both manual and automated data capture of vehicle performance was used in the project. This first phase of the project resulted in fuel savings of 3% in the first year across the entire fleet which was equivalent to a fuel expenditure saving of £7,300. Taking into account the staffing costs of the scheme which were £4,200, the net annual cost saving in year one was £3,100. Given that the set-up costs for the scheme were £3,050 (for software, in-cab computer and management time) the project had a payback period of one year.

In phase two of the project eight vehicles were fitted with in-cab data loggers capable of recording date and time, engine speed, road speed, idling time, distance, number of brake applications, harsh braking and rapid acceleration). These devices were therefore used to help identify the source of fuel efficiencies. Data loggers are also estimated to reduce accident rates by approximately 50%. Set up costs for phase two were £9,000 plus £700 for management time. Annual running costs of the project were £4,120 (to produce weekly reports and for staff time with the manual system which continued in other vehicles not fitted with the data loggers). A 5.8% reduction in fuel consumption was achieved, which is equivalent to a £14,500 reduction in fuel costs. Net annual savings were therefore £10,380 and, given the set-up costs, the payback period for the scheme of 11 months. Lower maintenance costs and reduced accidents which were also expected as part of the project have not been included in these calculations.

Example of a fuel management and driver training programme: McKelvie & Co
(DETR, 1999b)

A low-cost driver training scheme was set up in 1992 at McKelvie & Co a division of TDG. The company offered mainly dedicated distribution services throughout the UK. It operated a fleet of 152 vehicles. The intention of the scheme was to achieve reductions in fuel use, pollution and accident rates. The scheme resulted in fuel savings of 6% in the first year, rising to 8% by year three. The company reduced its annual CO_2 emissions by an estimated 740 tonnes, and accident rates per driver were also reduced. The set up costs of the scheme were £3,000, and the cost of running the scheme was £35,200 in the first year and £31,400 in subsequent years. The annual fuel savings in the first three years of the scheme were £49,000, £81,600 and £113,000 respectively. Net annual savings worth a total of approximately £145,000 were achieved over the first three years. In addition, vehicle accident costs fell by approximately £11,000 over the first three years, and maintenance costs were also reduced. The payback period of the scheme was calculated as nine months in year one; this has reduced to three months by year three (DETR, 1999b).

Example of a fuel management and driver training programme: BOC Gases
(Energy Efficiency Best Practice Programme, 2002)

BOC operates approximately 2,000 HGVs. Its Bulk Gas Delivery section operates approximately 200 vehicles with an annual fuel expenditure of £5 5 million. A fleet of over 700 vehicles, delivering gas cylinders, consumes fuel with a similar value. The bulk gas delivery vehicles are specialist tank vehicles distributing oxygen, nitrogen, carbon dioxide carbon monoxide, hydrogen and argon.

BOC Gases decided to set fuel saving targets for the Bulk Gas Delivery Fleet of £340,000, which represented about 3% of the previous year's fuel costs. This was achieved by a range of measures including:

- Nominating a 'Fuel Champion' to monitor and target fuel usage
- Continuous support, involvement and commitment from top management
- Introduction of in-house driver trainers
- An accurate method of collecting real-time vehicle mileage and fuel data
- Setting up fuel consumption benchmarks for specific routes and vehicles
- On-board vehicle and driver performance monitoring

Through this approach BOC Gases managed to reduce both its fleet energy costs, and the amount of exhaust emissions. Savings achieved through driver training amounted to £240,000 or 4.3% of the annual fuel expenditure with a three to six month payback. Another £110, 000 was saved by optimising the bulk storage of fuel. Aerodynamic kits demonstrated a potential fuel saving of 4% on the selected vehicle routes with a five-month payback.

Improvements in fuel used to refrigerate food products during transportation

The Transport KPI surveys in the food sector have revealed that refrigerated vehicles often wait fully loaded for 4-5 hours prior to despatch with the refrigeration equipment operating (McKinnon, 1999). Much more energy is required to keep products cold in a temperature-controlled vehicle than in the average cold store. The main reason for this pre-loading of vehicles is that cold store managers try to smooth the workload in the warehouse or get staff to load vehicles before the end of a shift. Warehouse efficiency is given priority over transport efficiency. In frozen and chilled distribution, more could be done to co-ordinate cold store and delivery operations to reduce total energy consumption.

