GREEN LOGISTICS

# *Developing innovative and more sustainable approaches to reverse logistics for the collection, recycling and disposal of waste products from urban centres*

**Literature review and identification of opportunities**


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# 1. Introduction

An overall aim of this review is to gain an understanding of the transport logistics associated with delivering core goods to commercial businesses in urban areas (high streets, shopping centres, etc.) and with the collection of returned goods and of waste materials from retailers. Core goods are defined here as those goods which are of fundamental importance to the business activity. So, for example, for retail outlets it would be the goods sold to customers and for service industries it would be the goods that are essential for the day-to-day operation of the business. In doing this, a secondary aim is to try to determine how different supply chains might join together in their returns or waste collection operations either through shared use of vehicles, staff or of premises, e.g. warehouses.

# 2. Delivery as part of the supply chain process

Although this study is primarily concerned with current methods for the return of goods and waste collection, a general overview of delivery vehicle movements and uses is warranted to aid understanding of possible options. This review is limited to considering only incoming deliveries of goods or services and does not consider any outgoing vehicle movements such as those associated with home deliveries (e.g. pizza delivery).

## *2.1 Overview of delivery models*

Goods deliveries in urban areas constitute the final leg of supply chains that may be considerable in length. The OECD (2003) reported that companies have been steadily concentrating their production capacity in fewer locations and expanding the geographical scale of their sourcing and distribution operations, leading to a wider logistic reach of companies. They also observed that this globalisation has meant that urban goods transport has become more integrated with long haul transport. McKinnon (2002) reported that many companies seek to centralise their warehouses and distribution centres, some operating out of one central distribution centre only, as the savings from having fewer premises far outweigh the additional costs of transporting goods longer distances. An important aspect of centralising operations is that the amount of inventory required is greatly reduced. McKinnon observed that both Nike and Rank Xerox operated out of a single, pan-European distribution centre. In contrast, in April 2007, ASDA announced[1] that they had saved 7 million road miles through opening ten 'local hubs' across the UK in the last five years and were planning to open five more in 2007 (Nottingham, Leicestershire, West Midlands, Cornwall and Yorkshire). They stated that these local hubs allowed local producers to pool their resources to reduce costs, cut carbon emissions and lower the overall environmental impact of food distribution. Although this statement from ASDA did not make it clear how local producers were able to pool their resources it is clear that more hubs will lead to reduced overall vehicle mileage. (***Key question -*** Can local hubs be used for consolidating recyclate/returns? Note: key questions are summarised in Section 5.)

McKinnon (2002) reported that a large and increasing proportion of freight, mainly in the form of parcels or pallet-loads, is assembled at local 'satellite' depots, trunked to

[1] http://www.asda-press.co.uk/pressrelease/107

a centralised hub for sorting, and distributed via other satellite depots to their final destinations. The OECD (2003) reported that in Korea, the national policy is to construct about 40 freight distribution facilities in major cities by 2011 to formulate a nationwide hub-spoke network with the aims of making the movement of goods more systematic, alleviating traffic congestion by using lorries more efficiently in urban areas and promoting more efficient land use for logistics activities. (***Key question -*** Can nationwide hub-spoke networks be used for returns?)

According to Allen *et al*. (2000), "the movement of goods and services in urban areas is influenced by a number of factors, the most critical of which can be regarded as:

- the design of the distribution system
- the type of premises being served
- the range and variety of the products used/sold
- the time of deliveries to premises"

Anderson (2000) defined three categories of urban distribution system:

1. **Centralised** - where a retail store receives all of its goods from a single distribution centre.
2. **Decentralised** - where a retail store receives its goods from a number of different goods suppliers all using their own vehicles.
3. **Hybrid -** where a retail store receives a significant proportion of its goods from a single distribution centre but also receives deliveries from a number of different goods suppliers all using their own vehicles (Figure 1).

*(**Key question -*** Are waste contracts generally different in centralised systems compared to decentralised?)

Their study confirmed that the more centralised the distribution the fewer the number of deliveries made to the shop.

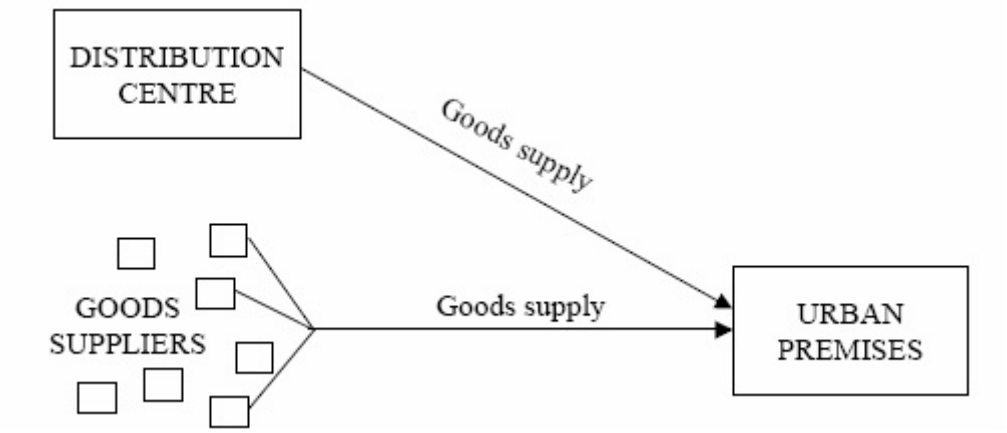



Figure 1 – Hybrid urban distribution system (Source: Allen *et al*. (2000))

In a study by the University of Westminster of businesses in Norwich and London, of the 58 urban premises surveyed, 12 used a centralised system, 16 used a decentralised system and 30 premises used a hybrid system of goods supply (Allen *et al*., 2000).

McKinnon (1999) portrayed a typical distribution channel layout for the food industry (Figure 2) while Potter *et al*., (2006) portrayed how responsibility for the movement of goods has evolved (Figure 3). Both these figures illustrate that movement of goods from the manufacturer to the regional distribution centre (RDC) is commonly referred to as 'primary' distribution while the onward movement of goods from the RDC to

retail outlets is known as 'secondary' distribution. Delivery of food directly from supplier to outlet is not typical for large-scale supermarkets, although there are some exceptions to this such as milk and bread deliveries and strawberries, plums and some vegetables are delivered directly to some ASDA stores by local farmers[2].

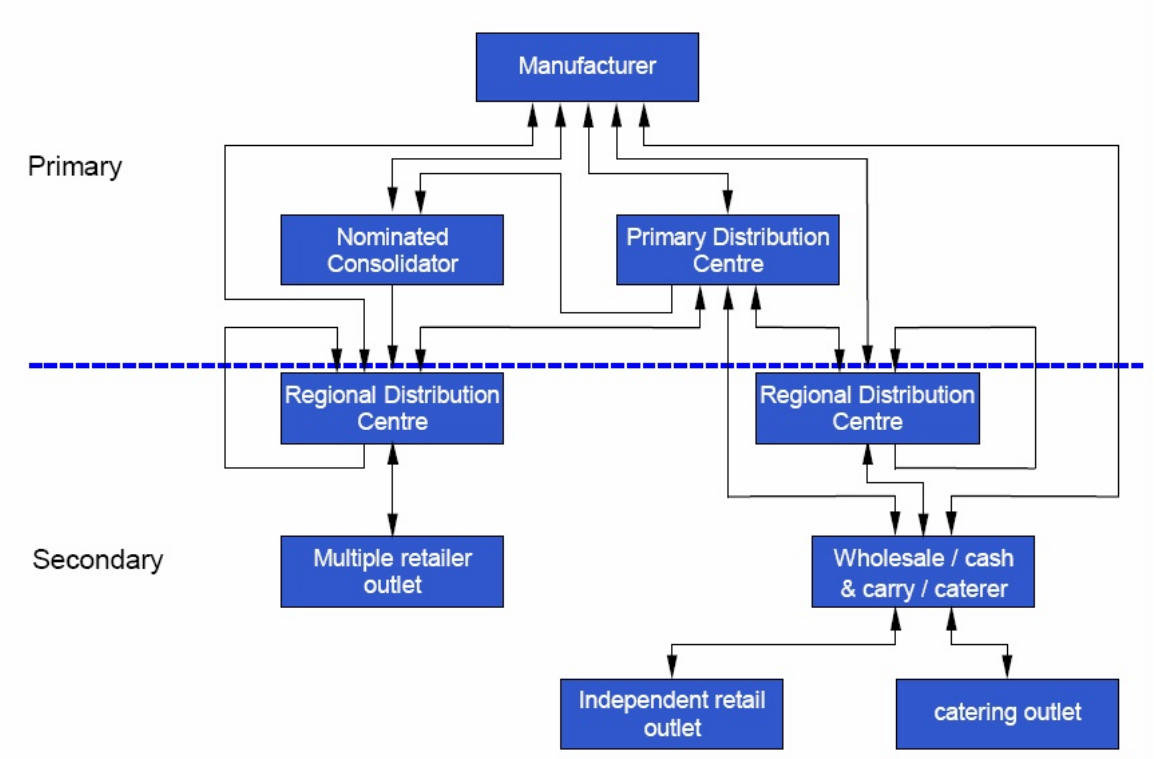



Figure 2 - Distribution channels in the food industry (Source: McKinnon, 1999)

[2] http://www.asda-press.co.uk/pressrelease/42

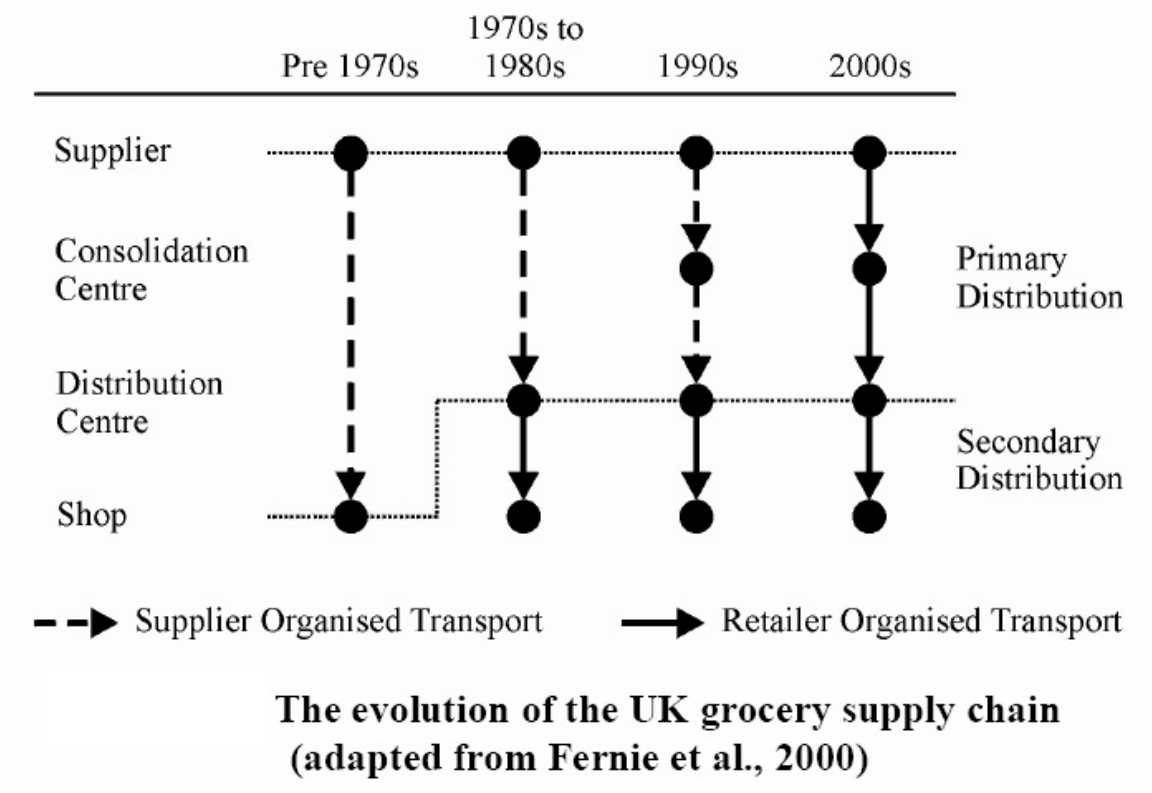



Figure 3 - Supplier/retailer transport over the decades (Source: Potter *et al*., 2006)

Rushton *et al*., (2001, page 50) identified the following main distribution channels between a manufacturer and a retail store:

1. **Direct -** goods are delivered directly from the manufacturer to the retailer either using the manufacturer's own vehicles or contracted out to a third party logistics (3PL) provider.
2. **Via manufacturer's depot -** manufacturer delivers goods to their own regional depots and then onto retailers, typically using their own vehicles, although can be outsourced to 3PLs. This was a most common method up to the 1970s but is less common nowadays ("still commonly used by brewing industry").
3. **Via retailer's depot -** manufacturer delivers goods to the retailer's depots. Retailer then organises delivery to shops either using own vehicles or outsourced. This is now a very common method due to the growth of the large multiple retail organisations.
4. **Via 3PL provider's depot -** Some 3PL providers not only provide distribution services but also warehousing services.
5. **Via wholesaler's depot -** the wholesaler acts as an intermediary. Typically the wholesaler buys in bulk at discounted prices and sells on to small retailers. Wholesaler normally delivers to retailers using own vehicles.
6. **Via cash and carry -** the cash and carry is a type of wholesale operation but the retailers have to collect goods themselves rather than have them delivered.

Waste materials are generated at all stages of the supply chain, as illustrated by Beamon (1999) (Figure 4), who used the phrase 'extended supply chain' to include consideration of waste and return goods; however, this was a rather high-level discussion and did not consider waste collection or return goods in any detail.

(***Key question -*** How do returns and waste pass back through supply chains?)

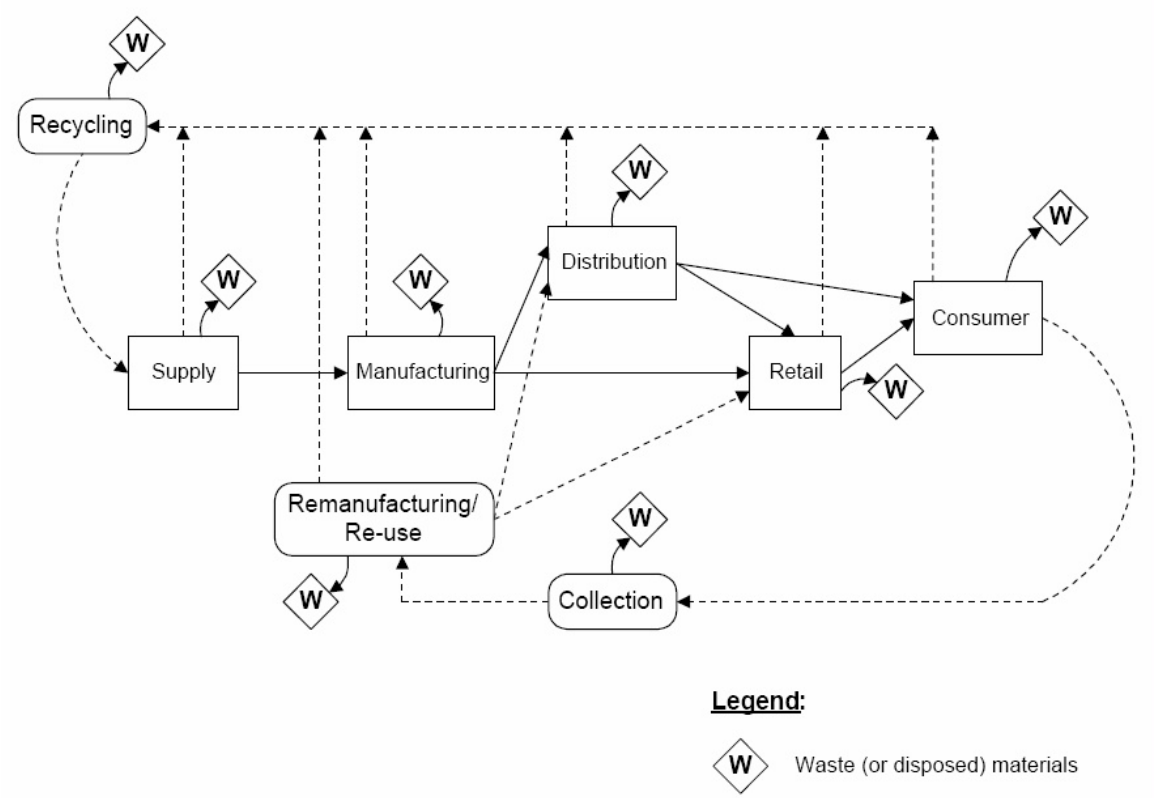



Figure 4 - Extended supply chain, considering waste and return goods (Source: Beamon, 1999)

Third party logistics providers can operate in a number of different ways (Rushton *et al*., 2001, page 60):

1. **Dedicated, exclusive service -** the vehicles, depots, warehouses, managers etc are exclusively available to the one manufacturer / goods supplier.
2. **Shared service -** a small group of similar types of manufacturers / goods suppliers are serviced together thereby saving on costs to each. An example could be various food suppliers delivering to grocery stores.
3. **Specialised service -** the nature of the goods demand a particular type of vehicle, e.g. frozen food or hanging garments.
4. **Multi-client distribution -** provided for any number of clients and for most types of product. Depots / warehouses can be available at the regional or national scale depending on the size of the 3PL.
5. **Transit only -** The 3PL performs the deliveries only and does not get involved in warehousing or keeping unordered stock to any great extent.
6. **Joint venture -** typically this is where a 3PL and a client company form a separate joint venture company to offer logistics services. This may occur where a client has its own distribution operations but they are under-used.
7. **Occasional use -** where a company runs its own distribution operations they may still need to contract out some work to a 3PL, e.g. during peak demand at Christmas.

McKinnon (2002) reported that the proportion of road freight tonnage carried by 3PLs had increased from 50% in 1981 to 67% in 2001.

McKinnon (1996) identified some major trends in retail logistics:

1. UK retailers now exert tight control over movement of goods from distribution centres to their shops.
2. Reductions in inventory and efficiency improvements have been gained through developments in 'composite distribution', whereby different goods are transported together, centralisation of slower-moving stock and the establishment of 'common stock rooms' for mixed retail businesses.
3. The requirement for shorter order lead-times has led to more frequent deliveries of smaller consignments in both the primary and secondary distribution sectors. This has lead to more 'less-than-container-loads' where delivery vehicles are not filled to capacity. The OECD (2003) added that "expectations are rising for same-day, 24-hour and two to four-day delivery, while delivery lead times of a week or more are declining."
4. Vehicle utilisation has been improved through integration of primary and secondary distribution (e.g. back-loading - see section 2.1.1)
5. Having improved the internal efficiency of their logistical operations, many retailers are closely collaborating with suppliers to maximise the efficiency of the retail supply chain as a whole. Supply Chain Management (SCM) and Efficient Consumer Response (ECR) provide a management framework within which retailers and suppliers can more effectively co-ordinate their activities. As the underpinning technologies for ECR are already well established in the UK, conditions are ripe for the application of this principle. The obstacles are likely to be managerial rather than technical.
6. Reverse logistics, as discussed elsewhere in this report.
7. Many deliveries are now made directly to peoples' homes through increased internet shopping.

### 2.1.1 Back-loading

Back-loading refers to the use of vehicles to carry loads on the return legs of delivery journeys, with the aims of increasing vehicle utilisation and improving transport efficiency. This is clearly of relevance to this study, which is considering how delivery vehicles might be used to collect waste and/or return goods. A guide to back-loading has been provided by the Freight Best Practice programme (DfT, 2007a), from which much of the text here is drawn.

Vehicle utilisation rates have been improving in the UK (see section 2.7.2). This has been due to a number of factors, including back-loading, outsourcing of road haulage operations, greater balance of inter-regional flows, increase in average length of haul, change in trip structure (more multiple collections and drops), growth in reverse logistics and new management initiatives (supplier collection, factory gate pricing and network systems) (DfT, 2007a).
McKinnon (2002) stated that "a substantial volume" of empty running would be virtually impossible to eliminate due to factors such as geographical imbalances in freight distribution, scheduling constraints and aversion to the risk of delay associated with picking up return goods, and vehicle incompatibility, where goods available for back-loading do not match the vehicle. (***Key question -*** How common a problem is vehicle incompatibility with the goods/waste to be moved?)

McKinnon and Ge (2006) assessed the potential for further reduction in empty running in the food supply chain, mainly focusing on longer distance trunking between factories, distribution centres and supermarkets. They found that suitable backloads were available for only 2.4% of the empty journey legs, representing 2% of

empty truck-kms. Their analysis highlighted the operational constraints on back-loading "in a sector characterised by short average trip length, tight scheduling and variable use of refrigeration."

Back-loading can either be 'internal', carrying one's own goods (e.g. surplus stock, re-usable packaging, returns) or picking up products from your own suppliers, or 'external', carrying goods for a third party, providing a haulage service and generating income. The DfT (2007a) reported an internal back-loading example where a major supermarket (Tesco) used returning shop delivery vehicles to collect goods from a supplier and take them to their distribution centre, resulting in an increase of vehicle fill of 26.5% over a five-year period, a reduction in average annual distance travelled of 19.9% and a fuel saving of £750,000 per year. Boots[3] also report using vehicles to pick up goods from their suppliers on the return journey and they claim to save 2.2 million kilometres of travel on UK roads (around 1,750 tonnes of carbon dioxide) each year as a result. John Lewis[4] also reported that they undertake back-loading, saving around 1.1 million kilometres (4%) of travel on UK roads, while for their sister company Waitrose, the savings were 2.3 million kilometres (8.5%).

The DfT (2007a) also report that Tesco have undertaken *onward supply,* where they have used suppliers to deliver goods to their distribution centres; however, waste and return goods are not mentioned here. They also reported an external back-loading example where Thorntons, the manufacturer and retailer of chocolates and confectionery, used four of their articulated lorries to carry out night-time trunking, five nights a week from Scunthorpe to Avonmouth on behalf of a third party. Although overall fleet mileage was increased as a result, this activity provided a useful revenue stream, off-setting some 17% of its own account distribution costs.