Aerodynamics

Aerodynamic styling of goods vehicles can help to reduce fuel consumption. Such devices can also result in other benefits including spray reduction, soiling reduction, a reduced sensitivity to side winds and improved performance at high speeds. A publication by the Energy Efficiency Best Practice Programme in estimated that suitable aerodynamic styling fitted to a vehicle used on long distance routes could result, on average, in a 6-12% reduction in fuel consumption (compared with a vehicle with no aerodynamic styling or poorly adjusted features). Many of these devices have been calculated to have payback periods of less than 3 years, with some devices having payback periods as low of 3 months (ETSU & MIRA, 2001).

10 VEHICLE ENGINES AND FUELS

An important factor in the quantity of fossil fuel use and pollutants emitted by goods vehicles is the fuel efficiency of the vehicle. Some of the operational factors that can help to improve fuel efficiency such as fleet management and driver training, computer

resulted in significant reductions in Vehicle Excise Duty (VED) for the heaviest goods vehicles in November 2000 has made the financial benefits of RPCs less attractive.

Examples of companies adopting these approaches include Tibbett and Britten which has fitted particulate traps to 32 new heavy goods vehicles. These vehicles are used on the company's contract with B&Q. Tibbett and Britten had to pay £33,700 and received government grants totalling £100,000. Gist has fitted particulate traps to 100 of their 28-tonne tractor units. Gist had to pay £80,000 in total for these traps and received government grants of £240,000 towards the cost (75% of the total) (Distribution Business, March 2002).

Diesel engines – fuel efficiency through fuel supply and engines

The UK Government has been actively encouraging companies to consider their existing fuel supply systems and the efficiency of diesel-powered vehicle engines in order to save both fuel consumption and money. They have identified five stages in which fuel inefficiencies can occur "for a road vehicle with an internal combustion engine from delivery to the storage point to the final dissipation of all of its latent energy" (Department for Transport, 2003). These are:

- Delivery, storage and issue
- Vehicle tank to engine.
- Through engine to flywheel
- Flywheel to road wheels
- Energy to vehicle motion

The fuel consumption of goods vehicles can be improved by "improving the efficiency of the engine as a converter of fuel into useable mechanical energy at the flywheel" Department for Transport, 2003). This can occur in two ways (Department for Transport, 2003):

1. by reducing the internal losses in the engine itself and to its ancillaries,

2. by improving the basic process of conversion of fuel to gaseous heat and pressure and hence to mechanical energy.

There are several methods by which each of these can be achieved (Department for Transport, 2003):

Reduce Internal Parasitic Losses (Reduce internal friction, pumping losses and power to ancillary drives)
- Mechanical and fluid friction losses
- Cooling system
- Secondary drives and systems
- Induction and exhaust losses

Improve Energy Conversion Rate (More energy delivered to the piston per unit mass of fuel)
- Fuel quality and chemical effects
- Mixing fuel and air
- Timing effects and engine management
- Mechanical design factors

Alternative fuels

Alternative fuels that are less polluting than diesel are available for specially-designed or adapted goods vehicles. These include liquified petroleum gas (LPG), natural gas

(CNG/LNG) and electricity. Grants are made available by the UK government through the Powershift scheme to assist with purchasing new vehicles fitted with these fuel systems as well as for retrofitting older vehicles. Examples of companies that have adopted these fuels are provided in the boxes below.

Examples of companies using LPG: Joynson Bruvvers and Sutton and East Surrey Water

Joynson Bruvvers Ltd (JBL) is a family-owned independent office supply company based near Oxford. They have a fleet of six distribution vehicles, three of which run on LPG. The vehicles are used for multi-drop work around Oxfordshire, with a typical route involving 40 drops per day and a total monthly mileage of around 1,500 miles per vehicle. The LPG vehicles are used on all routes. The LPG vehicles emit 9% less CO_2, 46% less CO and 57% less HC and NOx than the comparable petrol vehicle. There is a small loss in payload volume and weight due to the additional LPG tanks. The total running costs of the LPG vehicles are similar to those of the diesel vehicles (TransportEnergy, 2002a).