One form of distribution activity which is particularly effective in back-loading is the pallet network system (DfT, 2007a). The main feature of a pallet network is a hub through which all pallets are moved and trans-shipped. A pallet network allows members to collect another member's loads from the hub and deliver them in their designated area and to collect loads from their region and relocate them to the hub for onward delivery to the geographical areas of the other members. An in-depth survey of 17 pallet network fleets was carried out on behalf of the Freight Best Practice programme over a 48-hour period in 2004, which found that the pallet sector is achieving 72.8% vehicle fill, which compares well with the average figures in the food (53%) and non-food (54%) retail sectors (DfT, 2007a).

Heriot-Watt University (2007) reported that there are now various internet-based transport exchanges which allow suppliers and hauliers to be matched nationwide. They also reported that although some studies had suggested very limited potential of online freight marketplaces to improve freight management operations the actual experience of many freight trading platforms would seem to contradict this view. Further information on these trading platforms is given in section 3.7.4.

### 2.1.2 Factory gate pricing

[3] http://www.boots-csr.com/main.asp?pid=639

[4] http://www.johnlewispartnership.co.uk/Display.aspx?&MasterId=efd344d3-9a6e-47d7-9b15-d9d311b4b193&NavigationId=664

Factory gate pricing (FGP) refers to retailers collecting goods from the manufacturers' 'factory gates' rather than have the manufacturers deliver to their distribution centres. FGP can be considered to be a particular form of back-loading. This is a relatively recent trend, mainly being undertaken by large grocery chains. The main perceived benefits to retailers are increased control over the supply chain, allowing improved co-ordination and increased utilisation of vehicles.

Potter *et al*. (2006) investigated FGP operations and improving distribution options (Figure 5) for a large grocery chain. One of these options was to consolidate less-than-truckload deliveries from smaller suppliers at consolidation centres. Distribution costs were estimated to reduce by over 5%, with increased vehicle fill and reduced empty running within both the primary and secondary distribution fleets. Improvements in service levels and reduced inventory holding costs were also modelled. Le Blanc *et al*. (2004) modelled a 22% decrease in supply chain costs through FGP in the Netherlands.

There seems to be little information available about actual impact of FGP on the ground. McKinnon (2002) reported that within three months of adopting FGP "there was a significant decline in the number of Scottish hauliers delivering to Sainsbury's distribution centre at East Kilbride. Many of these hauliers were picking up loads from Sainsbury's English suppliers on return journeys. Now that responsibility for the transport operation has transferred to Sainsbury, much more of the primary delivery work appears to be undertaken by English based hauliers."

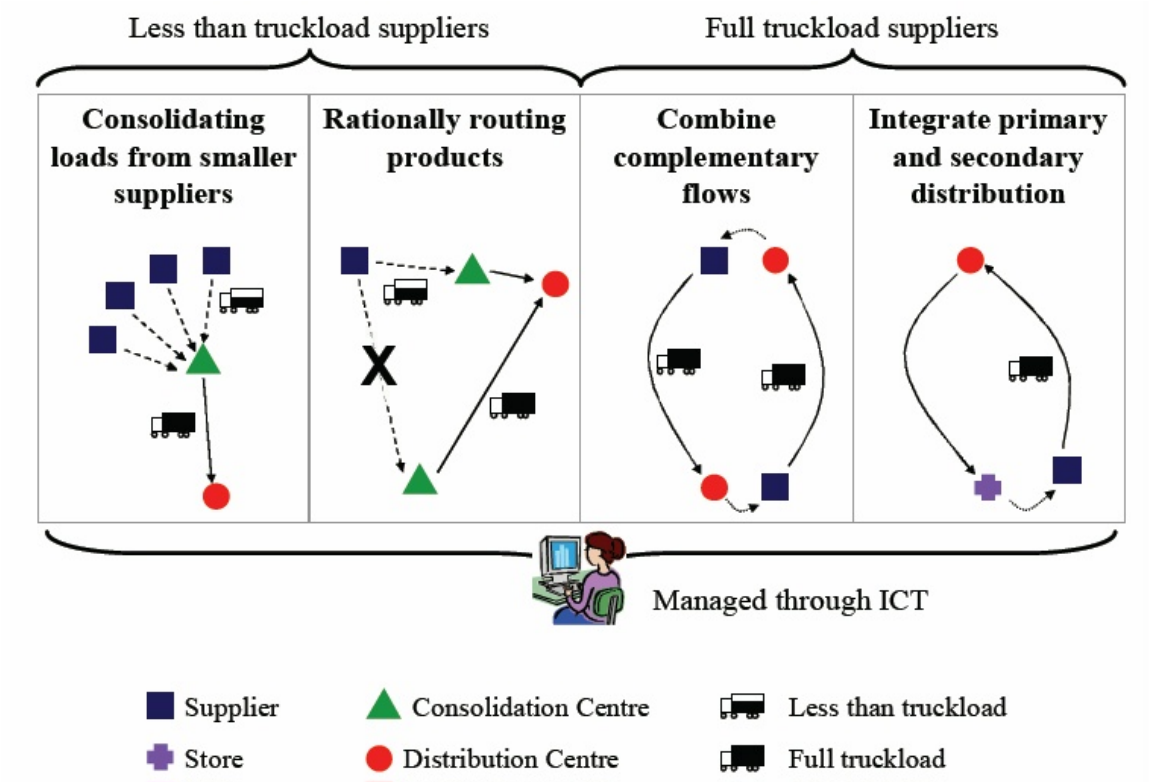



Figure 5 - FGP distribution channels (Source: Potter *et al*., 2006)

### 2.1.3 Push and pull logistics

Reducing costs and improving service levels are normally conflicting business interests. Reducing inventory to reduce costs makes it more difficult to satisfy varying customer demand. Increasing inventory to meet peak demand could result in unsold stock. These competing interests characterize push and pull logistics (Simchi-Levi and Simchi-Levi, 2004).

In a push supply chain, production and distribution decisions are based on long-term forecasts. Typically, the manufacturer uses orders received from the retailers' warehouses to forecast demand. The problem with this strategy is that it depends on forecasts from outside the manufacturer's control. For retailers who have negotiated favorable terms, there is little risk: if the inventory doesn't move after a certain period of time, the manufacturer takes it back. This is not good for manufacturers, however.

In a pull supply chain, actual customer demand, rather than forecasts, drives production and distribution. In other words, the manufacturer holds no inventory, but instead produces to order. On the surface, such a system is attractive because it allows the firm to eliminate inventory and increase service levels; however, it breaks down when lead times are too long to react to demand in a way that satisfies the customer. A pure pull strategy also makes it more difficult to take advantage of economies of scale, because production and distribution are based on demand, and therefore only scheduled as needed.
These inherent strengths and weaknesses have led companies to look at a hybrid strategy. In a push-pull system, the initial stages of the supply chain generally follow a push strategy, while the remaining stages move to a pull strategy.

In general terms if long-term forecasts have little uncertainty and variability, a push strategy should be followed. Stages where individual demand varies greatly should follow a pull strategy. A well-designed push-pull strategy helps organizations provide the most value with the least amount of committed inventory. By optimally positioning inventory across the supply chain, the firm is able to shift the trade-off between committed service to customers and the cost of inventory required to support that commitment.

The OECD (2003) stated that “the transport sector has now changed from a push market-oriented approach to a pull market-oriented approach which fully integrates customers into the supply chain. “

### 2.1.4 Supply chain management

Supply chain management (SCM) refers to the concept of different companies working together and sharing information, integrating logistics across companies and across supply chains (Fernie and McKinnon, 2003). They reported that the primary aim of SCM is to minimize inventory; however, the closer supply-chain co-operation may also improve transport efficiency. They also reported that collaboration between companies at different levels of the retail supply chain has traditionally been inhibited by three factors (Energy Efficiency Best Practice Programme 1998):

1. The adversarial nature of the trading relationships and mutual fear that one party will behave opportunistically and capture an unfair share of the benefits.
2. The absence of an organizational framework within which companies can openly exchange views, develop joint initiatives and benchmark their operations.

3. Uncertainty about each company's current level of transport efficiency and the overall efficiency of freight movement across the supply chain.

Other barriers to collaborative distribution are summarised in the ECR UK "Blue Book" on Collaborative Green Distribution (IGD, 2007):

1. *Technical issues.* The planning of any shared delivery mechanism into stores is difficult due to the variability in merchandising units, roll cages and dolly sizes used between stores. This is further complicated when different temperature regimes are required to store and transport products.
2. *Commercial.* There is no standardised model outlining how the transportation of another company's products should be managed.
3. *Store flexibility.* There is a peak in both in-store deliveries and warehouse deliveries in the morning.
4. *Delivery processes.* Delivery processes vary between retailers, e.g. levels of delivery checking, store-based support, documentation and returns.
5. *Focus and resources.* There are limited resources to investigate the potential for collaborative transport opportunities.

Two examples of collaborations between different companies are described: one between Coca Cola Enterprises (CCE) and Alliance Boots plc and one between CCE and Eddie Stobart Ltd (IGD, 2007).

Alliance Boots plc and CCE have collaborated by examining the flow of key products from manufacturing through each of their distribution networks through to stores. Boots has a national hub in Nottingham which supplies a number of regional depots. The depots generally hold minimal quantities of stock but are used to supply Boots stores, usually by next-day deliveries. One of Boots key products are 500ml PET drinks bottles supplied by CCE. As the demand for PET bottles has increased, CCE has invested in regional factories so that the stock can be held regionally for onward distribution to customers, thus reducing distribution costs. The Efficient Consumer Response, UK, 2006 initiative, identified that there was an opportunity to ship products direct from CCE production warehouses to Boots regional depots without consolidating the stock at the national hub in Nottingham. Such collaboration would reduce distribution costs for Boots and CCE and also reduce the number of transport and handling movements. The operating procedures used by both companies were reviewed and physical issues that could impede any collaboration were identified. Order patterns were analysed to identify whether there were significant volumes of orders to make direct deliveries cost-effective and if it would be beneficial to deliver less-than-full loads directly. The project required Boots operating procedures to be amended to enable depots to administer supplier deliveries. One key operational difference identified was in the type of vehicles used by the two companies: CCE used curtain-sided trailers as they were the most efficient method to transport palletized products; whereas rear-loading rigid-sided vehicles were used by Boots. A rear-unloading curtain-sided vehicle was tested and identified as a potential replacement for both businesses. The potential of simple backhaul arrangements between the two distribution operations was explored but this avenue failed due to vehicle differences. The CCE and Boots case study demonstrates that there are potential operational barriers that would need to be overcome before product flow could effectively be altered. However there is a lack of data quantifying the benefits. IGD (2007) highlight that businesses should not just focus their efforts on filling empty vehicles but should analyse and question the flow of products through the distribution system.

The collaboration between Eddie Stobart Ltd (ESL) and CCE illustrates how such collaborative partnerships can improve operational efficiency and vehicle utilisation. ESL uses a fleet of wagon-and-drag vehicles to transport raw materials from their UK depots (*Carlisle, Wrexham, and Braunstone*) to CCE depots (*East Kilbride, Wakefield, Malvern, Northampton and Sidcup*). These vehicles were frequently returning back to the point of origin empty. In order to improve operational efficiency, CCE assessed vehicle movements and identified that there was an opportunity to utilise ESL's wagon-and-drag fleet to deliver finished goods from Sidcup to Northampton and Wakefield to East Kilbride (Figure 6). Minor changes had to be made at the Sidcup and Northampton depots to enable the wagon-and-drag vehicles to load finished goods (e.g. reshaping of a concrete base to provide adequate turning space, creation of more loading bays). As a result, ESL ship four loads, Monday to Friday, from Sidcup to Northampton and three loads, Monday to Thursday, from Wakefield to East Kilbride and a further two on Fridays. Since the development of the project in March 2004, approximately 0.5 million miles of "empty mileage" have been used by replenishing empty vehicles with finished goods to be delivered around the CEE network.


Figure 6 - Eddie Stobart and Coca Cola delivery and collection points (Source: IGD, 2007)

Boots[5] also reported that they were taking part in collaborative trunking, or 'speed dating for trucks', with a number of other companies, including Tesco, Nestle and Unilever, as part of the Efficient Consumer Response, UK, 2006 initiative; however, keeping the speed dating analogy going, they stated that they had "only been on a few first dates and had not developed any meaningful relationships as yet."

[5] http://www.sml.hw.ac.uk/greenlogistics/barnes.pdf

## *2.2 Urban consolidation centres*

An urban consolidation centre (UCC) is a logistics facility situated relatively close to the geographic area that it serves (e.g. city centre, an entire town or a shopping centre), from which consolidated deliveries are carried out within that area. A range of other value-added logistics and retail services can also be provided at the UCC. The idea is to avoid large numbers of part-loaded large delivery vehicles entering the most congested parts of the road network, as frequently occurs in practice due to the trend towards inventory reduction and just-in-time logistics (Browne *et al*., 2007). These part loads are trans-shipped into smaller vehicles (e.g. vans). These vans may also be used for collection of return goods and/or waste.

Limiting factors to the widespread use of UCCs include the inherent delay introduced by an additional step in the delivery chain and the reduction in the retailer's control of the supply chain. Local authorities may have to adopt various carrot-and-stick measures to encourage or enforce use of the UCC. These measures may include compulsory orders or severe time-of-day and/or vehicle size restrictions within the urban area (Browne *et al*., 2007).

Browne *et al*. (2005) stated that "the traditional concept of a transhipment centre, with loads transferred into smaller vehicles, has generally not succeeded. Recent developments, with the main focus on improving vehicle utilisation and integrating the operation into the supply chain, seem to offer more potential".

The objectives of a UCC can include:
- reducing road freight traffic levels and environmental impacts
- altering vehicle types used (e.g. fewer light or heavy goods vehicles)
- improving efficiency of urban freight transport operations
- reducing the need for goods storage and logistics activities at urban premises

Browne *et al*. (2005) set out the following perceived pros and cons of UCCs, some backed up by evidence, others not:

***Advantages***:
- environmental and social benefits resulting from more efficient and less intrusive transport operations within urban areas
- better planning and implementation of logistics operation, with the opportunity to introduce new information systems at the same time as the consolidation centre
- better inventory control, product availability and customer service
- can facilitate a switch from push to pull logistics (described in section 2.1.3) through better control and visibility of the supply chain
- potential to link in with wider policy and regulatory initiatives
- theoretical cost benefits from contracting out "last mile"
- public relations benefits for participants
- potential to allow better use of resources at delivery locations
- specific transport advantages
- opportunity for carrying out value-added activities (one of which could be to act as a consolidation centre for returns/recyclate).

***Disadvantages***:
- potentially high set up costs (and sometimes high operating costs)
- much urban freight is already consolidated at the intra-company level or by parcels carriers, so limited benefits (or even negative consequences) for trying to

channel these flows through a consolidation centre. The potential scope for UCCs may therefore be limited

- difficult for a single centre to be able to handle the wide range of goods moving in and out of an urban area, for example due to different handling and storage requirements
- most studies report an increase in delivery costs due to an additional stage in supply chain which imposes a cost (and often a time) penalty, though this clearly depends on how well the centre is integrated into the supply chain and the extent to which all costs and benefits are considered
- a single consolidation centre for an urban area is unlikely to be attractive for many suppliers' flows due to the degree of diversion required from their normal routes, which might negate transport savings for onward distribution (a similar argument would apply to the return movement of goods)
- lack of enforcement of regulations for vehicles not included in the consolidation scheme
- organisational and contractual problems often limit effectiveness
- potential to create monopolistic situations, thus eliminating competition and perhaps leading to legal issues
- loss of the direct interface between suppliers and customers.

Browne *et al*'s (2005) study considered 28 operational UCCs, 13 pilot schemes and 26 at the research/feasibility stage for which a reasonable amount of information was available. Of the 28 operational UCCs, three were in the UK: Bluewater, Kent; Heathrow Airport and Meadowhall, Yorkshire; there was also one UK pilot trial site at Bristol (Broadmead). They mentioned that the Bluewater and Broadmead schemes both included removal of waste but did not provide any further information. Bristol City Council's website[6] reports that over 8 tonnes of cardboard and plastic have been recycled through collections from retailers since the Broadmead UCC started in May 2004; from private correspondence, the latest figure is reported as being 10 tonnes. This website also reports that the Broadmead UCC has reduced delivery vehicle movements by 72% for the 56 retailers who participated in their survey.

Although there appear to be examples of successfully operating UCCs there are many examples of failed schemes, the reason for failure often being due to funding issues. Given the relatively small number of examples UCCs cannot be considered to be typical of urban deliveries, however they may be of interest when considering options for making improvements.

The OECD (2003) reported of attempts to start up UCCs in the Netherlands (Maastricht, Leiden, Groningen, Amsterdam, Utrecht and Arnhem) between 1993 and 2000, and stated that "these experiences proved that UCCs for cities with fewer than 200,000 inhabitants and run by a public-private partnership on a less than fully commercial basis are commercially unsuccessful and not very effective in solving problems. The UCCs often faced problems due to their locations and did not receive support from the commercial transport companies." They considered that UCCs would only survive where they were related to commercially and privately-owned distribution centres of nationwide transporters.

## *2.3 Freight quality partnership waste/returns policies*

[6] http://www.bristol.gov.uk/ccm/content/Transport-Streets/freight.en

The UK government supports the development of 'freight quality partnerships' (FQPs) between the various actors involved in freight, including city, district and county councils, retailers, hauliers and police. A number of these partnerships have been established. Typically they have identified the main problems encountered by the freight industry and sought ways to improve them. A good practice guide has been written (DfT, 2003), reporting findings from five FQPs: Newton Abbot, Reading, Winchester and Hampshire, Derby and Derbyshire, the North West. Some of the items on the 'wish lists' of the freight industry, though not necessarily of all members of the FQPs are to:

- Improve the enforcement of parking restrictions on motorists to facilitate deliveries
- Relax enforcement of parking restrictions for delivery vehicles
- Improve signing and start work on a city centre freight access strategy
- Publicise the city's strategic lorry route and produce a map for delivery vehicle drivers indicating the most suitable routes
- Investigate the potential for out of hours deliveries, while recognising the concerns of some local businesses
- Consider reallocating road space, such as through 'no-car lanes' to benefit all essential road users
- Review loading and traffic restrictions
- Provide additional loading bays
- Provide additional overnight parking facilities.

The local authority viewpoint is typically to accommodate and support freight as much as possible, through measures such as those outlined above, but with regard to other, potentially conflicting objectives such as maintaining air quality, noise reduction and road safety.

Waste collection or the collection of return goods do not appear to be mentioned in the Department for Transport's good practice guide or on the FQP websites that have been looked at here [7], although some FQPs have considered options for consolidation centres, which may include waste collection and/or collection of return goods, and some mention that they are interested in promoting innovative ways to distribute goods. The issues of waste collection and collection of return goods do not seem to be a high priority for FQPs, which is surprising, perhaps, given the current high levels of interest in 'sustainability' and since landfill tax and producer responsibility are key directives to be followed.

Similarly, county-based waste partnerships such as Hampshire's Project Integra (http://www.integra.org.uk/) and Somerset Waste Partnership (http://www.recyclesomerset.info/pages/aboutus.asp) do not pay much attention to commercial waste transport, instead focussing on household waste collection and on recycling targets. This apparent lack of attention to waste/returns transport issues from FQPs and from waste partnerships emphasises the need for the research being undertaken in this study.

[7] South London FQP (http://www.southlondonfqp.com)
West London FQP (http://www.westlondonfqp.com)
Gloucestershire FQP (http://www.gloucestershire.gov.uk/index.cfm?articleid=6005)
West Midlands FQP (http://www.westmidlandsltp.gov.uk/default.php?id=1674)
Leicester and Leicestershire FQP (http://www.leicester.gov.uk/index.asp?pgid=7253)

## *2.4 Supplier / logistics provider characteristics*

This section aims to describe features of the companies that are involved in delivering goods and services to retailers and other urban businesses.

McKinnon (2002) reported that the proportion of road freight tonnage carried by 3PLs had increased from 50% in 1981 to 67% in 2001. A survey in Colchester (Steer Davies Gleave, 2005) determined the number of different companies that were either delivering goods to or collecting goods from the 244 surveyed businesses (Figure 7).

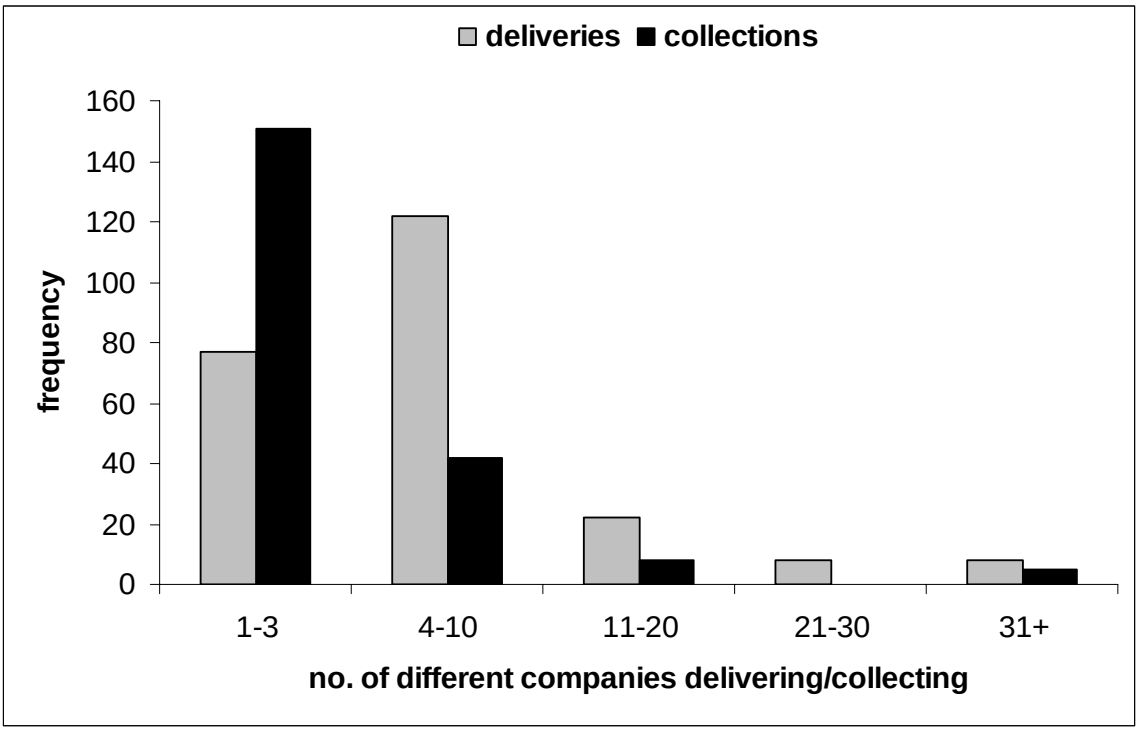



Figure 7 - Frequency plot of businesses receiving deliveries or collections in Colchester

Responses from 74 businesses in Winchester (Cherrett and Smyth, 2003) showed that:

- The average business in Winchester (across all business types) received core goods from 9 different suppliers. Results from the 2001/2002 'Effects of Freight Vehicle Movements in Winchester' survey suggested that the average business received 14 core deliveries per week. Comparing these results one can infer that some suppliers will make more than one delivery to a customer per week.
- Across all the respondents, 46% of supplier deliveries were organised by the supplier.
- Business managers stated that 44% of their core goods deliveries were made by courier. Thirty percent of the business mangers stated that they used their own company vehicles to collect goods from suppliers.
- The average business in Winchester would expect to receive 3 deliveries per week from their main supplier.