Sutton and East Surrey Water operate 21 bi-fuelled LPG/petrol-powered vehicles (3 cars and 18 vans) in their fleet of 156 vehicles. The 18 LPG Vauxhall Astra vans travel approximately 270,000 miles per year in total and it is estimated that using LPG will result in a total emission saving of nearly eight tonnes of CO2 when compared to the petrol-fuelled vehicles. The LPG vans emit 11% less CO_2, 39% less CO and 33% less HC and NOx than the comparable petrol vehicle. The fleet manager, has estimated that the annual fuel cost savings are £17,000. The total additional purchase cost for the fleet of 21 LPG vehicles was £21,150 (compared to the petrol version). The company received a 75% grant from TransportEnergy PowerShift. The company therefore had to pay £5,290 in additional purchase costs, or an average of £250 per vehicle (TransportEnergy, 2003e).

Examples of companies using CNG in the food sector: Safeway and Warburtons

One of the biggest users of CNG-powered goods vehicles is Safeway which currently operates 85 CNG-powered vehicles. This represents 11.5% of the total fleet. The company has its own network of CNG refuelling stations. As the company says in its Corporate Social Responsibility Report for 2003/4, "Safeway continues to work with manufacturers in order to encourage investment in CNG vehicles suitable for the supermarket sector. Third party operators, such as hauliers and suppliers, are also being encouraged to use CNG by refuelling at the depots with workshops held to demonstrate the business case for CNG, in Safeway's case total life costs of CNG and 10% less than for diesel equivalent vehicles" (Safeway, 2003).

Warburtons, the bakers, operate CNG-powered vehicles in their delivery fleet. In March 1999 they added two ERF dedicated CNG Cummins-engined large commercial vehicles to their fleet, which already comprised 10 CNG vehicles that they had acquired in 1998. They also have refuelling facilities at their Bolton depot. All the vehicles are used to deliver the company's bread products to food stores throughout the country. The two vehicles purchased in 1999 emit 3% less CO_2, 80% less CO and 34% less PM and 57% less HC and NOx than the comparable diesel vehicle. The cost of a CNG vehicle is between £10,000 and £13,000 (on rigid vehicles) and approximately £20,000 (for tractor units) extra than conventional diesel vehicles. Warburtons received a 50% TransportEnergy PowerShift grant towards these additional purchase costs. In terms of fuel economy and costs the company has calculated that the vehicles' fuel consumption is about 1.5 miles per kg of CNG compared to 2.5 miles per litre of diesel. Given that CNG is far cheaper than diesel, this has resulted in a reduction in fuel costs of approximately 10% (TransportEnergy, 2002b).

11 GROCERY HOME DELIVERY AND CAR-BASED SHOPPING TRAVEL

Grocery home delivery operations have been expanded significantly in recent years. Total home delivery grocery sales was £197 million in 1999 (Insightresearch.co.uk quoted in Powell, 2000). This was estimated to have increased to £530 million in 2000 (Verdict 2001). This was equivalent to approximately 0.7% of total multiple grocery retailer sales in the UK, and about 0.3% of total retail sales in the UK. In 2002, Verdict forecast that grocery home delivery will increase rapidly over the next five years; it estimated growth of 269 per cent to £5 billion over the next five years (thereby estimating current UK grocery home shopping sales of approximately £1.35 billion in 2001) (reported in e.logistics, 2002).

Grocery home delivery operations result in passenger trips to supermarkets being replaced by goods vehicle deliveries. These operations therefore have the potential to alter the tonne-kilometres and vehicle-kilometres associated with this last leg of the supply chain. Several studies have examined the effect of grocery (and DIY) home delivery on vehicle trip generation.

Farahmand and Young (1998) modelled the vehicle trip effects of home delivery for a typical UK grocery store with gross floor area of 2500m^2, and a typical DIY store with gross floor area of 10000m^2 . They assumed pre-home delivery weekday PM peak hour trip rates of 18 trips per 100m^2 for the grocery store and 10.2 trips per 100m^2 for the DIY store, that 10% of shoppers at both stores would switch to home shopping, and that delivery vehicles would carry nine customers' loads on each round trip. The results of their modelling are shown in Table A4-3.

Table A4-3: Summary of results

	Total trips generated prior to home deliveries	Total trips generated in home delivery system	Reduction in vehicle kilometres for trips previously made by home shoppers (%)
Grocery store	450	410	87
DIY store	1020	930	87

Note: It is important to note that the 87% reduction in vehicle kilometres refers to the comparison between those trips previously made by car which, as a result of the home delivery service, are now made by vans. It does not mean that the total vehicle kilometres travelled to and from the shops by all customers is reduced by 87%.
Source: Based on data in Farahmand and Young (1998).

Cairns (1999) modelled grocery home deliveries in Witney in Oxfordshire in the UK. Her findings indicated that if 10-20% of total shoppers were to use home shopping, the switch from customer car journeys to multi-drop van deliveries could lead to a 7-16% reduction in trip numbers (as vans replace car trips) and a 70-80% reductions in vehicle kilometres (for those customers using the home shopping service), even if each delivery van only carried eight loads of shopping. Cairns notes that even "if deliveries have to be within tight time constraints, there are still likely to be savings, since this will simply mean that more vans are required, each carrying a lower number of shopping loads. In the worst case, of course, vans would simply act as if they were cars, carrying one load of shopping each, and delivering to only one household. Hence, a delivery service would never generate *more* travel than individual car trips, when operating from a local base, providing all users got to the shops some other way, or ordered their shopping from home, and assuming no other changes in customer behaviour" (Cairns, 1999).

Punakivi and Saranen (2000) modelled the potential mileage effects of grocery home shopping in Finland. It was assumed that 1.63% of the 202,000 population spread over an area of 135 km^2 used the home shopping service. The calculations were based on actual shopping data for one week from five grocery shops in Finland's second largest grocery chain and actual details of customers' homes. All orders over 150 FIM were modelled as home deliveries; 1639 such purchases were made during the week. Four different home delivery services were modelled; these varied in terms of how long after the order the delivery was made and the time window offered. Table A4-4 shows the effect on mileage travelled.

Table A4-4: Effect Of Home Delivery On Mileage And The Number Of Delivery Vans Required

	Mileage per week (Car = 100)
Use of own car (current system)	100
Home delivery – next day in 1 hour slots	46
Home delivery – same day in three 2 hour slots	24
Home delivery – next day in reception box	13
Home delivery – chosen day in reception box once per week	7

Source: based on data in Punakivi and Saranen (2000).

Punakivi and Saranen (2000) also calculated the cost to the grocery chain of providing these different customer service thresholds. It was estimated that to offer next day delivery within a one hour time slot would be more than three times as expensive as delivery on a chosen day into a reception box at the customers' homes (so that the delivery could be made at any time of day) once per week.

Reductions in vehicle emissions were also calculated by Punakivi and Saranen (2000). For the best home delivery scenario CO emissions would be reduced by 98%, HC by 95% and NO_x by 75%.

Palmer (2001) modelled grocery home shopping using a large database of shopping activity and actual store locations. Two scenarios were examined for 2003, 2005 and 2010: (i) delivery from existing stores, and (ii) delivery from a mixture of stores and dedicated fulfilment centres. The results suggest that if one-third of all affluent households used grocery home shopping by 2010, there would be an overall reduction of approximately 20% in the total vehicle mileage associated with grocery transport of all affluent households.

These studies all indicate that home delivery could prove beneficial in reducing vehicle trip rates and the total distance travelled. This could obviously help to reduce traffic congestion as well as environmental impacts such as fossil fuel use and pollutant emissions and accident rates. However, it should be noted that vehicle-kilometres reductions are dependent on whether these households substitute grocery shopping trips for other types of trip. Also, grocery home shopping will also result in increases in the number of goods vehicle trips in residential areas, which may impose environmental and social impacts.

Companies operating home delivery services can use IT to help make these services as efficient for possible. For instance, Tesco uses Paragon (computerised vehicle routing and scheduling system). Customers place their orders online and select a two-hour delivery window. The order is then allocated by postcode to a local store and the data is transferred to Paragon at that store to plan the delivery. Paragon then communicates the order back to other Tesco IT systems to generate picking lists and delivery manifests for the driver. This system functions automatically and requires no operator intervention on a day-to-day basis (Distribution, 1999).