## *2.5 Goods delivery survey statistics*

### 2.5.1 General information about the surveys

A number of goods delivery surveys have been undertaken in recent years. These are introduced in this section with the findings summarised in subsequent sub-sections.

| Name used here | **Bexleyheath** |
|---|---|
| Location | The Broadway in Bexleyheath, East London |
| Date | October / November 2003 |
| Survey type | Business questionnaire |
| No. of businesses | 21 (from 251 asked = 8% response rate) |
| Types of businesses | Various retail stores, one bank, one restaurant, two pubs |
| Reference | Intermodality, 2004 (not published) |

| Name used here | **Birmingham/Basingstoke/Norwich** |
|---|---|
| Location | Distribution companies delivering to one or more of the above cities from various depot locations |
| Date | Sep/Nov 2001 |
| Survey type | Interviews/meetings with 7 companies involved in storage and/or distribution |
| Types of businesses | Drinks (beer, wine, soft) x 2; Dedicated storage/distribution for non-food retailer x 2; General storage/distribution, including drinks x 2; Parcels carrier |
| Reference | Allen *et al*., 2003 |

| Name used here | **Colchester** |
|---|---|
| Location | Colchester town centre |
| Date | Jan/Feb 2005 |
| Survey type | Business questionnaire |
| No. of businesses | 244 (from 800 asked = 30.5% response rate) |
| Types of businesses | Not specified but high response rate suggests that most business types would be covered. |
| Reference | Steer Davies Gleave, 2005 |

| Name used here | **Croydon and Sutton** |
|---|---|
| Location | Main shopping areas of Croydon and Sutton, South London |
| Date | Not mentioned in presentation but presumably recent |
| Survey type | Interviews with retail businesses |
| No. of businesses | 183 (121 in Croydon + 62 in Sutton) |
| Types of businesses | Broad range of retail with clothing retail being the most common at 25% of the total. |
| Reference | Lewis, 2007 |

| Name used here | **Ealing** |
|---|---|
| Location | Ealing town centre, West London.<br>Ten separate sites chosen to provide freight delivery movements for a wide range of land-use classes. |
| Date | 6 days in April 2004, 0700-1900 hours |
| Survey type | On-street observations of vehicles |
| No. of businesses | Not applicable, as vehicles not businesses were surveyed. |
| Types of businesses | Survey sites encompassed retail, entertainment, food and |

| | |
|---|---|
| | leisure premise land-use classes. |
| Reference | MVA, 2004 |

| | |
|---|---|
| Name used here | **Norwich and London** |
| Location | Various parts of both cities. |
| Date | April 1998 to June 1999 |
| Survey type | Interviews, meetings and discussion groups with:<br>- owners/managers of a range of different types of premises<br>-managers of suppliers and wholesalers supplying goods to premises in the areas<br>-goods vehicle drivers and service engineers working in the areas<br>- managers of freight transport companies supplying goods in the areas<br>- managers of service companies visiting premises in the area<br>- policy makers with responsibility for transport policy in the area |
| No. of businesses | 58 |
| Types of businesses | Wide range (see Table 2) |
| Reference | Allen *et al*., 2000 |

| | |
|---|---|
| Name used here | **Park Royal** |
| Location | Park Royal, West London, a major industrial area of over 1600 businesses. |
| Date | April to July 2002 |
| Survey type | Business questionnaire (also a count of LGVs and HGVs on various roads but this data not useful here) |
| No. of businesses | 64 (from 400 asked = 16% response rate) |
| Types of businesses | Not specified but included BBC TV, McVities, Royal Mail, Jewson, Exel and DHL |
| Reference | MVA, 2002 |

| | |
|---|---|
| Name used here | **Torbay** |
| Location | Torquay, Paignton and Brixham |
| Date | November / December 2003 |
| Survey type | Business questionnaire |
| No. of businesses | 34 (from 163 asked = 21% response rate) |
| Types of businesses | Wide variety, including small retail businesses, manufacturers, hotels and the regional hospital. |
| Reference | Devon County Council private communication |

| | |
|---|---|
| Name used here | **Winchester** |
| Location | Winchester city centre, Winnall and Bar End (both more industrial parts of Winchester). |
| Date | Original survey Aug/Sep 2001 with follow-up surveys later. |
| Survey type | Business questionnaire |
| No. of businesses | 133 (from 403 asked = 33% response rate) |
| Types of businesses | Various retail outlets, service industries, restaurants, pubs and hotels. |
| References | Cherrett *et al*., 2002; Cherrett and Smyth, 2003 |
| Name used here | **West Sussex** |

| | |
|---|---|
| Location | Chichester, Horsham, Worthing and Crawley |
| Date | May/June 2005 |
| Survey type | Business questionnaire |
| No. of businesses | 51 |
| Types of businesses | Various retail outlets, service industries, restaurants, pubs and hotels. |
| Reference | Cherrett and Hickford, 2005 |

## 2.5.2 Number/frequency of deliveries

The average number of core goods deliveries per business, across the various surveys, is shown in Table 1. From this it can be seen that the highest delivery rates were seen in Park Royal, a largely industrial area, and the lowest in West Sussex, where the survey area included some relatively small towns.

Table 1 - Average number of core goods deliveries

| **Survey** | **Average number of core goods deliveries per business** | | **Comments** |
|---|---|---|---|
| | **on a weekday** | **in a week** | |
| Bexleyheath | 4.4 | 23 | |
| Colchester | 8 | 42 | |
| Croydon / Sutton | not available | | The majority of the stores were reported to have less than 5 deliveries per week with 85% of them having less than 10 deliveries per week. |
| Norwich/London | 6.5 | 34 | The median number of weekly deliveries was 14. |
| Park Royal | 13 | 68 | Almost half of all businesses surveyed received 2 to 5 deliveries per day but many received more and 8% of businesses received 50+ deliveries per day. |
| Winchester city centre | 3 | 16 | |
| Winchester (Bar End and Winnall) | 6 | 32 | |
| West Sussex | 1 | 7 | |

The average number of deliveries per business may be substantially inflated by a small number of premises receiving a large numbers of deliveries. This was the case in the Norwich/London study, for example, where a factory-scale bakery received around 400 deliveries per week, and four other businesses (a department store, a convenience grocer, a retail warehouse and a builder's merchant) received 100-200 deliveries per week. In the Norwich/London study the average number of weekly deliveries was 34 while the median was only 14. The median is probably a better indicator of what is 'typical', although it is perhaps foolhardy to generalise about numbers of deliveries as they are highly variable depending on the business. This was seen in the Norwich/London study which showed how the number of deliveries varied from business to business and how they varied by type of distribution channel (centralised, decentralised or hybrid - see section 2.1) (Table 2). The Winchester survey also provided a breakdown by type of business (Table 3).

Table 2 - Deliveries v distribution channel (Norwich/London)

| Type | Ownership | Dispatch points | Deliveries/week |
|---|---|---|---|
| **Centralised** | | | |
| Dry cleaning | Multiple | 1 | 1 |
| Furniture | Multiple | 1 | 1 |
| Gift shop | Multiple | 1 | 1 |
| Clothes | Multiple | 1 | 2 |
| Clothes | Multiple | 1 | 2 |
| Travel agent | Multiple | 1 | 2 |
| Fast food | Multiple | 1 | 3 |
| Pizza restaurant | Multiple | 1 | 3 |
| Florist | Independent | 1 | 6 |
| Shoes | Multiple | 1 | 6 |
| Department store | Multiple | 1 | 12 |
| Variety store | Multiple | 1 | 15 |
| **Decentralised** | | | |
| Gift shop | Independent | 50 | 3 |
| Clothes | Independent | 8 | 4 |
| Shoes | Independent | 15 | 5 |
| Printing/photocopying | Franchise | 4 | 6 |
| Furniture/carpet | Independent | 20 | 10 |
| Florist | Independent | 6 | 10 |
| Hardware | Independent | 50 | 18 |
| Books | Independent | 50 | 25 |
| Public house | Independent | 12 | 26 |
| Builders merchant | Independent | 30 | 35 |
| **Hybrid** | | | |
| Off-licence | Multiple | 6 | 3 |
| Stationery | Multiple | 5 | 9 |
| Public house | Multiple | 7 | 13 |
| Pizza restaurant | Multiple | 9 | 17 |
| Chemist | Multiple | 3 | 24 |
| Newsagent | Independent | 11 | 25 |
| Convenience grocer | Independent | 6 | 26 |
| Books | Multiple | 50 | 40 |
| Furniture/carpet | Multiple | 50 | 46 |
| Chemist | Independent | 40 | 50 |
| Supermarket | Multiple | 7 | 60 |
| Convenience grocer | Multiple | 30 | 159 |

Table 3 - Core goods deliveries by business type and vehicle type (Winchester)

| Business Type | Mean number of core deliveries in a week |
|---|---|
| Food retail | 16.4 |
| Clothing retail | 4.8 |

| | |
|---|---|
| Other retail | 8.6 |
| Restaurant | 3.0 |
| Public House | 5.0 |
| Hotel | 24.5 |
| Banks | 5.3 |
| Other Services | 9.7 |
| Warehousing | 36.8 |
| Manufacturing | 24.1 |
| Personal Services | 2.3 |

## 2.5.3 Times of deliveries

***Time of day***

The different surveys reviewed here have suggested slightly different peak times of day for deliveries to retailers: however, the consensus view is that the morning (0500-1200 hours) is the busiest period. For food supplies, McKinnon (2002) suggested that the peak was 0500-0900 hours (Figure 8); for general deliveries the Colchester survey suggested that the peak was 0900-1200 hours (Table 4).

Other surveys suggested the following peak periods for general deliveries: Ealing, 0900-1300 and 1400-1600; Croydon and Sutton, 45% mornings, 5% afternoons, 10% evenings, 40% anytime; West Sussex, 0600-0900 and 0900-1600, typically mid-afternoon. Boots[8] provided time of day data for deliveries to their own shops and to Sainsbury's and to Musgrave's (grocery chain) (Figure 9), which shows that, for Sainbury's, the main peak is 0500-1200; for Boots, the peak period is not well defined but it appears to be overnight, from 2000 hours to midnight; and, for Musgrave's, most deliveries take place from 0400-0700 hours.

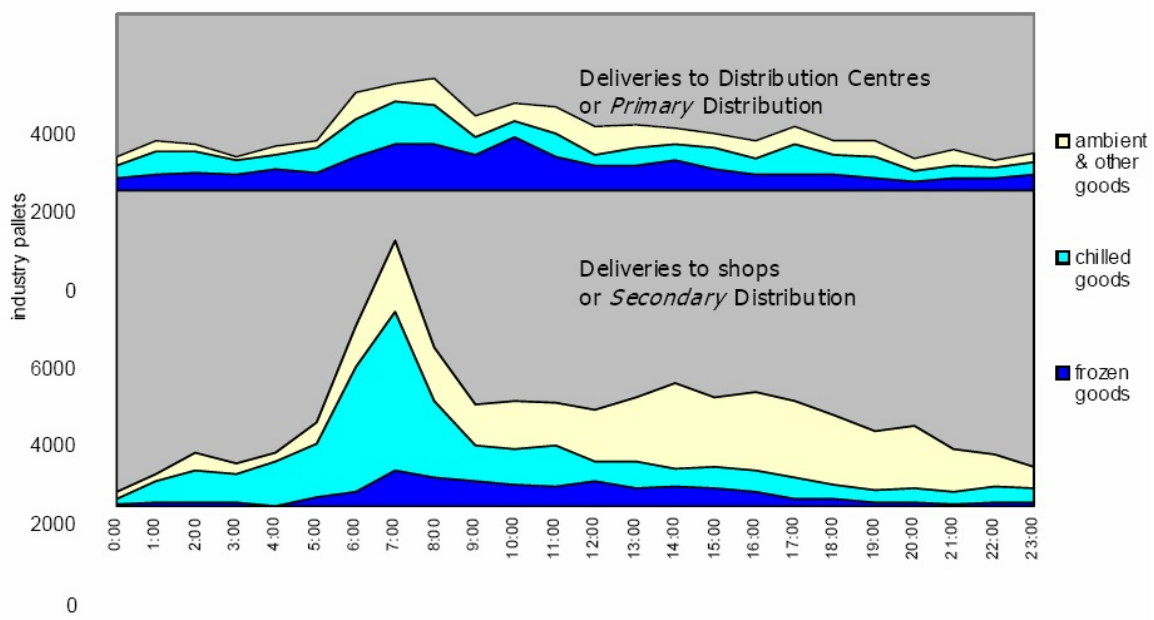



Figure 8 - Food deliveries by time of day (Source: McKinnon, 2002)

[8] http://www.sml.hw.ac.uk/greenlogistics/barnes.pdf

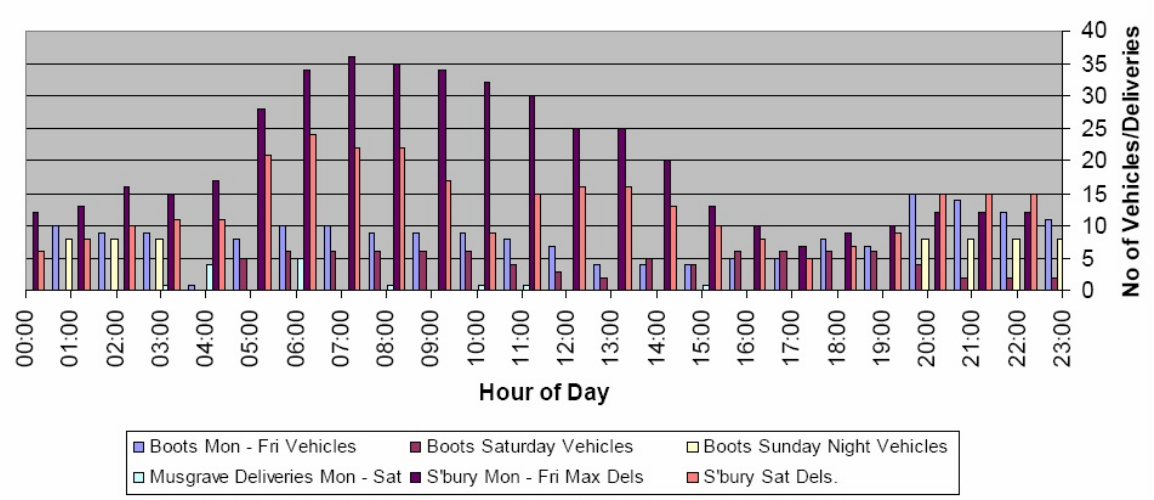



Figure 9 - Delivery patterns for Boots, Musgraves and Sainsbury in Greenwich, London

Table 4. Delivery times (Colchester)

| Delivery time | No. of respondents |
|---|---|
| 0600-0900 | 43 |
| 0900-1200 | 175 |
| 1200-1500 | 64 |
| 1500-1800 | 32 |
| 1800-2100 | 7 |
| Overnight | 1 |
| Total | 322 |

Allen *et al*. (2000) commented that many retailers had a marked preference for morning deliveries so that they can begin their working day by unpacking and sorting deliveries while the premises are relatively quiet and so that customers do not have to wait for goods to arrive, as well as due to operating time restrictions. They also noted that, although some deliveries take place during the very early morning, before the morning traffic peak, and in the later morning, after the morning traffic peak has subsided, a sizeable amount of deliveries coincide with the morning traffic peak, with its associated congestion problems.

(***Key question -*** Could commercial waste collections be reduced if stores were holding recyclate for the supplier to collect the next day?)

(***Key question -*** Are delivery vehicle schedules 'convenient' for waste collection given the stores daily work schedule?)

***Day of week***

The surveys show that the vast majority of deliveries are made Monday to Friday, with comparatively little made at the weekend. The busiest day of the week varies from place to place (for example, Tuesday was the busiest day in Torbay but the least busy day midweek in Ealing); this may be related to market days. Generally, though, the differences between Monday to Friday, are quite small. The Bexleyheath, Colchester Ealing and Park Royal surveys allow a comparison of responses to the

question “What is your busiest day(s) for deliveries?”, where more than one day may be stated (Figure 10).

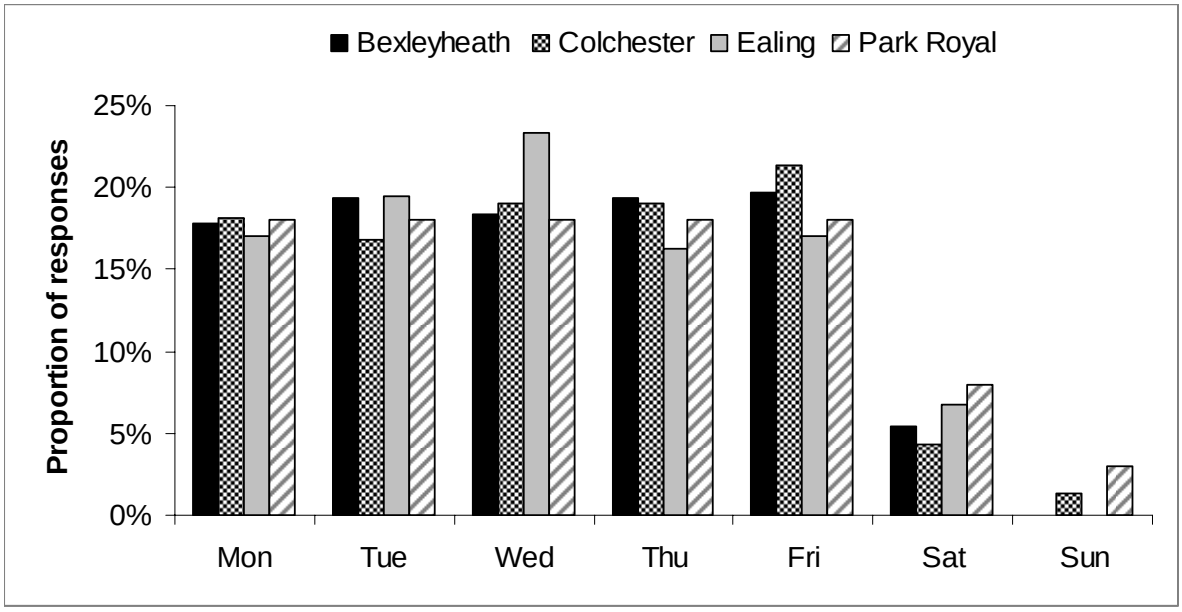



Figure 10 - Proportion of businesses stating busiest day(s) for deliveries

The Croydon and Sutton survey (Lewis, 2007) indicated that deliveries were scheduled as 67% regularly on a weekday, 10% regularly at the weekend and 23% ad hoc.

***Time of year***

As one might expect the run up to Christmas tends to be the busiest time of year for retail deliveries. This was confirmed by the Bexleyheath, Colchester, Winchester and West Sussex surveys, among others. The Bexleyheath and Colchester surveys allow a comparison of responses to the question "What is your busiest month(s) for deliveries?", where more than one month may be stated (Figure 11).

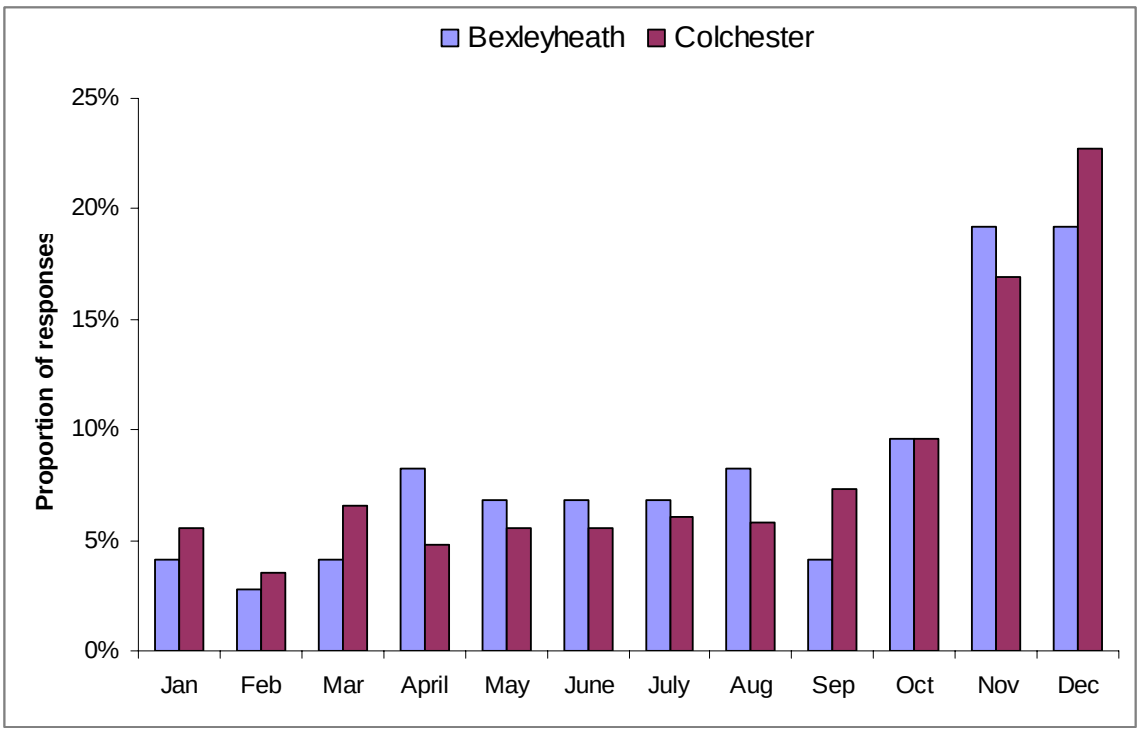



Figure 11 - Proportion of businesses stating busiest month(s) for deliveries

The West Sussex study showed that the peak business periods were November and December, when the mean number of weekly core goods deliveries generated by the sample would increase by 46%.

The Torbay survey indicated that the peak months for delivery were July and August, followed by June and December. Troughs occurred in November, January, February and March. This result reflects the fact that Torbay, being a holiday destination, is busiest during the traditional holiday periods, i.e. summer.

***Timed deliveries***

McKinnon (2002) reported that there has been a steep increase in the proportion of factories, warehouses and shops demanding timed deliveries, typically in 30-minute windows. If a delivery vehicle arrives late then the driver may be turned away or asked to wait until the reception bay staff are ready to receive it. This may cause delivery drivers problems, particularly on congested roads and where the rounds are multi-drop. This may also be a consideration when planning further work in collecting returns or waste packaging.

***Night time deliveries***

From the above analyses it can be seen that not many deliveries are currently made overnight. This option has been considered by the South London freight quality partnership. Lewis (2007) estimated that time savings of around 2 minutes per kilometre could be saved, based on figures from various European cities where night-time deliveries are made. One of the main concerns is noise; some areas of the UK are already subject to delivery curfews, typically from 11pm to 7am, preventing night-time deliveries. The DfT (2003) reported that the "majority of businesses (in Newton Abbot, Devon) were against out of hours deliveries because of staffing problems, increased costs resulting from operating later/earlier, security difficulties, the problem of checking goods, and noise."

McKinnon (2002) reported that the proportion of night-time driving for freight, in terms of vehicle kms, had increased from 15.1% in 1996 to 19.4% in 2001, according to Department for Transport statistics; however, much of this driving would be on motorways and other major roads rather than in urban areas.

## 2.5.4 Dwell times

Dwell times are of interest because they could give an indication of the time available to open deliveries and return packaging in the same vehicle or to prepare and present items for return/recycling from different retailers in the same street (i.e. consolidating take-back on the same vehicle from neighbouring stores).

The Bexleyheath, Winchester and West Sussex surveys estimated average dwell times for different vehicle types (Table 5).

Table 5 - Mean dwell times (minutes)

| | | Winchester | | | | West |
|---|---|---|---|---|---|---|
| **Goods vehicle** | **Bexleyheath** | **City centre** | **High Street** | **Bar End** | **Winnall** | **Sussex** |
| articulated lorry | 30 | 31 | 41 | 50 | 21 | 40 |
| rigid lorry | 21 | 21 | 20 | 20 | 13 | 26 |
| van | 16 | 9 | 12 | 8 | 7 | 8 |
| car | 15 | 9 | 7 | 7 | 7 | - |

For the West Sussex study (Cherrett and Hickford, 2005), combining the core goods deliveries and service vehicle visits across the sample of respondents showed that the average business would generate 54 minutes of standing vehicle time each day over a six-day trading week, a significant proportion of which (58%) was likely to be on-street.

The study in Norwich and London also considered average dwell times. In the majority of cases these were less than 30 minutes. However some full loads delivered on articulated vehicles took as long as 3 hours and tanker deliveries to a pub took up to 2 hours (Allen et al., 2000)

## 2.5.5 Delivery locations

Delivery locations are of interest to this study as they could give an indication of how easy it might be to consolidate return goods or waste from neighbouring retailers into one vehicle. Levels of off-street loading/unloading areas will clearly depend on the type of location. At Park Royal, a mainly industrial area, 85% of the responding businesses had an off-street delivery area, while in the Norwich/London study, 60% of businesses did **not** have an off-street delivery area.

The first Winchester study (Cherrett *et al*., 2002) reported that 61% (80) of the business managers stated that delivery vehicles parked on the public road outside their premises, 27% (35) that vehicles parked on the company premises (off the public road) and 12% (15) that vehicles parked on a public road away from the premises when deliveries were taking place. The second Winchester study (Cherrett and Smyth, 2003) included a survey of 19 suppliers, which indicated that 43% (8) were not sure where their vehicles parked, 32% (6) used a public road, and 22% (4) parked off-road at the client's premises (with 3% 'other'). The 'not sure' result strongly suggests that if you want to know where delivery vehicles park it is better to ask the business managers receiving the goods, rather than the business managers supplying the goods. Talking to drivers would be best of all, of course, but this would involve having to talk to a far greater number of people.

A survey of 13 service providers in Winchester (Cherrett and Smyth, 2003) indicated that they parked: on a public road for 38% of all service visits; off-road, at the client's premises for 31% of visits; in a pay-and-display public car park for 28% of all visits (the remaining 3% was described as 'other').

The West Sussex study showed that in Chichester, Horsham and Worthing, parking on-street outside the client's premises was the norm (Table 6); the results for Crawley were quite different as many of the businesses were in a shopping mall which had its own loading/unloading area - described as being 'away from the client's premises' - from which goods were delivered to shops either manually or using some equipment (roll cages, carts etc.). Use of equipment is covered in section 2.5.6.

Table 6 - West Sussex delivery locations

| | **client's premises** | **public road** | **away from client's premises** |
|---|---|---|---|
| Chichester | 31% | 69% | 0% |
| Crawley | 50% | 13% | 37% |
| Horsham | 31% | 61% | 8% |
| Worthing | 29% | 71% | 0% |
| Overall | 33% | 58% | 8% |

## 2.5.6 Vehicle types

A cross-survey comparison of vehicle types used is shown in Figure 12 with data in Table 7. The variations in figures found between sites reflect not only the different locations but also the varying characteristics of the surveys. In some cases (e.g. Croydon/Sutton and West Sussex) deliveries by car do not appear to have been considered (it seems unlikely that none at all were made by car). The composition of the businesses that were surveyed in each case would also be a major contributory factor explaining variation. In particular, some of the surveys included service

vehicles - Ealing for example, which explains the high proportion of vans (60%) - whereas some did not.

Table 7 - Cross-survey comparison of vehicle types used

| Goods vehicle type | Bexleyheath | Colchester | Croydon/ Sutton | Ealing | Winchester | West Sussex |
|---|---|---|---|---|---|---|
| artic | 10% | 9% | 25% | 4% | 16% | 33% |
| rigid lorry | 39% | 27% | 40% | 18% | 50% | 30% |
| van | 45% | 39% | 25% | 60% | 33% | 37% |
| car | 6% | 21% | 0% | 15% | 1% | 0% |
| other | 0% | 4% | 0% | 3% | 0% | 0% |

**(Key question -** Are van take-back schemes the way forward, i.e. many small back-loads of recyclate/returns as opposed to fewer HGV take-backs? What would the impact of this be in terms of mileage?)

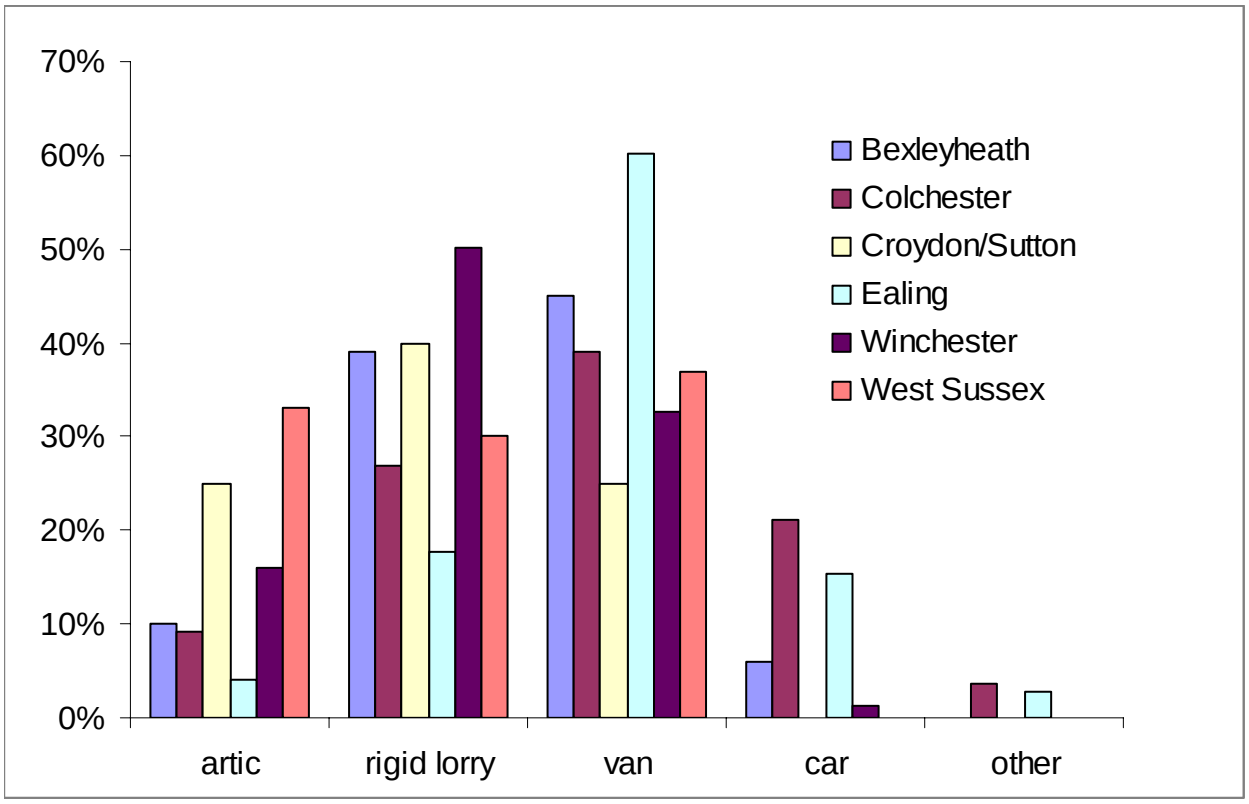



Figure 12 - Cross-survey comparison of vehicle types used

As one would expect, many different vehicle types are used for deliveries. In the Birmingham/Basingstoke/Norwich study, for example, the seven distribution companies that were interviewed used vehicles ranging in gross vehicle weight from 3.5 tonnes to 38 tonnes with each company using two or three different sizes of vehicle. From the retailers' perspective, the Norwich/London study indicated that 58% of the surveyed businesses were serviced by different vehicle types, ranging in size from vans to large lorries. Vans were used exclusively for only 19% of these businesses and most of these were independent businesses rather than multiple outlets, many receiving relatively small average delivery sizes and sourced goods from several different suppliers, each of which either delivered the goods directly themselves or contracted an express/parcels company to make the delivery.

The Winchester study provided a breakdown of vehicle type by business type (Table 8). The results indicated that for core food deliveries, rigid lorries were used in the main, while vans were the mode of choice for the services sector. Articulated HGVs were used more by warehousing and manufacturing premises in the more industrial areas of Winchester. A similar analysis of vehicles used for different types of goods deliveries in the Netherlands is shown in Figure 13.

Table 8 - Core goods deliveries by business type and vehicle type in Winchester.

| Business Type | %Artic | %Rigid | %Van | %Car |
|---|---|---|---|---|
| Food retail | 21 | 55.8 | 23.2 | |
| Clothing retail | 32 | 42 | 26 | |
| Other retail | 7.5 | 38.4 | 49.5 | 4.5 |
| Restaurant | 57.1 | 14.3 | 14.3 | 14.3 |
| Public House | | 70 | 30 | |
| Hotel | | 100 | | |
| Banks | | | 100 | |
| Other Services | 5.3 | 21.2 | 65.7 | 7.8 |
| Warehousing | 21.8 | 44.9 | 33.3 | |
| Manufacturing | 27.2 | 34.3 | 38.5 | |
| Personal Services | | 25 | 60 | 15 |

| Weight | Contents – length | Goods |
|---|---|---|
| Less than 3.5 tonnes | Maximum: 8m³ – 6 metres | Parcels<br>Services<br>B2B<br>Independent retail |
| 3.5 – 7.5 tonnes | Maximum: 23m³ – 7.5 metres | Lifestyle(clothes/shoes)<br>Daily products(food)<br>B2B<br>Parcels |
| 7.5 – 18 tonnes | Maximum: 40-44m³, 10 metres | Bars/restaurants<br>Lifestyle (clothes/shoes)<br>Daily products (food)<br>B2B |
| 18 – 40 tonnes | Maximum: 34-100m³, 19.3 metres | Department stores<br>Daily products (food)<br>Do-it-yourself |

The production requirements for new vehicles are: less visual intrusion, increased safety, better working conditions, high capacity, light weight, and clean engine.

*Source:* Netherlands Forum for Physical Distribution in Urban Areas *(Platform Stedelijke Distributie).*

Figure 13 - Vehicle use in the Netherlands (Source: OECD, 2003)

The Colchester study also examined the relationship between numbers of deliveries and the types of vehicles used and found that:

- Articulated lorries were most commonly used for those businesses receiving large numbers (more then 40) of weekly deliveries.
- Rigid lorries were most commonly used for those businesses receiving between 21-40 weekly deliveries.
- Light vans were prevalent in delivering to town centre premises.
- Cars were used to deliver to 20% of premises but were not allowed legally to use loading bays.

Allen *et al*., (2000) observed that vehicle size and weight restrictions or road widths might influence what vehicles are used in certain areas. For example, in Norwich some of the city centre roads are narrow which forces the use of smaller vehicles than might otherwise be used. They also observed that where the driver has to make a relatively large number of deliveries to different premises then it might be the amount of work that the driver can perform in a day that constrains the volume of goods that can be delivered and hence the size of vehicle required.

***Special types of vehicle or equipment***

Some types of goods might require the use of special types of vehicle or in-vehicle equipment. For example, some foods might require refrigeration; some clothes might need to be hung to avoid creasing. Envirowise (2002) commented that switching to the use of pallets rather than roll cages within vehicles would provide more options for back-hauling used packaging. The Colchester study indicated how goods were handled at the delivery stage (Table 9). The extent to which equipment is used will relate not only to the types of goods but also to where the vehicle has to be unloaded (section 2.5.5).

Table 9 - Type of handling survey in Colchester

| Type of handling | Most often | Often | Some times | Never |
|---|---|---|---|---|
| By hand | 176 | 29 | 24 | 3 |
| Roll cage | 22 | 13 | 21 | 57 |
| Hand truck | 26 | 25 | 33 | 43 |
| Fork lift | 0 | 0 | 5 | 81 |
| Other | 8 | 2 | 2 | 4 |

(***Key question -*** Are roll cages used for returning packaging waste? How is waste presented for collection by the delivery vehicle?)

The DfT (1999) commented that “Tesco have developed an integrated distribution system using their own vehicles to collect from suppliers as well as using suppliers' vehicles to meet their secondary distribution requirements. New packing technologies and trailer configurations were also developed to enable vehicles designed to carry pallets to carry store cages, and temperature-controlled trailers to operate in both single and multi-compartment configuration.” McKinnon (1996) stated that “a large proportion of grocery deliveries in the UK are made by multi-compartment vehicles capable of transporting food at 4-5 different temperature regimes”.

The Croydon and Sutton survey indicated that loose boxes were the most common packaging type (56% of stores), mixed deliveries were also common (56% of stores) and only one store solely used hanging rails and another store used solely roll cages. The Winchester survey provided an analysis of package sizes received and delivery methods (Table 10).

Table 10 - Characteristics of the typical delivery provided by the main supplier in Winchester (package sizes are in centimetres)

| | Box sizes (cm) | | |
|---|---|---|---|
| | Small (12*32*24) | Medium (52*55*52) | Large (>52*55*52) |
| No. business receiving these boxes | 21 | 49 | 28 |
| Mean no. boxes received by each | 9.4 | 17.2 | 10 |

| | | | |
|---|---|---|---|
| business in a typical delivery | | | |
| Min | 1 | 1 | 1 |
| Max | 50 | 200 | 50 |
| STDEV | 9.38 | 38.86 | 11.81 |
| % Delivered by hand | 62.5 | 79.6 | 50 |
| % Delivered by pallet | 20.8 | 16.3 | 31.3 |
| % Delivered by roll cage | 16.7 | 2 | 12.5 |
| % Delivered by 'other' means | 0 | 2 | 6.3 |

McKinnon and Campbell (1997) considered the use of double-decked vehicles, which increase the amount of floor space available. Since there are limits on the height to which most products can be stacked, they stated that loading is usually constrained more by the available floor space on the lorry than by its cubic capacity or by its weight. The second deck allows greater load consolidation and improved vehicle utilization. Although this paper suggested the effectiveness of using double-decked vehicles there has not been much publicity to suggest that they are being widely used in practice. One example found is Boots[9], who now use 41 doubled-decked vehicles and report that these vehicles reduce three journeys down to two, compared to their standard vehicles, saving 5.2 million kilometres and around 1340 tonnes of CO2 emissions per annum. In 1986, John Lewis became the first UK retailer to introduce fixed double-decker trailers. To date, they now have over 130 multi-decker trailers in their fleet, saving over 6.4 million kilometres per year.[10]

## *2.6 Service deliveries*

### 2.6.1 Types and number of service visits

The Bexleyheath, Winchester and West Sussex surveys all produced a breakdown of service visits by the type of service provided. The results are summarised in Figure 14.

From Figure 14 it can be seen that:

- Mail deliveries were the most common service visit type in Winchester and West Sussex; the definition of mail delivery in Bexleyheath must have been different from Winchester and West Sussex as the proportion of mail deliveries in Bexleyheath is disproportionately small.
- Window cleaning and general cleaning were next most common.
- Waste collection was the third most frequent type of service visit in West Sussex but was lower in Winchester and in Bexleyheath.
- Catering was the 4th most frequent type of service visit in Bexleyheath but was considerably lower in Winchester and West Sussex.

[9] http://www.boots-csr.com/main.asp?pid=639

[10] http://johnlewispartnership.co.uk/Display.aspx?MasterId=efd344d3-9a6e-47d7-9b15-d9d311b4b193&NavigationId=664

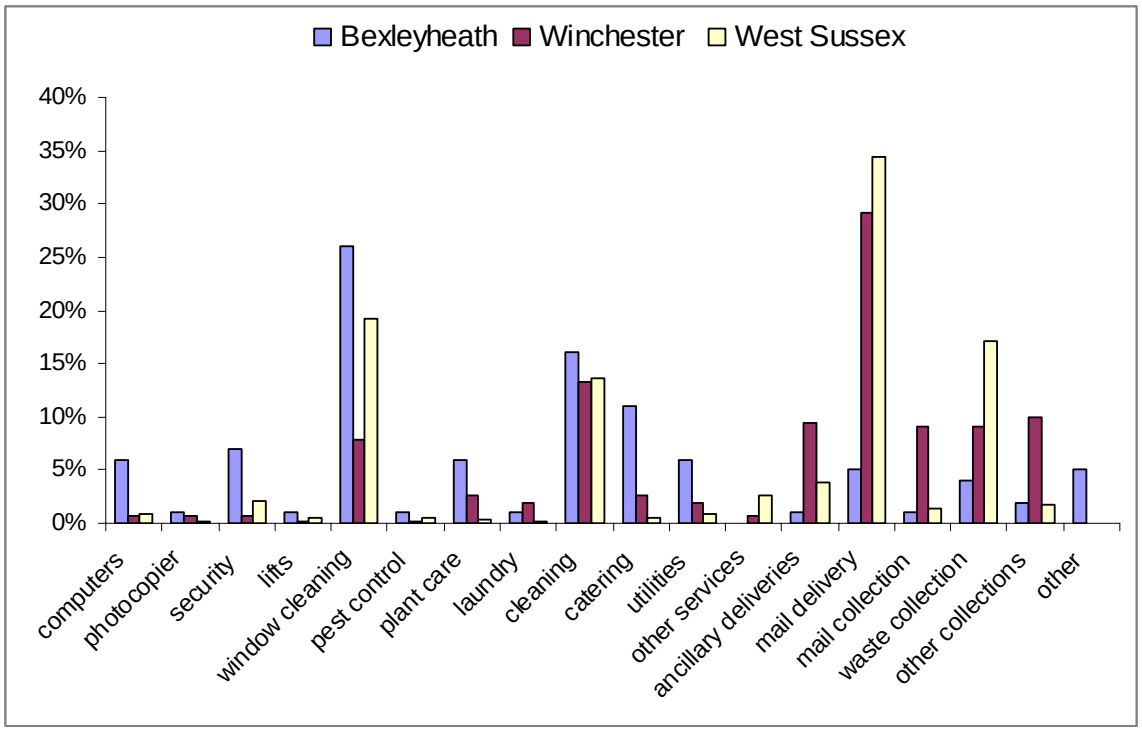



Figure 14 - Frequency plot of service visits by type

## 2.6.2 Vehicle types used

The Winchester (Cherrett *et al*., 2002) and West Sussex (Cherrett and Hickford, 2005) surveys were the only ones providing a breakdown of service visits by vehicle type (Table 11). The two surveys show a similar pattern, although there were slightly more cars used and slightly fewer articulated lorries used in West Sussex compared to Winchester.

Table 11 - Comparison of service vehicle types

| Service vehicle type | Winchester | West Sussex |
|---|---|---|
| articulated lorry | 8% | 3% |
| rigid lorry | 8% | 8% |
| van | 53% | 50% |
| car | 14% | 22% |
| motorbike | 0% | 0% |
| bicycle | 2% | 1% |
| foot | 15% | 16% |

## 2.6.3 Dwell times

The West Sussex survey (Cherrett and Hickford, 2005) indicated that mail deliveries and collections took the least time (all being in the 1 to 15 minute category). Specialist waste collections were also very short, highlighting that many retailers will use specialist containers and skips compatible with their waste contractor's collection vehicle, making them easy to collect and deliver.