11. FACTORS LIKELY TO OFFSET THE WIN-WIN POLICIES

Factors which may reduce or outweigh the benefits of the policies described in the preceding sections include:

- Quick response product replenishment
- Impact of congestion on journey reliability
- Drivers hours legislation/driving licence changes
- Sourcing strategies (length of haul over which food products are moved from source to point of sale)
- Increase in product range and availability
- Use of air freight for food transportation

11.1 Quick-response

Quick response generally entails more frequent delivery of smaller orders. Other things being equal, one would expect it to reduce the average size and weight of consignments. In a survey of 44 UK frozen food suppliers carried out in 1998 (McKinnon and Campbell, 1998) it was found that average consignment size has, in fact, declined from 11.7 pallets to 9.8 over the previous three years (Figure A4-2). It was predicted that this average would drop further to 8.4 pallets by 2001 (no follow-up survey was undertaken to check the accuracy of this prediction). When these averages were weighted by company turnover, however, a different picture emerged. This suggested that the average order size had been fairly stable and would drop only slightly over the next three years.

Several of the larger firms acknowledged that quick-response had been exerting a downward pressure on order size but this had been largely offset by an underlying growth in sales volumes.

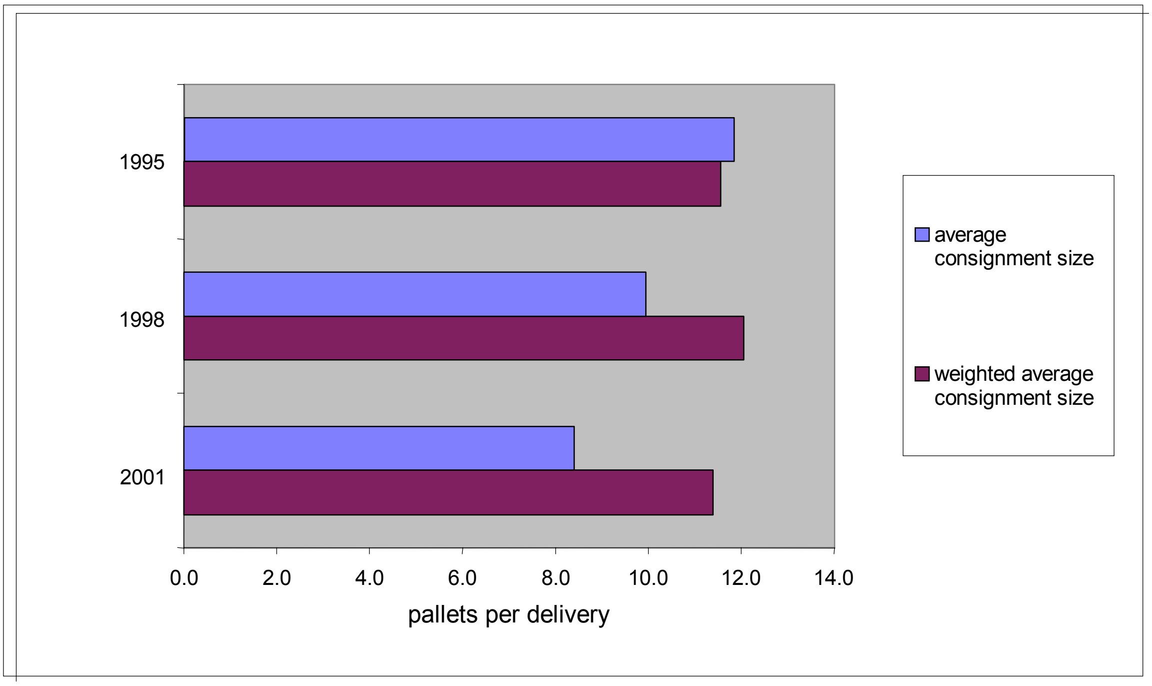


Figure A4-2. Average Consignment Size for Frozen Food Products, 1995-2001

It is often argued that the move to more frequent ordering of smaller quantities is reducing vehicle load factors and thereby generating extra lorry traffic per tonne of product delivered. It is important, however, to emphasise the distinction between order size and vehicle payload. As several orders can be consolidated in a single load, a decline in average order size need not result in a contraction of the average payload. Assuming that the capacity of the vehicle remains unchanged, a reduction in average order size can be offset by an increase in the degree of load consolidation. The 1998 survey evidence indicated that several developments have been increasing the level of consolidation:

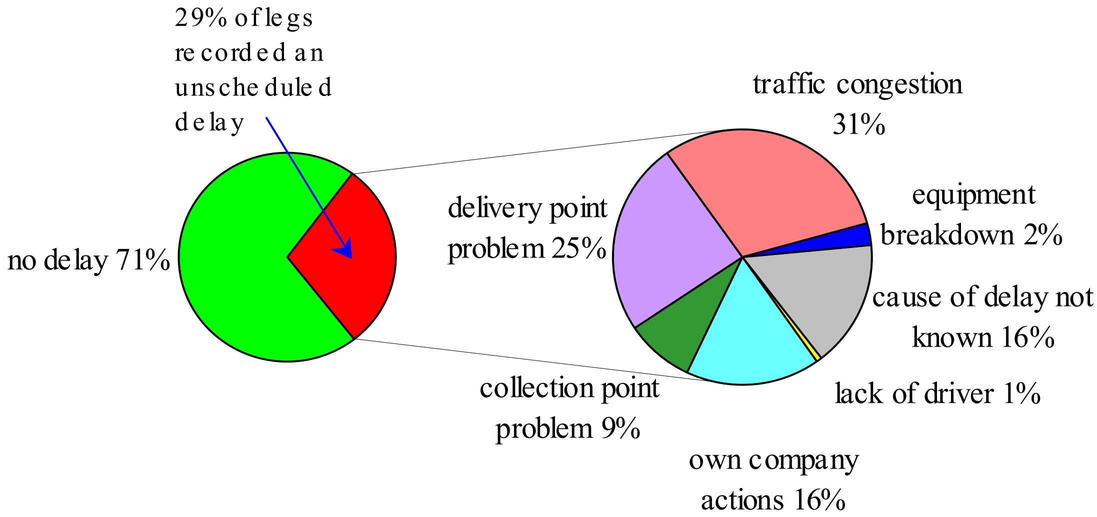
- concentration of production capacity in fewer plants; in some cases this has followed company mergers / takeovers, in others it has involved the internal restructuring of a single firm's product operation.
- concentration of manufacturers' cold storage space at fewer sites:
- concentration of retailers' cold storage capacity in fewer RDCs, resulting in flows of frozen food being channelled through fewer locations: for example, between 1993 and 1998, J. Sainsbury reduced the number of RDCs with a cold store from 13 to 4 7.
- greater use of third-party consolidation services provided by logistics service firms

These trends tended to counteract the downward pressure on order sizes which many firms reported. The net effect on vehicle utilisation was difficult to determine, however. This is partly because many of the firms consulted were unable to provide utilisation data but also because of difficulties in establishing a consistent measure of vehicle loading.

11.2 Impact of Congestion on Journey Times:

The 2002 Transport KPI survey in the food supply has shed some light on the relative importance of traffic congestion (Figure A4-3). Of the 15,250 journey legs monitored, approximately 29% were subject to a schedule deviation. Traffic congestion was the main cause of 31% of these delays. A much larger proportion of delays (50%) resulted from problems at the delivery or collection point or actions by the company responsible for the delivery. Focusing on the main cause, however, overlooks the inter-relationship between by these different causes and possibility that a delay originally caused by heavy traffic can be amplified by booking in restrictions at distribution centres and shops. Many companies are, however, building additional slack into their schedules to buffer against these various forms of delay. This is increasing delivery costs and partly offsetting the efficiency trends outlined earlier.