The average cleaning visit took the longest time, at 65 minutes, with lift maintenance taking 56 minutes on average. The total weekly service visit time for the 47 surveyed businesses was estimated to be 142 hours of service activity. Given that 83% of these service visits were undertaken by motorised transport, implies that each business would generate 2.5 hours of service vehicle stationary time per week which could be directly outside the premises or in local car parks.
(***Key question -*** To what extent do cleaning visits remove recyclate?)

The Winchester survey (Cherrett *et al*., 2002) measured the average dwell time by the type of service visit (Figure 15).

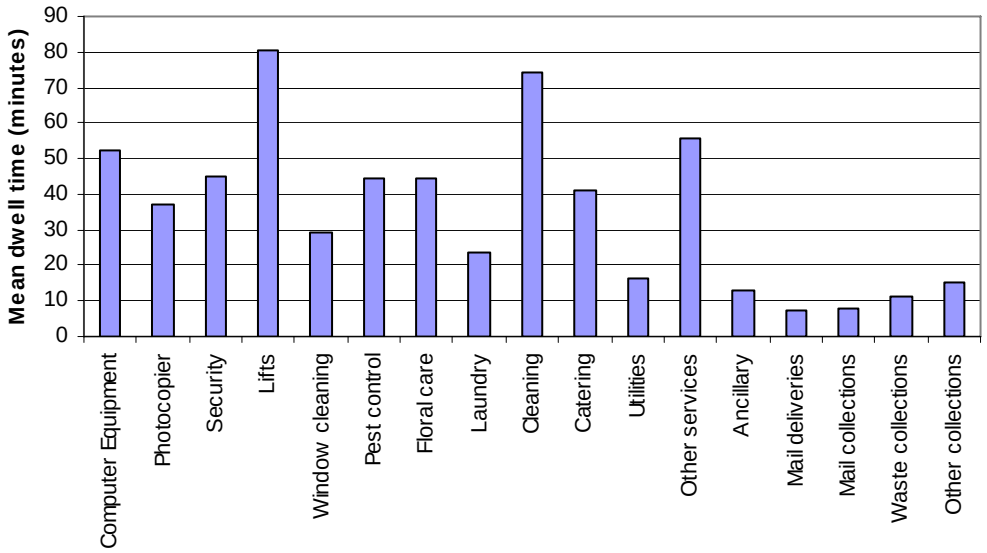



Figure 15 - Mean dwell time by service type

## *2.7 Delivery rounds*

### 2.7.1 Number of drops

The number of delivery points (drops) on the delivery round is of interest here as single drop rounds will be more suited to the collection of waste and/or return goods in comparison to multi-drop delivery rounds, where there might not be space on the vehicle, particularly on the first few drops. This section attempts to describe delivery rounds in terms of the numbers of deliveries made, time taken etc. They range from dedicated single-drop rounds to rounds containing 50 or more deliveries. Typically the dedicated single-drop round will be where a large volume of goods are delivered to a large store. Rounds containing 50 or more deliveries are typically deliveries of small parcels. In the Birmingham/Basingstoke/ Norwich study of seven distribution companies, the average numbers of deliveries on their rounds were 2,3,4,7,8,18, for the companies involved in either drinks distribution, non-food distribution or general distribution, and 44 for a parcels carrier. The average time taken on these rounds ranged between 2½ and 10 hours. On the longer rounds driving time was the main factor, comprising nearly 70% of the total time and this was typically due to the fact that the trips started and ended from a regional distribution centre (e.g. one was in Swindon and one was in Redditch). The average driving distance on the longer rounds ranged from 208km to 371km. Vehicles may come from even further afield than that: the Bexleyheath study indicated a wide range of origins for delivery vehicles including Scotland, the north of England and Cornwall.

The Norwich/London study indicated that 48 out of 58 premises received all deliveries from vehicles performing multi-drop work, 8 out of 58 from vehicles performing single-drop work and 2 out of 58 from vehicles performing both types of drop. Of the eight premises receiving goods deliveries from vehicles performing single-drop deliveries, seven were premises owned by large companies with many premises, and were among the largest premises studied with lorries generally carrying full loads. The vehicles performing multi-drop deliveries to the 48 premises studied were operated by a range of different types of companies: suppliers, wholesalers, freight transport companies, the company owning the premises.

The Norwich/London study identified two distinct types of multi-drop rounds; the study did not mention collection of waste or returns on either type:

(i) Those on which the vehicle visits a number of different premises that have no commercial relationship with each other. The Norwich/London study found examples of this type of round being performed by suppliers, wholesalers, express and parcels companies and third party distribution companies. Of the 48 premises receiving multi-drop deliveries, 34 received their deliveries by this type of multi-drop round.

(ii) Those on which the vehicle visits a number of different premises all of which have a commercial relationship with each other (i.e. all premises are owned by the same company or group). All the premises receiving goods deliveries from this type of multi-drop round have internally centralized goods supply systems with goods being dispatched from their own distribution centres to the premises. The Norwich/London study found examples of this type of round being performed by third party distribution companies and by the company owning the premises themselves. Of the 48 premises receiving multi-drop deliveries, 14 received their deliveries by this type of multi-drop round.

### 2.7.2 Vehicle utilisation

Examining existing vehicle utilisation gives an idea of what might be possible for the collection of return goods or waste packaging. However, it should be noted that collecting returns or waste packaging could cause problems in making any subsequent deliveries on the round if these collected goods or waste get in the way.

The Birmingham/Norwich/Basingstoke study (Allen *et al*., 2003) indicated that the average vehicle fill rate at the start of the delivery round ranged between 43% and 79%, suggesting that there was typically at least 20% spare capacity for the seven distribution companies studied. There did not appear to be any obvious relationship between fill rate and the type of delivery operation. The average vehicle idle time at the depot ranged between 22% and 58%.

A survey of 22 vehicle fleets involved in non-food retail indicated that the average fill rates at the start of trips were 58% by volume, 62% by weight and 84% by deck area (i.e. floor space). When averaged over all legs of the trips, these figures reduced to 51% by volume, 54% by weight and 74% by deck area, the reductions being due to deliveries being made on multi-drop rounds. These data originated from a number of major retailers including Marks and Spencer, John Lewis, B&Q, Argos, Woolworths and Littlewoods. It was reported that factors that may limit efficiency could include: lack of data measurement, so failing to raise awareness of the problem; purchase of standard vehicle sizes or body types that are not appropriate; the inherent or perceived need for fleet consistency or flexibility; allowance for future business growth; other issues from within the business, which require priority to be given to

parameters such as frequency of delivery (DfT, 2006a). This study also commented that vehicle utilization may be improved by including collection of inbound merchandise from suppliers, internal movements between distribution centres, or even movements on behalf of other organisations (e.g. from a supplier to a competitor). At least two of the companies that participated in the survey were reported as doing this already.

Empty running rates of delivery vehicles in the UK have reduced over the years: from 32.6% in 1980 (McKinnon, 2002) to 26.5% in 2003 (DfT, 2004a). The DfT study (2006a) reported that only 11% of freight transport legs are 'empty running' but the carriage of empty handling units, packaging for recycling and returns account for a further 21.5% of legs, and the number of legs where only merchandise is delivered account for only 58% of all legs. They stated that "companies must strike a fine balance to ensure intermediate and final legs are better utilised while still ensuring the fleet's primary role, i.e. delivery, is protected and optimised." This study also reported that the average volume utilisation for vehicles stood at 51% for non-food retail distribution and 52% for the food supply chain, while the weight utilisation for vehicles averaged at 54% for non-food retail distribution and 53% for the food supply chain. Pallet networks (see section 2.1.1) were found to be achieving an impressive 72.8% vehicle fill rate (DfT, 2007a).

### 2.7.3 Time utilisation

A DfT study (2006a) of 22 businesses involved in non-food retail deliveries indicated that "during the survey period vehicles were in the process of being loaded/unloaded or running on the road for only 38% of the time and allowing for safety inspections/maintenance (7%) and breaks from driving taken on the road (1%) vehicles were unproductive for 54% of the available time. Significantly, 21% of a vehicle's time is spent preloaded awaiting departure. This inactivity can be caused by constraints elsewhere in an operation, such as the number of loading docks or the unavailability of vehicles and drivers. It is also possible that vehicles, especially trailers, have to be ready for immediate dispatch to make up for delays encountered in other trips. Spreading the use of vehicles in this way can lead to reduced utilization (but faster turnaround times)."

Fernie and McKinnon (2003) provided a breakdown of time utilisation for vehicles involved in food distribution, based on a survey of over 2000 rigid trailers.

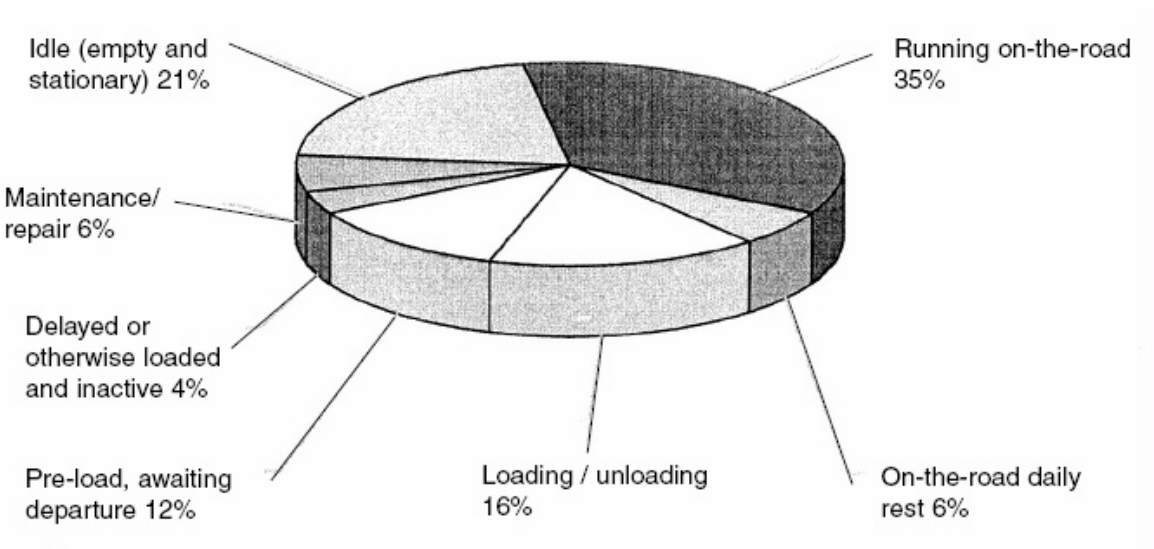



Figure 16 - Average time utilisation in grocery distribution (Source: Fernie and McKinnon, 2003)

### 2.7.4 Problems

Delivery round problems are of interest to this study as they may identify some issues that might be relevant to the collection of returns goods or waste collection. Fernie and McKinnon (2003) analysed the reasons for delays affecting food deliveries based on a survey of 27 grocery retailer managers, 50 grocery manufacturer managers and 21 logistics service provider managers (Table 12). They reported that although traffic congestion was a significant problem, 56% of delays were due to management issues that could have been avoided.

Table 12 - Reasons for delays in food distribution (Source: Fernie and McKinnon, 2003)

| *Cause of delay* | *Percentage of all journey legs* | *Average duration (minutes)* |
|---|---|---|
| Delivery-point problems | 8 | 58 |
| Traffic congestion | 6 | 35 |
| Own company actions | 3 | 64 |
| Collection-point problem | 2 | 40 |
| Equipment breakdown | 1 | 88 |
| Lack of driver | 1 | 47 |
| No single cause | 5 | – |

## *2.8 Use of delivery vehicles for waste collection or return goods*

This section aims to assess the extent to which delivery vehicles are already being used in practice for waste collection or returning goods.

In the West Sussex study, businesses were asked to indicate whether delivery vehicles also removed any goods (e.g. returns) or waste collection (e.g. packaging) as part of the delivery process. For return goods, the responses were that 39% of businesses 'always' had returns collected by delivery vehicles, 57% 'sometimes' and only 4% 'never'. For waste collection, the responses were that 31% of businesses 'always' had their waste collected by delivery vehicles, 16% 'sometimes' and 53% 'never'.

In July 2006, a press release from ASDA[11] stated that they had opened four purpose-built recycling facilities in 2005 at a cost of £32m in Lutterworth, Wakefield (Figure 17), Skelmersdale and Bedford enabling its fleet of delivery trucks to collect cardboard and plastic packaging from the back of stores. They reported that they had recycled 140,000 tonnes of cardboard (8% of the UK cardboard market) and 5,500 tonnes of plastic packaging from store waste. Other waste types collected, segregated and treated separately include paint, fluorescent tubes, animal by-product waste (composted for use as a soil conditioner) and photographic chemicals (from which silver is recovered).

Sainsbury's also report that they use their lorries to return items (reusable crates, pallets, plastic and cardboard for recycling) to their depots and also to collect deliveries from their suppliers (factory gate pricing). They also mention that an 'Integrated Transport Management system' facilitates this process, and will be fully operational across all sites by 2008[12].

The fashion store Next[13] mentioned that they had recently equipped 102 stores with compactors and balers for cardboard and polythene and that in 2005 they had undertaken a trial of reverse hauling cardboard and polythene to a central distribution centre for compacting and baling. They stated that this system required further investigation before they could assess the benefits.

Woolworths[14] reported that card and plastic materials are taken back from their stores to their distribution centres for recycling, although they didn't mention which vehicles are used. They also reported a new initiative for dealing with cardboard and polythene waste, introduced at their Swindon distribution centre early in 2006, in conjunction with Futur, one of their recycling partners, which involves exporting the waste to China in containers that would otherwise be empty. Their 2006 year-end recycled packaging statistics were 193 tonnes of plastic and 12,279 tonnes of card.

[11] http://www.asda-press.co.uk/pressrelease/35
[12] http://www.j-sainsbury.com/files/reports/cr2007/index.asp?pageid=30
[13] http://www.next.co.uk/pdfs/corporate%20responsibility%202006.pdf
[14] http://www.woolworthsgroupplc.com/csr/csr2006/files/pdf/csr2006.pdf

Figure 17 - ASDA recycling facility at Wakefield

Conversely, Body Shop [15] reported that a reorganisation of their UK transport operations in 2006 had resulted in lorries no longer returning to their warehouse with recycling waste. They said that "driving a limited amount of PET bottles across the country for recycling simply did not make environmental sense".

Anderson *et al.* (1998) undertook a study of the implications of the UK packaging waste regulations on freight transport and logistics, which included case studies of Xerox, The Body Shop, Palmer & Harvey McLane, Tesco and Marks and Spencer. This study reported that these companies were already taking part in recycling and recovery schemes prior to the introduction of the regulations. At the time of the study, packaging waste and its related transportation represented only a very small proportion of the total quantity of freight lifted and moved, and vehicle kilometres performed in Britain (packaging waste constituted approximately 0.5% of total freight lifted and moved by road and approximately 0.4% of total road freight vehicle kilometres).

Apart from the West Sussex study, all of the above examples of back-loading waste have been for large organisations. This partly reflects the fact that information about larger organisations is more readily available but it may also be an indication that back-loading waste is more feasible for large organisations, as they have the resources to undertake the work. (***Key question -*** in principle, large organisations could take-back the recyclate on behalf of other, smaller companies on the high street. What would the benefits be if they were will to do this?)

# 3. Existing returns procedures

## *3.1 Background*

[15] http://valuesreport.thebodyshop.net/index.asp?lvl1=8&lvl2=5&lvl3=0&lvl4=0

While a large majority of research regarding sustainable development through the use of effective transport and logistics systems has focused on the delivery of the product to the market place, little has been undertaken to assess the impact on sustainability of unsold or returned goods.

The OECD (2003) acknowledges that "Reverse logistics need to be developed. The imminent need in many countries to reduce, reuse and recycle waste will only become feasible with a transport system which carries used and returned goods for reuse and recycling (reversed logistics) in a cost-effective manner."

The management of return flows is becoming increasingly important for a growing number of businesses. Governmental policy and legislation, such as the WEEE Directive and environmental regulations restricting the disposal of potentially hazardous product and packaging materials, have forced manufacturers to take responsibility for the take-back of used goods from customer markets. Customer awareness is also creating opportunities for "green branding" and new markets for returned goods. Moreover, return flows can reduce production costs by replacing raw materials.

Each year in excess of £5.75 billion worth of goods are returned to retail stores in the UK. The logistics cost for handling these goods is estimated to be in excess of £500 million a year (DfT, 2004b). Most companies do not know the true cost to the business of reverse logistics.

A typical urban retailer has a number of particular issues to address regarding reverse logistics, some of which differ from those of manufacturers or distributors. They have to be able to deal with obsolete, damaged or unsold stock, and to have facilities in place to manage products returned by customers for a variety of reasons, as well as for the proper disposition of packaging and other waste products.

The increase in waste products has led to awareness of the need for new ways to deal with waste, resulting particularly in increased attention to recycling. Recycling usually implies that used products are returned to their original producers. Even where excellent waste collection systems exist, the need for recycling used goods requires specialised collection and transport of these goods; it is generally not possible to use the same vehicle to transport both foodstuffs and products to be recycled. See Section 6.2 for more detailed information on this topic.

Table 13 compares how various features of logistics systems for retailers differ for forward and reverse logistics processes (adapted from Tibben-Lembke *et al.*, 2002).

Table 13 - Differences in forward and reverse logistics (from Tibben-Lembke *et al.*, 2002)

| **Forward** | **Reverse** |
|---|---|
| • Forecasting relatively straightforward<br>• One to many transportation<br>• Product quality uniform<br>• Product packaging uniform<br>• Destination/routing clear<br>• Standardized channel<br>• Disposition options clear<br>• Pricing relatively uniform<br>• Forward distribution costs closely monitored by accounting systems<br>• Inventory management consistent<br>• Product lifecycle manageable | • Forecasting more difficult<br>• Many to one transportation<br>• Product quality not uniform<br>• Product packaging not uniform<br>• Destination/routing unclear<br>• Exception driven<br>• Disposition not clear<br>• Pricing dependent on many factors<br>• Reverse costs less directly visible<br>• Inventory management not consistent<br>• Product lifecycle issues more |

| | |
|---|---|
| • Negotiation between parties straightforward<br>• Marketing methods well-known<br>• Real-time information readily available to track product | complex<br>• Negotiation complicated by additional considerations<br>• Marketing complicated by several factors<br>• Visibility of process less transparent |

Retailers have a variety of options to manage obsolete or damaged stock. Short life products are generally disposed of once the expiry date is reached, thus recovering none of the value of the product. Sales and mark-downs are especially common in fashion retail, to sell overstocked or out-of-season products; this usually entails a much lower margin, but at least some capital recovery is made. There may also be agreements in place with suppliers or manufacturers to return unsold goods.

## *3.2 Characteristics of returned products*

Rogers *et al.* (1999) give estimates of product returns by industry (Table 14).

Table 14 - Sample return rates by industry (from Rogers *et al.*, 1999)

| ***Industry*** | ***Percent*** |
|---|---|
| Magazine publishing | 50 |
| Book publishers | 20-30 |
| Book distributors | 10-20 |
| Greeting cards | 20-30 |
| Catalogue retailers | 18-35 |
| Electronic distributors | 10-12 |
| Computer manufacturers | 10-20 |
| CD-ROMs | 18-25 |
| Printers | 4-8 |
| Mail order computer manufacturers | 2-5 |
| Mass merchandisers | 4-15 |
| Auto industry (parts) | 4-6 |
| Consumer electronics | 4-5 |
| Household chemicals | 2-3 |

Return rates obviously vary according to the types of retail, but Rogers *et al.* (2001) estimate that overall, customer returns account for six percent of all product returns across the retail sector.

In their review of over 60 case studies involving reverse logistics, De Brito *et al.* (2002) found that, once the cases were categorised according to the United Nations classifications for industry, around 60% were in manufacturing, about 20% in the wholesale and retail trade, and about 10% in construction. With regard to the products involved, almost half the cases dealt with metal products, machinery and equipment. Around 30% of the products being processed were transportable goods like wood, paper and plastic products. Around 20% were food products, beverages, tobaccos, textiles and apparel and less than 10% fell into the category of ores and minerals. The majority of the cases involved high value products.

## *3.3 Reasons for product returns*

The reasons for products being returned are discussed by a number of authors. De Brito *et al.* (2003) categorise returns under three headings:

- **Manufacturing returns** – raw material surplus, quality-control returns, production leftovers or by-products;
- **Distribution returns** – product recalls, commercial returns (unsold products and wrong or damaged deliveries), stock adjustments, functional returns (distribution items, carriers, packaging); and
- **Customer returns** – reimbursement guarantee returns, warranty returns, service returns, end-of-use, end-of-life returns.

While the latter two categories clearly apply to retailers, manufacturing returns are less likely to have an impact on reverse logistics in the urban environment.

Rogers *et al.* (1999) place reasons for returns within a basic framework (Table 15), based on whether the goods in the reverse flow are coming from the end user or from another member of the distribution channel such as a retailer or distribution centre; and whether the material in the reverse flow is a product or a packaging material.

Table 15 - Characterisation of items in the reverse flow (from Rogers *et al.*, 1999)

| **Source of Reverse Flow** | | |
|---|---|---|
| | **Supply chain partners** | **End users** |
| Products | Stock balancing returns<br>Marketing returns<br>End of life/season<br>Transit damage | Defective/unwanted products<br>Warranty returns<br>Recalls<br>Environmental disposal issues |
| Packaging | Reusable totes<br>Multi-trip packaging<br>Disposal requirements | Reuse<br>Recycling<br>Disposal restrictions |

In the DfT (2004b) report *The Efficiency of Reverse Logistics*, the results of examining a variety of company supply chains are discussed, including the main drivers of product returns. While these are often regarded as resulting from consumers returning faulty products, there are also many internal drivers that lead to product returns. Indeed, for some product groups, consumer returns account for only a small proportion of total returns.

***Fast moving consumer goods***

'Fast moving consumer goods' (FMCG) are products that have a quick turnover and relatively low cost, generally including toiletries, soaps, cosmetics, teeth-cleaning products, shaving products and detergents, as well as other non-durables such as glassware, bulbs, batteries, paper products and plastic goods. The factors reported as causing product returns for FMCG retailers are:

- **Forecast accuracy** and **demand variability** – imbalances between forecast supply and demand will lead to a stock-out situation, or overstocking of goods which will have to be returned.
- **Promotional activities** – overstocking can result from sales of limited period discounted items, 'Buy one get one free' offers, etc.
- **New product introduction** – it is often difficult to determine the success of new products, and overstocking may result if this is over-assessed.