Figure A4-3. Main Causes of Schedule Deviation in the Food Supply Chain

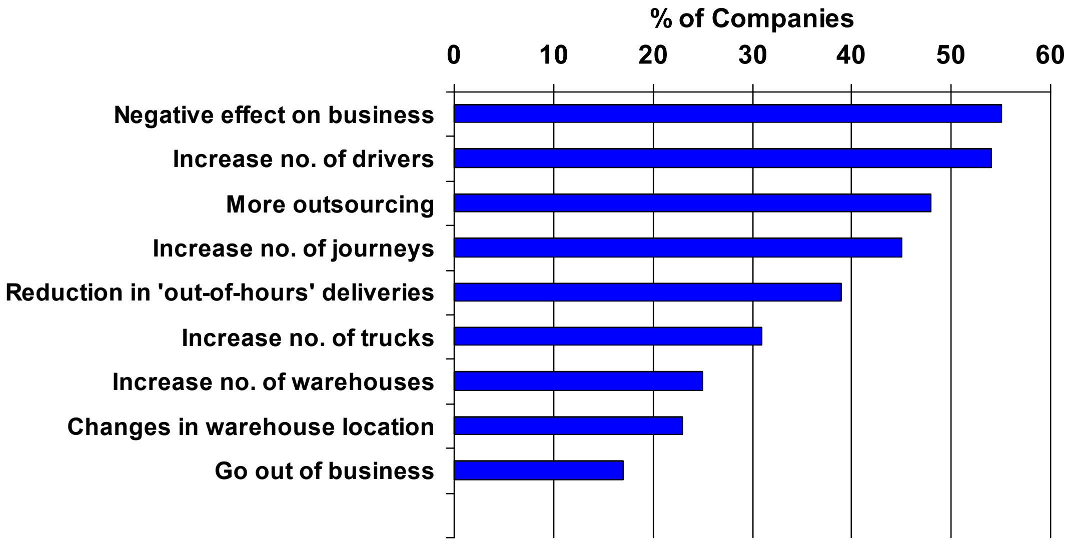


Source: 2002 Food KPI Survey (McKinnon and Ge, 2003)

11.3 Effect of the Working Time Directive on Distribution Operations

The Lex Transfleet / FTA 2002 survey of around 200 fleet managers enquired about the likely effects of the working time directive (WTD) on their companies and transport operations (Figure 5). Just over half of them anticipated that it would have a negative effect on the business, mainly by increasing the number of drivers required. As there is an acute driver shortage in some parts of the country, finding the additional drivers may prove difficult. Roughly 45% of the respondents predicted that the number of separate journeys would have to increase, presumably because the working time limits would restrict the length of some journeys, particularly during the night. Night time operations are likely to be most serious effected by the WTD. It may limit opportunities for night-time working and force a higher proportion of deliveries to made during the day when the road network is more congested.

Figure A4-4. Predicted Effects of the Working Time Directive



Source: Lex Transfleet / FTA (2002)

11.4 Effect of US Bioterrorism Act on the global distribution of perishable food

The long distance movement of food by air to and through the United States has been complicated by the imposition of the Bioterrorism Act (BTA) of 2002. This legislation, which is designed to improve the traceability of food across the international supply chain, requires all importers and carriers of food products to notify the US Food and Drink Administration at least 8 hours prior to their arrival at a US port or airport. If this advance warning is not provided, the food consignments are impounded. This regulation applies both to imports and food transhipped via the US ports and airports. This has created particular problems for companies distributing fresh produce by air via the United States. Given the reduction in production and distribution lead-time, to enhance product quality and cut inventory levels, airfreight companies often only get details of consignments shortly before they are despatched. Airfreight information systems, linking airlines, freight forwarders, transit shed operators and importers, are often unable to respond rapidly enough to meet the requirements of the new legislation. A significant amount of perishable food is not 'flown as booked', risking 'administrative detention' at a US airport. As temperature-controlled storage facilities are very limited at most US airports (with the exception of Miami, which has become a major food distribution hub), there is an increased risk of airfreighted food consignment being wasted. It has been estimated that worldwide around 40% of the air freighted food is already lost as waste (*Distribution Business*, October 2001). The European Commission has also expressed concern that the BTA is acting as a 'burden on trade' particularly for food and drink consignments transiting the United States.

11.5 Sourcing strategies

The UK food industry is likely to continue to increase the quantity of food sourced from overseas (Garnett, 2003). A report entitled The Future of Global Sourcing by the Institute for Grocery Distribution in 2002 predicted that "factors such as declining trade barriers, rising price transparency and advances in technology will combine to make global trade easier. As a result, retailers will seek out new suppliers in new markets to meet consumer demands, particularly those related to variety, availability and price"

(IGD, 2002c). All other things being equal, as the proportion of products being sourced from more remote locations increases, so too does the total transportation required to supply these products to consumers.

11.6 Increases in product range and availability

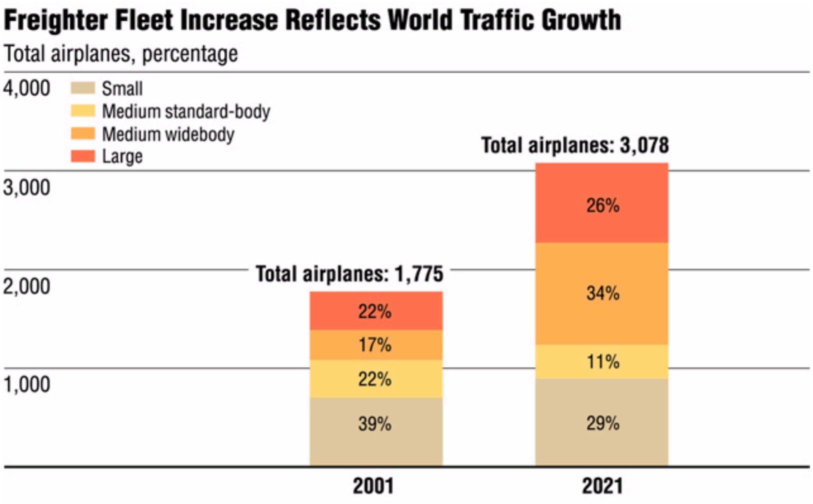
Hart (1999) studied changes in product assortments in several food and mixed retailing operations over a 5-10 year period. "Each retailer gave a total figure for current product lines compared with the total number of lines ten years previously. Examining the percentage change in product lines across both retail sectors there is seen to be a clear difference in trends between the food and mixed retail businesses in the sample….. Food retailers had all expanded their lines, from a minimum of 7 per cent to a maximum of 400 per cent. The relative number of lines also varied. Food A demonstrated 120 per cent growth, from 9,000 lines in 1984 to 20,000 lines in 1994; Food B, indicating a 10 per cent growth, had expanded from 22,500 lines to 25,000 lines. In the most extreme case, Food D had expanded by 400 per cent from 600 lines to 3,000 lines. Interestingly, an optimum limit of 25,000 lines appeared to have been reached by the food retailers generally, although not all stores carried the full range. These figures may be related to the growth in store sales area which peaked during the time of the study. Furthermore, the overall increase in lines during this period could be attributed to the more sophisticated space modelling and sales-based ordering systems which have enabled a higher concentration of lines per square foot, resulting in more effective space utilization."

Increases in the variety of products being sold in food stores are likely to continue in future (including exotic items grown overseas), as is the trend in providing seasonal products on a year-round basis. As Urban (1998) has noted, "It has long been acknowledged that displayed inventory has an effect on sales for many retail products". These increases in product range and availability may well result in increases in food transportation, depending on the extent to which consolidation of these product flows can be achieved.

11.7 Use of air freight

Forecasts for air cargo indicate that demand will increase over the next two years, and will result in a level of demand that will overcome the downturn that started at the end of 2000 (Boeing, 2003).

The greater cargo security requirements for passenger airlines that have come into force in the last couple of years are resulting in an increase in shippers' preference for dedicated freighter services. Belly-hold services for air cargo on commercial passenger planes currently provide just over half of air freight capacity. However, passenger fleet belly-hold capacity is forecast to grow more slowly than overall cargo traffic, creating a greater reliance on dedicated air freighters over time.



Historically the freighter fleet has doubled every 10 years to meet the growing demand for air cargo. Given the greater average payload of air freighters now being manufactured (average payload is projected to increase by 23% over the period 2001 to 2021) the freighter fleet is forecast to rise by 75% by 2021 (see figure below - Boeing, 2003).

The forecast growth in demand for air cargo services coupled with the shift from passenger to freighter aircraft is likely to result in significant increases in air cargo miles for food and other sectors. However, this will be partly offset by the increase in freighter payload.

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