- **Product range and safety stock policy** – consumer expectations of available choice mean that companies tend to provide a wide range of stock keeping units (SKUs), and there is inevitably overstocking of some SKUs.
- **Product life cycles** – short product life cycles, especially in the electronics and high-tech market can provide a competitive advantage, but may lead to high levels of product returns if not managed appropriately.
- **Logistics trade-offs** – the cost of manufacturing and logistics are relatively low compared to lost revenue from not having shelf availability, which can lead to excessive stock holding.
- **Purchasing policies** – products are often purchased ahead of seasonal demand to minimise the prices paid for goods, which can affect the logistics processes within the supply chain.
- **High on-shelf availability** – consumer expectations and the desire for stock to be continuously available can lead to problems of overstocking, resulting in greater levels of returns**.**
- **Legislative factors** – discussed above, producers and retailers are likely to have to take back products they sell post consumer use.
- **Cash flow management** – retailers may take advantage of existing agreements regarding the return of goods to suppliers or manufacturers in exchange for credit, in order to ease their cash-flow position.
- **Liberal returns policies** – typically for defective goods, such policies result in damaged or non-resalable stock being returned to the retailer, which then has to be dispositioned appropriately.
- **Customer 'no-faults found'** – high levels of products are returned by customers unable to follow the instruction manual, who then assume there is a fault with the product; for many such items, the cost of returning to "grade-A" for re-sale is uneconomical, so products tend to be sold to 'jobbers' at a significant reduction.

***Returns policies***

While the reasons given above for returns are generally applicable across the whole retail sector, customers tend to be the largest single source of returned stock. It should be noted that the introduction of more liberal returns policies on goods other than FMCG have resulted in some customers taking advantage of such policies.

One particular example of a company's liberal returns policy damaging its bottom line was the US business, Costco Wholesale Corporation, which decided in January 2007 to tighten its policy on the length of time available to customers to return electronics items (MSNBC, 2007). Until then, Costco had allowed customers to return items at any time for a full refund, with the exception of personal computers, where returns were limited to six months. But concerns were raised that the policy was proving problematic for some high-end electronics such as high-definition televisions, some of which were returned for supposedly normal reasons, such as customer perceptions of picture quality; however, some customers appeared to be taking advantage of price drops by returning an older item and then purchasing a more recent, less expensive model.

As a result of a similar lenient returns policy at a different company in the UK, there is an increase in the level of returns of TVs following global sporting events or after Christmas (DfT, 2004b). Other examples of such abuse include clothing being returned after it has been worn for a single occasion, and high-value camcorders sent back lacking integral parts such as the memory stick, or barcodes being

removed from new items and placed on much older ones, which are then returned (Campbell-Boreham, 2007).

To help alleviate problems such as this, some companies, such as The Return Exchange [16] offer a service allowing retailers to detect and stop fraudulent and abusive return behaviour using bespoke software and use of statistical models to track consumer behaviour.

## *3.4 Managing product returns*

Figure 18 shows a schematic of a typical supply chain, with the inclusion of the recovery process. While the Test facility is optional, consolidation of returns, especially those relating to WEEE, may offer important benefits in reducing freight kilometres travelled.

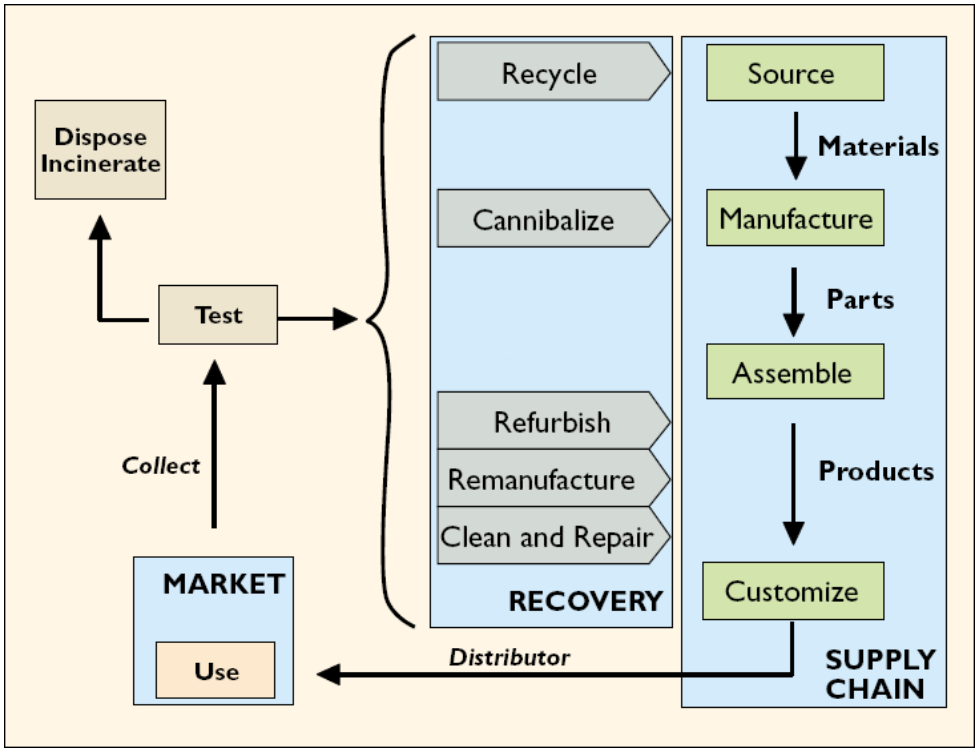



Figure 18 - Recovery processes incorporated in the supply chain (Source: Hillegersberg *et al*., 2001)

The costs and other implications of managing product returns can be problematic for retailers. Some retailers, particularly the larger chains, manage returns themselves, while others control the management of returns in a cost-effective and efficient manner by outsourcing these responsibilities. Third party logistics suppliers (3PLs) provide multiple, integrated logistics services, such as transportation, warehousing, cross-docking, inventory management, packaging, and freight forwarding. Some third parties solely promote reverse logistics as their core competence, offering specialised expertise, facilities and systems, and often offer alternative channels of disposition from the traditional ones available.

The failure of some 3PLs to move beyond their core commodity service to become true multi-service providers has led to the emergence of 4PL service providers, which

[16] www.thereturnexchange.com

is a business process outsourcing (BPO) provider; “a supply chain integrator that synthesizes and manages the resources, capabilities, and technology of its own organization with those of complementary service providers to deliver a comprehensive supply chain solution” (Mukhopadhyay *et al.*, 2006). Other management systems (e.g. warehousing) can also help to alleviate the problems associated with returns (Parvenov, 2005).

As legislation such as the WEEE directive comes into force, and organisations have to be able to deal with an increasing volume and variety of returns, there are opportunities for the small or medium-sized retailers to cooperate with other organisations to create sufficient volumes to justify the development of reverse logistics programmes (Shih, 2001).

Other ‘non-traditional’ secondary channels to markets are becoming more prevalent (DfT, 2004b); the growth of online auction sites such as EBay has given a new lease of life to products that might traditionally have entered the waste stream.

It is suggested (Dowlatshahi, 2000; DfT, 2004b) that if organisations managed product returns holistically, with an integrated supply chain approach, then the current levels of returns would be reduced significantly, and would lead to enhanced profitability for retailers, and have a positive effect on sustainable distribution.

Carter *et al.* (1998) proposed a hierarchy of disposition (Figure 19) which suggests that resource reduction – the minimisation of materials used in a product, and the minimisation of the waste and energy achieved through the design of more environmentally efficient products – ought to be the goal in the reverse logistics process. Consequently, both the forward and reverse flows of materials will be minimised.

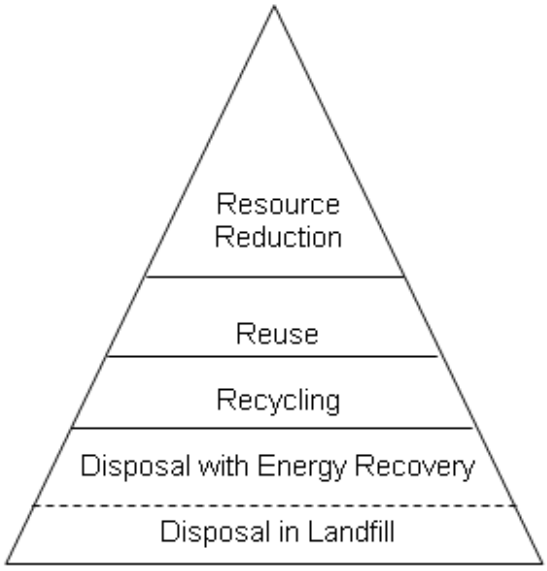



Figure 19 - Hierarchy of product disposition (Source : Carter *et al.*, 1998)

This approach is adapted in later literature (DfT, 2004b), where in order to minimise the impact of product returns, a simpler hierarchy of product disposition is suggested:

- Reduce
- Reuse
- Recycle

*Reduction* of returns could be attained through better management of the supply chain.
*Reuse* of returns will maximise their asset value through effective refurbishment programmes.
*Recycling* refers to the best route for material recovery of products that cannot be re-sold. Products that cannot be managed through these three elements will enter the waste stream.

In order to be effective in utilising this hierarchy of disposition, organisations should aim to adopt the following management approaches:

- Integration
- Collaboration
- Evaluation

*Integration* embraces supply chain strategy, network infrastructure, process management and outbound/inbound logistics. *Collaboration* embraces asset management, specialist service providers, shared services and competitors. *Evaluation* embraces sustainability, cost and performance measures. Utilisation of a framework involving these elements will provide an opportunity for retailers, together with other parts of the supply chain, to work towards the objectives of economic performance and sustainable development.

Guide *et al.* (2003) highlight the alternative approaches to obtain used products from consumers for reuse. The *'Waste Stream Approach*' relies on diverting discarded products from land-fill by making producers responsible for the collection and reuse of their products. The *'Market-Driven Approach*' relies on end users returning their products to a firm specialising in their reuse. End users are motivated by financial incentives, such as deposit systems, credit towards a new unit, or cash paid for a specified level of quality. A combination of the market-driven and waste stream approaches is also possible. Product returns may be mandated or encouraged by legislative acts, but firms may still encourage the returns of products in known condition by offering incentives.

The authors go on to propose a three-stage closed-loop hierarchical model framework to aid in the designing, planning and controlling of logistics and related activities. The model allows a planner to investigate which method(s) of product returns is the most profitable.

Beamon (1999) suggested that organisations must develop procedures that focus on operations analysis, continuous improvement, measurement, and objectives, including the following tasks:

- **Identify processes.** For each product within the supply chain, identify all inputs, outputs, by-products, and resources.
- **Develop a performance measurement system.** Given the complexity of most supply chains, a single performance measure will likely be inadequate in assessing the true performance of the supply chain. Thus, a system of performance measures will be necessary. Such a performance measurement system must include measures for the three environmental categories given above, as well as existing operational measures.
- **Measure the supply chain system.** Calculate the actual composite performance at each step in the supply chain process for each product. The composite performance, as calculated at each supply chain process step, will be a function of the performance measures.

- **Prioritise.** After all processes for all products have been measured, prioritise the process steps in order of increasing composite performance.
- **Develop alternatives and select approach.** Develop alternatives for performance improvement (targeting first those process steps exhibiting the worst composite performance, based on prioritisation), and select a preferred approach.
- **Establish auditing and improvement procedures.** Establish schedules and procedures for auditing and continuous improvement, including emergency and non-compliance procedures.

Rogers *et al.* (1999) also focus on the process of monitoring returns: "one of the biggest challenges facing firms dealing with reverse logistics is a lack of information about the process … Poor data collection leads to uncertainty about return causes. In the long run, the most valuable outcome of sound reverse logistics management is the accumulation of data."

***Product recall***

In August 2007, US toymaker Mattel recalled around 20 million toys worldwide, just one of several examples of product recalls at this time, including toothpaste, pet food, laptop batteries, spinach and contact lens solution (Kator, 2007). The implication of such large-scale product recall is that a great deal of unexpected material is being transported back up the supply chain. However, if efficient reverse logistics practices are already in place, the impact would have been similar to the post-Christmas returns spike. Although it is comparatively easy to track pallet-loads of goods returning to a distribution centre, a more difficult task is to monitor individual items returning through the postal system from consumers.

## *3.5 Reverse logistics in the urban environment*

In the literature available on logistics in an urban environment, or 'City Logistics', to which it is often referred, little mention is made of reverse logistics. City logistics implies that goods transport to the inner city is consolidated in a distribution terminal outside the city (e.g. urban consolidation centres - see section 2.2) and thereafter distributed by one logistics provider to urban areas (DfT, 1999).

Environmental impacts of logistical activities are most severe when population densities are highest; i.e. in cities. Urban freight transport deals largely with the distribution of goods at the end of the supply chain, so deliveries are likely to be frequent, but limited to carrying small loads. Possibilities for the extension of the traffic infrastructure within cities are limited and unsustainable.

Taniguchi *et al.* (2003) proposed three basic pillars as the guiding principles for green city logistics: mobility, sustainability and liveability (Figure 20). These pillars ought to support and enhance the goals and objectives of logistics, such as efficiency, congestion alleviation and energy conservation. The harmonization of efficiency, environmental friendliness and energy conservation is vital for ensuring sustainable development of freight transport in urban areas (Geroliminis and Daganzo, 2005). Thus, the goal of city logistics should be to deliver and collect the goods for activities produced in a city in an efficient way, without disrupting the sustainable, mobile, liveable and environmental friendly character of the city.

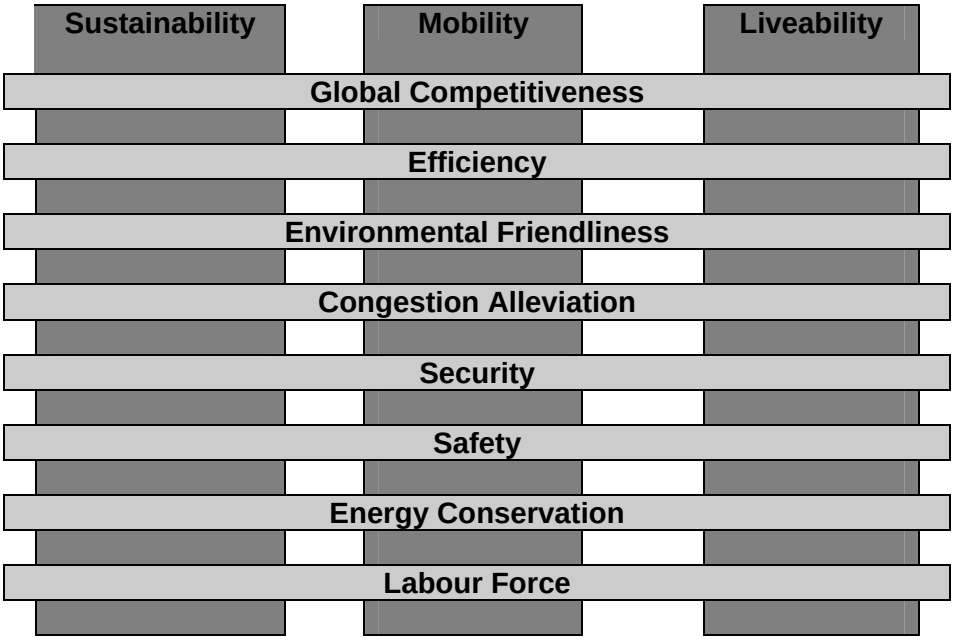


Figure 20 - Structure of visions for city logistics (Source: Taniguchi *et al.*, 2003)

The environmental impact of the transportation requirement of logistics can be alleviated somewhat by consolidating freight (section 2.2) and balancing 'back-haul' movements (section 2.1.1) (Shakantu *et al.*, 2002). Making use of spare capacity on the return leg of a delivery journey makes more efficient use of valuable resources such as fuel and driver time by finding loads that need to be shipped between similar areas as those visited by the returning vehicle. Higher load balance helps reduce the number of empty trucks on the road, alleviate traffic congestion and cut down pollutant emissions (DfT, 2005).

Geroliminis and Daganzo (2005), in particular, presented several examples of sustainable city logistics and green logistics schemes that have been used in various cities around the world (Figure 21), and while these largely focussed on the delivery of goods, many of the innovations and ideas could be applied to the reverse logistics process.

| Category | Implemented Policy |
|---|---|
| Restriction zones | 1. Copenhagen - City Goods Ordinance for capacity management |
| | 2. Sweden - Environmental Zones |
| | 3. UK - Low Emission Zones |
| | 4. Brussels – Lorry dedicated routes |
| Clean vehicles | 5. Rotterdam - Electric Vehicle City Distribution System |
| | 6. Osaka - Electric Vans |
| | 7. Zurich-Cargo Tram |
| Coordinated transport | 8. Berlin - Goods Traffic Platform (Public Private Partnership) |
| | 9. Stockholm - logistical centre for coordinated transports |
| Congestion mitigation | 10. Barcelona - Multiple Use Lanes; on line parking information |
| | 11. Paris, Barcelona, Rome - Night delivery schemes |
| Charging | 12. London Congestion Charging |
| | 13. Germany - Truck Toll System |
| Information systems | 14. New York and Vancouver - Internet Port Information Systems |
| | 15. Tokyo – Advanced Information Systems |
| Water use | 16. Amsterdam - Floating Distribution Centre |
| | 17. Venice - Waterborne traffic management decision support system |

Figure 21 - “Green” logistics schemes (Source: Geroliminis and Daganzo, 2005)

The EC’s *Urban Freight Transport and Logistics* brochure gives an overview of research from the Fourth and Fifth Framework programmes, together with policy implications and requirements for future research (EC, 2006).

One outcome of the “Best Urban Freight Solutions” project (BESTUFS, 2003) was a series of recommendations on the following themes:

- Statistical data, data acquisition and analysis regarding urban freight transport
- City access, parking and access time regulations and enforcement support
- E-Commerce and urban freight distribution (home shopping)
- Road pricing and urban freight transport
- Urban freight platforms (single company platforms, freight villages, urban distribution centres)
- Intelligent transport systems
- Public Private Partnerships

Building on the structure and experience gained from this project, BESTUFS II aims to strengthen and extend the promotion and dissemination of “City Logistics Solutions” in Europe and beyond, e.g. by establishing new links with other networks, groups and other international experts that interface with urban freight transport issues (BESTUFS, 2006). A BESTUFS Best Practice Handbook on waste transport logistics in urban areas was published in 2005. This considered the important but often overlooked issue of waste disposal and treatment in urban freight transport. The Handbook contains an overview of approaches to urban waste transport in different countries as well as case studies of urban waste transport initiatives (BESTUFS, 2005a). A BESTUFS workshop on “Urban Waste Logistics” was held in Vienna in March 2006; this included presentations about the use of rail, water, and

hybrid vehicles in waste logistics as well as case studies of Graz, Madrid, London and Zurich (BESTUFS, 2005b).

## *3.6 Networks for reverse logistics*

There are a variety of delivery models, as outlined in section 2.1; a number of types of networks for reverse logistics can also be identified. Halldórsson and Skjøtt-Larsen (2007) identify the two reverse supply chain 'extremes' – at one extreme, there is the centralized reverse supply chain, whereby one organisation has responsibility for collection, inspection, disposition and redistribution of returned items. At the other extreme is the decentralized reverse supply chain, which consists of multiple organizations involved in all these processes. Between the two extremes are various hybrids.

Four basic physical network types for retail organisations to handle returns were identified by the authors of *The Efficiency of Reverse Logistics* study (DfT, 2004b). Different elements of each of these basic forms might be utilised by retailers to obtain a full solution to their returns management issues:

**Type A: *Integrated outbound and returns network***

Utilising backhauling, a company's own fleet or distributor takes returns from retail outlets to the regional distribution centre (RDC). The sortation and potential refurbishment processes are carried out at the RDC. This works well if the frequency of delivery to stores is high, and volume of returns is also high.

One of the earliest successful cases of this type of reverse logistics network was at Estée Lauder in the US. Having previously been simply sending to landfill about $60million per year's worth of returned cosmetics, the company invested around $1.3million in a reverse logistics software system to help manage these returns. As a result, the company was able to recover in the first year more than all the money invested, through reduced staffing and other costs, and cutting the volume of destroyed products in half (Caldwell, 1999).

Another more recent example is given in *Efficiency of Reverse Logistics* (Dft, 2004b), where one of the case studies focuses on an unspecified general merchandise retailer with stores throughout the UK, both small and very large outlets, together with a home shopping operation. A liberal returns policy offers customer confidence, but does lead to a higher level of product returns.

The structure of part of the supply chain is shown in Figure 22.

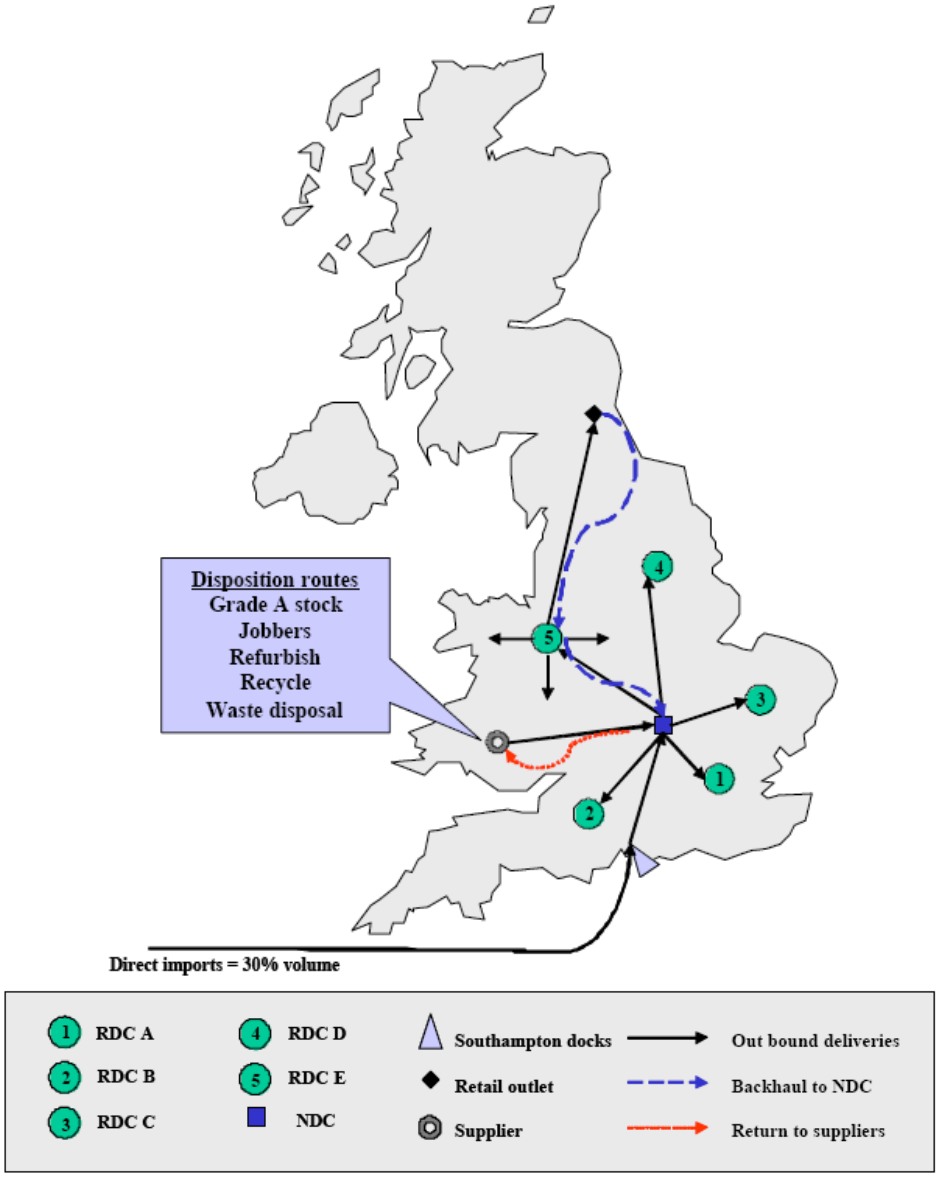



Figure 22 - Distribution and returns network – General Retail Merchandiser (Source: DfT, 2004b)

Around 90,000 products are returned each week. These returns are generally backhauled from stores to a national distribution centre via regional distribution centres, often by the company's own vehicle fleet, although some of this transport activity may be carried out by a third party haulier. Transport costs are estimated to be around 40p per item, but with no specific budget in store to allow returns management, almost all stock is returned regardless of the damage level; only around 20% of returned goods are found to actually be faulty

**Type B: *Non-integrated outbound and returns network***

A separate network is used for managing returns, typically a third party logistics supplier (3PL) taking returns (on an 'as and when required' basis) from stores to a separate location where the reverse logistics activities are undertaken by the retail organisation. This works well if the level of returns varies in volume but is generally low.

An example similar to this type of network is used as a model for a voluntary take-back program for power tools in Germany (Klausner and Hendrickson, 2000). Five years after its inception, 13 of the 33 major German power tool manufacturers were involved in the scheme, whereby customers could return old power tools to a dealer, who would contact a third-party logistics provider once a box of around 200 tools was ready for collection. The tools are then taken to a processing facility, where they are appropriately catalogued, disassembled, and materials recycled where possible, at a net take-back cost to the manufacturer of around 6% of the unit revenue. Thus, if return rates increased, either through more stringent legislation or wider-ranging advertising, the free-to-consumer system would no longer be viable. The authors propose a model whereby greater revenue is gained through the remanufacturing and recycling process by implementing an electronic data log, enabling product degradation to be monitored and reusable parts to be readily identified by firms who would buy back products near their end-of-life.

**Type C:** ***Third party returns management***

Total management of returns is outsourced to a third-party contractor. The retailer benefits in that no expertise is required to be developed in-house – the 3PL provides the necessary returns management processes, with supporting technologies and refurbishment and disposition programmes.

An example of this type of network is the home delivery arm of Argos, the UK's leading general merchandise retailer, with 670 stores in the UK and Republic of Ireland, and annual sales of around £3.8bn (Spooner, 2007). Many of the goods purchased are delivered directly to the customer via the home delivery service, Argos Direct, which is managed by DHL Exel Supply Chain (DESC) who have responsibility for the four distribution centres (DCs) and 34 out-bases, as well as home delivery across UK & Ireland.

Of the 90,000 goods delivered per week (DHL, 2007), returns account for 6%; nearly half of these returns are due to late cancellations by the customer, and a further quarter are due to the customer not being at home to receive the goods. Returned products are sorted for various dispositions: back to stock, if the packaging is unopened; returned to supplier; disposal; several types of jobbing (mainly if the product has been sourced from outside the UK). DHL carry out all the sorting, preparation, listing and out-loading activities.

**Type D:** ***Return to suppliers***

Goods returned to the suppliers are exchanged for credit. Retailers have little responsibility for returns in this scenario. However, there may be additional costs in terms of vehicle kilometres, as the goods have to return to the supplier before disposition.

## *3.7 Innovative solutions to managing returns / reverse logistics processes*

As part of the focus on environmental sustainability, and the need to reduce waste and carbon emissions, a number of potential solutions in a variety of areas have

recently emerged, including alternative strategies to manage returns or retail-generated waste; use of new vehicle technologies and routing strategies; changes in the transport infrastructure; supply chain coordination; and use of information and communication technologies all can be used to reduce the impact of returns and waste.

### 3.7.1 Alternative methods of managing waste or returns

Companies which specifically target different types of waste or returns generated in the retail and business environment have recently been formed. Details of some of these are given below.

***Dove Recycling***

Dove Recycling (www.doverecycling.co.uk), formed in July 2005 and based in Hampshire, aims to help businesses reduce their waste through a tailored collection system. Typically, businesses are charged a collection fee for which they receive weekly or fortnightly collections, depending on their needs. The waste is transported to their premises where it is bulked into containers and then disposed of at a local recycling site. While this system was being trialled, an electric powered vehicle, supplied by Hampshire County Council as part of the EC-funded MIRACLES project, was used to transport the collected cardboard and paper recyclate. While this vehicle is still available to the scheme, traditional vans are also used.

***FareShare***

FareShare (www.fareshare.org) is a national organisation that works with over 100 food businesses, wholesalers and retailers (e.g. Greggs, John Lewis, Waitrose, Somerfield) to reduce the amount of food waste sent to landfill by redistributing surplus fresh food to day centres and night shelters for homeless people.

The scheme, started in June 2002, consists of 8 independent franchisees around the country (London, Brighton & Hove, Dundee, Edinburgh & Lothians, West Yorkshire (Kirklees), Manchester, Southampton and South Yorkshire (Barnsley)), with further expansion currently planned. According to the FareShare website, 2000 tonnes of food was saved from being wasted during 2005. This food was then redistributed, along with other food-related support services, to a community food network of 300 organisations. This food contributed to over 3.3 million meals to 12,000 disadvantaged people each day in 34 cities and towns across the UK. The claim is made that the businesses involved reduced $CO_2$ emissions by 13,000 tonnes. However, it is likely that these savings will be offset somewhat by the vehicle kilometres travelled in the distribution process.

***Auction Assist***

Aiming to help people or businesses who may want to sell goods or stock on the internet, but do not have the technical abilities, Auction Assist (www.auctionassist.co.uk) offers an auctioning service on eBay. Items are

taken to a local Auction Assist centre, either by the prospective seller, or via arranged collection by ParcelForce. From the auction centre the items are sold to the highest bidder on the internet site, and sent to the buyer from there. Any proceeds are sent to the original owner. It is unclear how this method of disposal would affect the number of kilometres travelled, since journeys to the auction centres would not normally have been made. However, items sold through eBay still need to be sent to the purchaser via traditional methods. Research would need to be undertaken to determine its effect on the transport system.

***RASCAL***

RASCAL is described as the most comprehensive in store newspaper and magazines returns processing system in the world (http://www.rascal-solutions.com **)**. A PDA is used to store product information including the title of the magazine, on and off sale dates and the stores supplying the wholesaler. Titles that are due for return are scanned and the PDA provides information on the wholesaler that the goods should be returned to. Such information is transmitted to the RASCAL database website, and on receipt of returned products the wholesaler is required to transmit a credit from its system. The system which is used by a range of high street retailers including Tesco, Sainsburys and One-stop provides them with an effective tool to track all returned stock.

The following schemes are not necessarily applicable to the retail sector, but some of the ideas and methodologies behind the schemes could be transferable to urban retail returns management in the future.

***Waste Interchange Ltd***

The Waste Interchange (www.wasteinterchange.co.uk) is an online tool that links recycling companies to those businesses that have materials that they wish to dispose of. Businesses can list materials they have available which can subsequently be viewed by registered recycling companies. Updates are sent to recyclers as new materials are registered online and they can also list what materials they require.

***Furniture Re-use Network (FRN)***

The Furniture Re-use Network (http://www.frn.org.uk/) is the national co-ordinating body for around 400 furniture and appliance re-use and recycling organisations, which exist across the UK. The objectives of the network are to offer support and training to these organisations, and to reduce poverty by helping needy households access furniture, white goods and other household items at affordable prices. During the financial year 2005-06, the network helped around 500,000 low income households, re-used 1.9 million items, which diverted around 65,000 tonnes of waste from landfill (FRN, 2007).

This growing sector is now able to reprocess electrical items in line with Waste Electrical & Electronic Equipment (WEEE) regulations and is developing partnerships with local authorities to collect bulky waste.

***Fonebak***

It is estimated that around 15 million mobile phones are replaced each year in the UK. The main channels for disposing of mobiles are the shops that sell them, and there are a number of schemes which offer a

mobile phone recycling service, many set up recently to help businesses and consumers comply to WEEE legislation. One such organisation, established in 2000, is Fonebak (www.fonebak.com), with over 1000 clients representing every network operator in the UK and many major networks, retailers (e.g. Currys Virgin, Dixons and PC World), manufacturers and charities across Europe. With around 10,000 phone collection points across Europe, they have collected over 3.5 million phones since 2002. They also offer a reverse logistics service, which manages the collection of mobile phones and accessories from over 2000 outlets throughout the UK.

***Computer Aid International***

Re-using a computer is around 20 times more effective at saving lifecycle energy use than recycling (Young, 2007). Computer Aid International (www.computeraid.org) is a charitable organisation which aims to provide high quality, professionally refurbished computers for re-use in education, health and not-for-profit organisations in developing countries. The organisation has shipped over 90,000 PCs, mostly distributed to schools and colleges with the active support of host governments of around 100 countries. However, there are around 3 million PCs decommissioned in the UK every year.

***Redpack***

The use of pick up and drop off points is familiar to many field service engineers in the US and mainland Europe, however this practice is less prevalent in the UK, partly due to poor execution by service providers. A US parts logistics provider, RedPack Network Inc (www.redpackit.co.uk), has recently acquired the assets of Collectpoint, which formerly offered a consolidation-based delivery and returns network. One aspect of the current system is that service parts can be returned to the appropriate depot via a local Redpack location, with the aim of consolidating returns and reducing the total vehicle kilometres associated with the management of these returned parts, with the advantage of liberating engineers' time for jobs rather than travelling. While this is a B2B (business-to-business) network specific to the service engineer industry, there are parallels with retail returns, and it might be possible for a cross-retailer returns consolidation scheme to use the same network and technologies.

## 3.7.2 New vehicle technologies

The implementation of new vehicle technologies could offer potential benefits when incorporated into the reverse logistics process.

***FIDEUS***

The EU-funded FIDEUS project (Freight Innovative Delivery of Goods in European Urban Space) "aims to provide a complementary set of vehicle solutions to support an innovative approach to the organisation of urban freight transport, in line with political strategies to safeguard the 'liveability' of cities, while being compatible with efficient logistics". One aspect of the project is the use of three new vehicle types, including an innovative small electric transporter for sensitive areas and pedestrian zones, as shown in Figure 23.

Figure 23 - Electric transporter for use in FIDEUS

***Cargotram and E-Tram, Zurich***

Cargotram, a scheme introduced in Zurich in March 2003, consists of two trailers which have been converted into a mobile rubbish collection station. In March 2005 the tram was making nine stops around the city on a monthly basis (Figure 24). The main objective was to move waste collection away from the road and as close to the clients as possible, and also to provide facilities at a time when the working population was not at work. The system resulted in a more cost effective, faster and environmentally friendlier alternative to the traditional waste collection system, with added benefits of reducing congestion.


Figure 24 - Cargotram in Zurich

E-Tram, introduced in January 2006 aimed to collect unwanted electrical and electronic appliances from the same nine pick-up points as Cargotram but on different days. E-tram staff sort objects into different bins as they are received, whereas in Cargotram they are stowed for later processing.

Other freight trams are proposed for use in Paris, Dresden, Amsterdam and Vienna.

### 3.7.3 Supply chain coordination

Coordination and collaboration between different supply chain owners could result in greater efficiency in the reverse logistics process.

***Collaborative green distribution***

In 2005, as part of the continued effort to increase collaboration between retailers and their suppliers, a project was initiated under the sponsorship of ECR UK (Efficient Consumer Response UK) to look at the various aspects of 'collaborative green distribution' (IGD, 2007). The workgroup's objectives were to investigate different ways retailers and suppliers could work collaboratively to reduce transport costs, improve efficiencies and equally importantly, improve the 'green' credentials of the UK food & grocery retail industry. The project aimed to see whether further transport efficiencies could be achieved by trying to optimise transport across a network of retailers and suppliers in a collaborative way.

At its inception, three potential ways of increasing transport collaboration were explored:

- *Collaborative multi-partner trunking* – looking at whether trunking (the internal transfer of product between sites within a company) opportunities could be expanded to networks of trading partners to reduce empty transportation legs.
- *Shared conurbation deliveries* – whether multiple partners could come together to use a shared common fleet servicing conurbations.
- *Shared deliveries to far flung places* – looking at ways transport networks servicing stores and consumers away from conurbations could be improved.

Opportunities were perceived as follows:

- Mixing-up the transportation networks of grocery and non-grocery retailers with their combined supplier bases allows imbalances of flows to be addressed and empty loads eliminated.
- Similarly, when aggregating flows, new distribution points become economic.
- Finally, the process forced companies and their trading partners to address transport efficiencies on an individual, or one-to-one, basis.

However, certain barriers were also recognised, including a lack of standards, particularly relating to pallet size, and business models for the carriage of another party's goods. The lack of delivery flexibility and widely differing processes involved was also cited as a potential problem.

Two case studies are included in this report. Eddie Stobart Ltd (ESL) and Coca-Cola Enterprises (CCE) collaborated together by observing that the ESL fleet delivering raw materials to one of the CCE sites, had been running empty back to the point of origin. By investing in larger vehicles, and altering some aspects of the structures at the depots, and managing the loads to be transported more effectively, it was possible to gain long-term benefits, improving the efficiency of both companies.

Another collaboration with CCE was that of Alliance Boots plc. Boots network strategy had been based around a national hub at Nottingham, which enabled a quick and responsive service to a number of regional depots. However, an opportunity was identified that would enable delivery of 500ml bottles of soft drink from CCE production warehouses directly to the Boots regional depots, alleviating

the need to consolidate stock through the Boots national warehouse. Transport and handling costs for both parties were decreased as a result of this collaboration. Other possible opportunities included simpler backhaul arrangements between the two distribution operations, but due to different vehicle types being used, this could not be taken forward.

***Berlin 'goods traffic platform'*** [17]


Within Berlin's city limits, 45 million tonnes of goods are distributed by trucks and smaller delivery vans each year, with an expected future increase in these figures. A 'goods traffic platform' (what we would call a freight quality partnership (section 2.3)) has been developed in an ongoing project which aims to reduce the frequency of freight deliveries through cooperation between various actors and stakeholders (including local administrative bodies, shopkeepers, the police, local chamber of commerce, etc.). Measures include:

- Reducing the number of deliveries, either through co-operation between various recipients (with adjacent shops being supplied by the same carrier) or a combination of deliveries to a single recipient.
- The designation of special delivery zones. Key zones are clearly designated with a zigzag line on the road and a "no stopping" sign preventing any parking by private cars.
- Redesign of junctions with improved control of traffic lights and alterations of turn-off tracks.

In the future, additional measures like the improvement of the logistics of buildings in co-operation with architects and stress analysts shall be implemented. Results indicated that goods traffic platforms (FQPs) are successful tools, as they contribute to the reduction of congestion during loading or unloading of vehicles.

***Logistical centre for coordinated transport, Stockholm***

As part of the Trendsetter project, a logistical centre for coordinated transport in the new city district Hammarby Sjöstad, in Stockholm, was set up in the beginning of 2003. The aim was to reduce energy use and $CO_2$ emissions through coordinated transport to the district residents, municipal institutions such as schools, day-care and elderly-care centres, as well as private companies operating in the district.

The centre is responsible for delivery of on-line purchased daily goods, dry cleaning services, and distribution of food and beverages. Furthermore it has the potential of becoming Sweden's first integrated distribution system for locally produced food directly from approximately 300 local farmers. Feasibility studies based on surveys of attitudes showed a great interest in using the logistics centre. Besides the reduced environmental impact of transports, other external positive effects include enhanced traffic security, an increased level of service for residents, and improved availability for locally produced food.

## 3.7.4 Information and communication technologies

[17] http://www.managenergy.net/products/R937.htm

The emergence of e-commerce as a new retail channel is one of the major manifestations of the internet. Retailers are able to sell products and services directly to consumers without the need to establish a physical point of sale. Some products, such as airline tickets and music CDs, can be delivered digitally to the end consumer, but most products purchased online must be physically transported to the end-user. A reliable, efficient delivery system is an essential element for gaining customer loyalty online, and subsequent profitability. Home delivery is increasingly a key element in e-commerce.

The impact of e-commerce on business-to-business interaction, especially in the area of supply chain integration, is also likely to be a significant development (Lee and Whang, 2001). Generally, the consequences of e-commerce on green logistics and reverse logistics are little understood, but some trends can be identified. Physical distribution systems are changing as a result of e-commerce becoming more accepted and used. Retailing distribution is disaggregated, and the trend towards consolidation has reversed (Rodrigue *et al.*, 2001).

It is unclear, however, how these new technologies will impact on the reverse supply chain. Since products are more likely to be returned in an environment of greater e-commerce, there is a direct impact on the amount of products moving up the supply chain. Traditionally, shoppers have borne the costs of moving goods from the retailer to home, but with e-commerce, this aspect of the supply chain is integrated in the freight distribution process. The result potentially involves more packaging and more tonne-kms of freight transported, particularly in urban areas.

There are several problems associated with faulty or damaged goods that are delivered to customers' homes, including: who is responsible and will pay for the damage, the additional transport requirements and costs involved to remove the goods and then deliver replacement goods, and the inconvenience caused to the customer in achieving a resolution to any dispute and the delay in receiving the goods purchased. The market for managing the return of goods is growing as the pace of e-commerce retail sales accelerates. While the historical rate for returning merchandise is about 5%, some estimates suggest that online-driven products realize return rates in excess of 30% (Park *et al.*, 2004).

One of the major tasks in the planning of reverse logistics activities is to be able to manage the uncertainty inherent in systems involved in product recovery and reuse, where used products are a far less homogeneous and standardised input resource than traditional raw materials and new parts. Modern information technology can play an important role in dealing with this uncertainty (Fleischmann *et al.*, 1997; Lee *et al.*, 2001; Kokkinaki *et al.*, 2002, De Brito *et al.*, 2002, Jun *et al.*, 2006). However, Mortensen and Lemoine (2005) found that no information technology tools were being utilised to support the coordination and integration of the reverse logistics activities in five out of six typical supply chain case studies.

Enabled by Web technology, there are significant advances in information exchange, particularly between different actors in the supply chain. Kokkinaki *et al.,* (2002) suggest that Web technology and e-commerce contribute to more efficient returns handling in four major directions:

**Proactive minimisation of returns** – increased efficiency of forward logistics using on-line tracking and tracing; selecting an appropriate product mix for the target market using web-accessible databases; 'gatekeepers' for on-line purchases which aim to minimize returns due to misunderstanding of product functionality, and 'no fault found' returns;

**Minimisation of returns' uncertainty** – when customers declare a return, they are directed to a Web interface that collects data on the condition of the product, the intended collection method, the time and the place of the return;
**Returns and third party logistics operators** – 3PL are often employed to provide end-to-end process management for returns as they can make more money out of it than businesses themselves. Increasingly 3PL offer Web-enabled applications with real-time access to data across their customers' reverse supply chain;
**Consolidating returns channels** – exploiting the Web, Original Equipment Manufacturers (OEMs) consolidate their channels of returns into a central stream. In a sense, these sites operate as electronic outlets that are owned by the OEM and aim to redirect their returns back to the market swiftly.

The general aspects of e-commerce for reverse logistics are shown in Table 16 (Kokkinaki *et al.,* 2000). The authors identify electronic marketplaces as the most prominent e-commerce model for the support of reverse logistics activities.

| E-Commerce Applications | Reverse Logistics Tasks |
|---|---|
| Marketing | Advertisement of available used products, parts or material |
| | Notification of used products, parts or material, currently sought |
| Purchasing | Search for suppliers/customers |
| | Making purchasing commitments |
| | Receive information of expected delivery |
| | Respond to request for sought used products, parts or materials |
| Sales | Price setting (i.e. fixed, negotiations, auction) |
| | Order processing |
| | Tracking and tracing orders |
| | Customer invoicing, collection and payment |
| Post Sales/Service | Product tracking |
| | Customer support |
| | Customer/product monitoring |

Table 16 - E-Commerce relation to reverse logistics (from Kokkinaki *et al.*, 2000)

White and Daniel (2003) consider three types of cooperative alliances likely to be forged between differing electronic marketplaces – the merger between previously separate marketplaces; the acquisition of one marketplace by another; and the formation of an interoperability between existing marketplaces. The reasons such alliances are likely to form are to increase access to trading partners, to make available a greater range of services to the consumer, and to enable multi-tier supply chain integration.

An electronic logistics marketplaces (ELM) is a specific electronic marketplace model, acting as an intermediary facilitating the exchange of logistics services. Thus, ELMs can be considered to be the electronic hub using web-based systems linking shippers and carriers together for the purpose of collaboration or trading (Wang, *et al.*, 2007). A basic ELM is normally composed of three key parties: shipper, carrier and technology provider with the primary objective of reliable delivery. Customers may also have access to an ELM, and other parties, such as freight forwarders and financial service providers may also be involved.

There are two types of ELM – open and closed marketplaces. Open ELMs have no barriers to entry for shippers and carriers. One example of such a marketplace is an on-line freight exchange for the spot trading of transport services. Hauliers and truck drivers can search online for available freight, or post their available transport capacity, enabling haulage companies and couriers to have a cost effective and efficient means of locating outbound, return loads and regular work for their vehicles.

In the UK, TeleRoute (www.teleroute.co.uk) is such an ELM offering loads and vehicles across Europe. Users are requested to enter appropriate details (such as regions of departure and arrival, date of loading, weight and length of vehicle), and are then given the opportunity to contact one of the offers available at that time. The user is charged only when contact details are requested.

A similar service is offered by Truckspace (www.truckspace.co.uk), but they also give details of storage requests and offers. As well as users offering haulage space, requests can be made by fax and SMS, removing the requirement to access the Internet using a computer. Another company, FreightAlerts (www.freightalerts.co.uk), allows users to access information about possible haulage exchanges, but also give details of couriers for the transport of much smaller items.

Examples of businesses offering similar services in the US include The Cargo Marketplace (www.cargosphere.com), which offers details of transporting goods by sea and air transport as well as by road. Further airfreight exchange details are available from GF-X (www.gf-x.com).

These a just a few examples of open electronic logistics marketplaces, but as Wang *et al.* (2007) point out, the development of closed ELMs was prompted by the increasing need for shippers to retain linkages with preferred business partners, enabling more complex services to be offered, that might encompass complete order fulfilment services, including the management and handling of returns. However, the authors also highlight the fact that there has been limited research on closed ELMs, and in particular there is a lack of empirical studies.

A further integration of the reverse logistics system could be through on-line auctions opening up the opportunity to dispose of returned goods to a variety of channels to market (DfT, 2004b). One example in the UK is Oxfam, which recently opened an online store, acting as an alternative method of selling donated goods, which have traditionally been sold in high-street charity shops. In 2000, the charity experienced a dramatic drop in profits (McMurry, 2000), acknowledging that problems with their traditional sales were largely due to higher retail costs, with increased competition for the goods they offered. With the opening of this internet shop, there will inevitably be consequences for the transport-related impact of the goods sold on-line, which will no longer be circulated in a relatively local area as previously.

## *3.8 Barriers to reverse logistics*

Despite the growing importance of reverse logistics practices, it is not free from barriers or challenges. Halldórsson and Skjøtt-Larsen (2007) argue that most logistics systems are ill-equipped to handle reverse product flows, as the methods of transportation, storage and handling are often very different from those used in the forward flow, and have cost implications as a result. They suggest the following challenges related to reverse flows have to be overcome:

- *Large variations in timing, quality and quantity of product returns* – resulting in difficulties in forecasting requirements and resource allocation
- *Lack of formal procedures for product returns* – dealing with unpacked products with little identification can be a time-consuming and potentially costly process
- *Delayed product returns causes reduction in market value* – for time-sensitive items, such as clothing, books and electronic equipment, the time-to-remarket is an important aspect of the returns process
- *Lack of local competence in inspection, evaluation and disposition of returns* – the presence of these competencies locally is an essential requirement in a decentralised returns network, in order for costs and vehicles kilometres to be minimised
- *Risk of cannabalisation of market for new products* – without the appropriate practices in place, there is a risk that products returned as new, or which could be sold to a secondary market would be disassembled and recycled instead
- *Lack of performance measurement of the efficiency of reverse logistics* – a commonplace feature of forward logistics channels, there is a need for similar metrics to be in place for the reverse flow.

These themes are largely reiterated by Ravi and Shankar (2005) in their review of the reverse logistics processes involved in the automobile industry, as follows:

- *Lack of efficient information and technological systems* – such systems used effectively at the product design phase can influence the recovery and reuse of returns. Tracking and tracing returns (using modern barcode techniques, or RFID) and linking to sales can support inventory management.
- *Problems with product quality* – while products in the forward supply chain tend to have a uniform quality, those in the reverse flow can vary, from unwanted (and untouched by the customer) to faulty or damaged. To facilitate efficient product disposition, screening or gatekeeping at the entry point into the reverse logistics flow, or at a distribution centre, for instance, could help alleviate some of the problems associated with the quality of product returns.
- *Company policies* – restrictions put in place to protect the quality of manufactured goods can have implications on the potential uses of returned products. The advent of extended producer responsibility and perceptions that involvement in environmentally friendly reverse logistics schemes could help promote their companies to the public, have meant that formerly rigid policies are now tending to change to acknowledge the relative importance of the reverse flow.
- *Lack of appropriate performance metrics* – without appropriate measuring tools, it is difficult to assess to impact of changes in the system.
- *Lack of training related to reverse logistics* – education and training a essential to the growth of a successful business. Training on new technological processes introduced as part of a reverse logistics programme needs to be implemented, alongside guidance on any other development and management issues arising.
- *Financial constraints* – although use of efficient reverse logistics systems has been shown to be cost effective, the financial implications of supporting the infrastructure, manpower and technological requirements can be a significant barrier.
- *Lack of commitment by top management* – efficient leadership is necessary for a programme to be successful, and top management should provide continuous support for the planning and implementation of reverse logistics.
- *Lack of strategic planning* – identifying reverse logistics goals and specifying long-term plans for their implementation, particularly in the rapidly changing environment, is another vital aspect of a successful reverse logistics programme.
- *Reluctance of the support of dealers, distributors and retailers* – the fact that the quality of product returns is likely to be highly variable, and that consumers may

take advantage of a liberal returns policy can lead to resistance on the part of some key actors in the supply chain to engage in such a system.

## *3.9 Assessment of reverse logistics requirements*

The development of the Reverse Logistics Self-Assessment Workbook (DfT, 2007b), has been undertaken for practitioners to carry out a review of their reverse logistics operations relating to retail return management, and to guide in helping to improve such programmes. Many of the issues and barriers highlighted above are addressed by the Workbook. The review approach follows eight stages:

*Planning*

1. **Identify the need** – estimate costs and benefits from undertaking a review
2. **Gain senior level buy-in** – provides top level commitment required to ensure credibility and support
3. **Identify reverse logistics champion and resources** – ensure successful project management and regular reporting

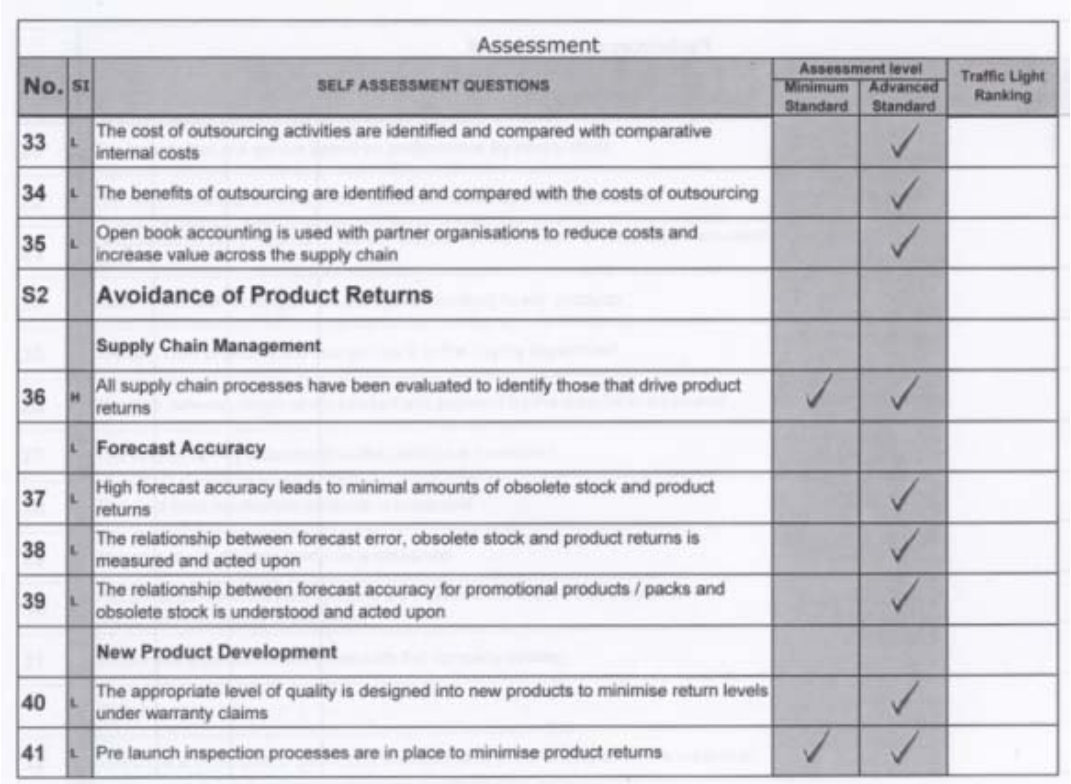
*Self-assessment*

4. **Define the level of assessment** – allow both exploratory and comprehensive reviews, two levels are available: minimum and advanced standard of assessment
5. **Conduct self-assessment** – workbook in Excel or hard copy
6. **Identify areas for improvement** – outputs are traffic-light performance measures; red and amber can be targeted

*Improvement*

7. **Utilise the project improvement process** – application of business improvement cycle (Define, Measure, Analyse, Improve, Control)
8. **Measure results and embed** – measure through cost benefit analysis

An example page of the self-assessment workbook is given in Figure 25.



| Assessment | | | | | |
|---|---|---|---|---|---|
| No. | SI | SELF ASSESSMENT QUESTIONS | Assessment level: Minimum Standard | Assessment level: Advanced Standard | Traffic Light Ranking |
| 33 | L | The cost of outsourcing activities are identified and compared with comparative internal costs | | ✓ | |
| 34 | L | The benefits of outsourcing are identified and compared with the costs of outsourcing | | ✓ | |
| 35 | L | Open book accounting is used with partner organisations to reduce costs and increase value across the supply chain | | ✓ | |
| S2 | | **Avoidance of Product Returns** | | | |
| | | **Supply Chain Management** | | | |
| 36 | H | All supply chain processes have been evaluated to identify those that drive product returns | ✓ | ✓ | |
| | L | **Forecast Accuracy** | | | |
| 37 | L | High forecast accuracy leads to minimal amounts of obsolete stock and product returns | | ✓ | |
| 38 | L | The relationship between forecast error, obsolete stock and product returns is measured and acted upon | | ✓ | |
| 39 | L | The relationship between forecast accuracy for promotional products / packs and obsolete stock is understood and acted upon | | ✓ | |
| | | **New Product Development** | | | |
| 40 | L | The appropriate level of quality is designed into new products to minimise return levels under warranty claims | | ✓ | |
| 41 | L | Pre launch inspection processes are in place to minimise product returns | ✓ | ✓ | |

Figure 25 - Self-assessment workbook sample page

# 4. Existing waste collection procedures

This section reviews the waste collection contracts available to retailers in terms of i) main companies servicing waste and recycling collections, ii) types of materials collected, iii) receptacles and vehicles used and iv) alternative procedures.

'Trade waste' has been defined as "the commercial element of municipal waste" and covers the waste products produced by retail establishments, offices, hotels and restaurants. Under section 34 of the 1990 Environmental Protection Act, commercial premises have a 'duty of care' to make satisfactory arrangements for their waste collection. Under the 'duty of care', businesses have a legal responsibility to ensure that waste is stored properly and that all waste collected is transferred to an 'authorized person', such as a local authority or waste contractor. The person collecting the waste must have a license and must issue a waste transfer note describing the waste type and origin. The waste transfer notes issued must be kept, by law, for a minimum of two years. The duty of care extends until the waste has been finally disposed of or has been fully recovered.

Local authorities who offer trade waste collections can do so as a separate entity, using a separate fleet of dedicated vehicles and hiring out their own bins to businesses as part of the contract (e.g. Southampton City Council). Others collect trade waste as part of the domestic residual round (e.g. New Forest District Council), where local traders register with the council and put waste out on specific collection days in specified sacks or bins.
Retailers (or any other commercial activity) wishing to separate recyclate from the waste stream need to find the most convenient mode of collection. Wastebook[18]

[18] http://www.wastebook.org/content.htm

provide a checklist for businesses looking for a suitable contractor to collect recyclate. The advice is summarised in Table 17.

Table 17 - Checklist for businesses looking for suitable waste contractor

| Checklist | Pointer |
|---|---|
| What materials do they take? | Check what materials they take - it may help if they take more than one type.<br>Check grades and types of materials. |
| What quantities do they require? | They will only collect if it is economic to do so.<br>They may only collect once a certain amount of material has been accrued. |
| Collection or delivery methods? | Distance from their depot and frequency they visit the area may be determining factors.<br>Local firms may want to recycle particular materials and may carry out a 'milk round' to several businesses.<br>Can you work with neighbouring businesses to save costs etc. |
| How can you maximise separation and storage of materials at your premises? | Contamination can make it difficult to recycle.<br>Check how materials must be separated.<br>Check on containers provided and whether baling is preferred.<br>Check space, limited space may result in contractor making more frequent visits (this will cost more). |
| Involving staff | Does company provide advice for staff.<br>Collections work better if members of staff are informed. |
| Payments / costs | Ask what contractors pay for materials or charge for collection (as with cardboard).<br>Costs must be weighed against existing disposal costs and environmental benefits of waste reduction.<br>Many prices for secondary materials are cyclical - establish what happens when the prices fall. |
| Subsidiary service | Subsidiary service may be offered, e.g. paper recyclers may have shredding services for confidential papers. |
| Contraries | It is important to identify the things that damage the recycling process and ensure that they are not in the materials collected. |
| Proof of registration | Check that the contractors are registered or exempt waste carriers. |

## *4.1 Waste collection contracts*

An analysis of recycling collection schemes has identified that there are two main options available to retailers. These consist of collections by commercial waste contractor and by local authorities.

### 4.1.1 Commercial waste management contracts

Within the UK, there are a number of national (e.g. Biffa, Sita, Onyx, Cleanaway[19]) and local waste management companies that provide a range of services to the retail sector. Larger contractors can frequently manage all of the retailer's waste management requirements through the integration of recycling with existing general waste collections. Other contractors provide a specialist service for the recovery of particular waste streams, for example Severnside, who solely collect and recycle cardboard.

Due to the number of waste contractors operating within the UK, it is not feasible to review all of the services available. Research conducted by the University of Southampton and Hampshire County Council, as part of the MIRACLES project[20], provides an overview of the waste management practices (e.g. number of bins used, frequency of collection and waste types produced) adopted within a high street setting. Surveys of 100 businesses in Winchester High Street were conducted to investigate the waste management practices and broader issues associated with commercial recycling collections. Only 32% of these businesses stated that they recycled. It is predicted that this low rate of participation was because 66% were using SERCO who did not provide any recycling services.

Five different collection companies were stated as being used by the 100 businesses. The main operator was SERCO, which was used by 66 businesses. The other operators (with numbers of users in brackets) were: Biffa (14), SITA (3), Cleanaway (2) and Onyx (1). In addition, 6 businesses said that a member of staff removed the waste while 8 businesses did not supply the information.

The results from the survey provide an indication as to the number of different waste contractors and vehicles that can be employed in commercial waste collection within a high street setting. Winchester High Street is compact with limited available road space, therefore vehicles collecting waste and recyclate would have a noticeable effect on traffic congestion.

SERCO, Biffa, SITA, Cleanaway and Onyx were all identified as waste contractors operating on Winchester High Street. An appraisal of the services provided to the retailer has been conducted in terms of i) materials recycled, ii) frequency of collection, iii) receptacles used and iv) cost of collection (Table 18).

***Materials recycled***

All of the waste contractors apart from SERCO facilitate the collection of dry waste and a wide range of recyclate. Cardboard and paper, plastic and glass (including confidential waste), which are representative of the retail waste stream, are the most common recyclates collected by waste contractors. Biffa and Cleanaway also provide services for electrical and electronic wastes and hazardous waste (e.g. fluorescent tubes and toner cartridges) collections (Table 18). With the implementation of the Waste Electrical and Electronic Directive (WEEE) (2002/96/EC) and Hazardous Waste Directive (91/689/EEC) there is an increased demand for separate collections of these waste streams. It is evident that Biffa, SITA, Cleanaway and Onyx all provide services for the collections of similar dry recyclates, therefore, theoretically, one contractor could service all premises on Winchester High Street (except those producing hazardous wastes and WEEE).

***Frequency of collection***

[19] Both Onyx and Cleanaway are now owned by Veolia Environmental Services
[20] http://www.winchestermiracles.org/

Waste contractors provide a flexible service where the frequency of collection is dependent on the needs of the individual retailer in terms of the quantities of waste produced and size of receptacle required. In addition to daily, weekly, fortnightly or monthly collections (and variations thereof), waste contractors also provide an on-demand service, where materials can be collected, as and when required, including next day call out. The flexibility of the service caters for the wide range of retailers' collection requirements.

The review of operations on Winchester High Street indicated that 56% of businesses had a weekly waste collection while around 40% had two or more collections a week; this information was not available for the other (4%) businesses interviewed (Figure 26).

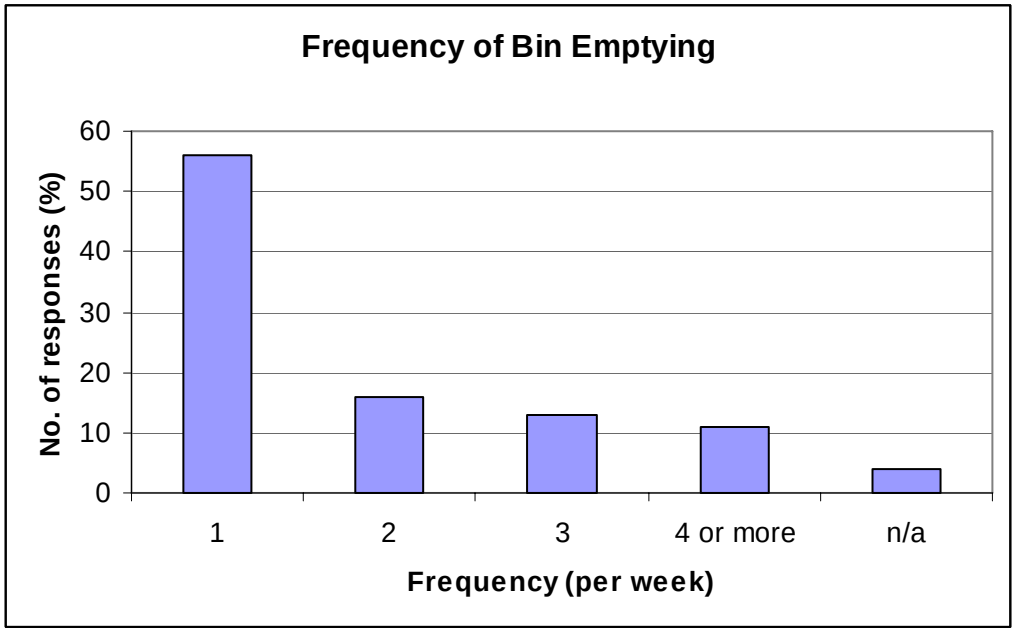



Figure 26 - Frequency of commercial waste collection on Winchester High Street

A study in Norwich and London showed that approximately a quarter of businesses received one waste collection trip per week, another quarter received two to five waste trips per week, and about one half received more than five waste trips per week. Three quarters of respondents used a single waste collection company, while one quarter use more than one. Separation of certain types of waste for recycling took place at 19 of the 52 premises that provided details of waste disposal. At nine of these 19 premises, packaging waste to be recycled was removed from the premises by core goods delivery vehicles (Allen et al., 2000).

***Receptacles***

All businesses setting up waste contracts are issued with bins as part of the service agreement. The type of receptacle provided by the contractor is typically dependent on i) the type of waste being separated, ii) quantity of waste produced, iii) available space, and iv) frequency of collections.

Sacks and small bins are provided for the in-store separation of paper and confidential wastes and also where there is not enough space for the allocation of bins. Of the businesses sampled along Winchester High Street, 30% used sacks to dispose of their waste, primarily for these reasons.

A wide range of bin designs (front and rear-end loaders, eurobins, skips which may be supplied with lockable lids) and sizes are available for bulkier recyclates which are typically stored outside in a designated area with general waste bins. For contractors providing collections for hazardous wastes and electronic and electrical wastes, the nature of materials requires special handling, storage and transportation. Hazardous waste is typically stored in special lockable, weatherproof and durable containers whereas electronic and electrical waste are required to be stored and collected in pallets or cages?.

The number of units stored is dependent on available space; contractors typically will provide collection for single or multiple units (1000s). The number of bins required by a retailer will be influenced by the number of different waste streams being collected and the total volume of waste. The Winchester High Street survey highlights that approximately 50% used up to two external bins (Figure 27).


Figure 27 - Number of external bins used by retailers on Winchester High Street

Front-end loaders (FELs) are ideal for light compactable wastes which include paper, packaging and plastics (Figure 28). The bins used are available in a range of sizes, they are easy to load and can be fitted with lockable lids. The capacities of front-end loaders typically range from 2 to 10 cubic yards (Table 18). The range of bin capacities also varies between contractors. As part of the contract, the retailer is permanently assigned with a container which is subsequently emptied on site. Containers can be used with heavy duty compaction front loaders or mobile compaction vehicles.


Figure 28 - An example of a front-end loader (Grundon)

Rear-end loaders (RELs) are also ideal for light compactable wastes, however, they are also suitable for retailers producing heavier waste. The range of bin capacities used is typically 2-16 cubic yards (Table 18). Containers can be used with heavy duty compaction rear end loaders or mobile compaction vehicles.

Roll-on-roll-off containers are used to handle large volumes of bulky, low and medium density, dry, mixed waste or segregated waste for recycling (e.g. pallets, wood, polystyrene, paper, cardboard, metals or demolition waste) deposited in a wide range of containers or skips (Figure 29). This service is ideal in situations where on-site compaction is not practical; however, some containers are supplied with static and mobile compactors (e.g. Viridor). When full, a specially-designed vehicle will collect the container, dispose of the waste and replace it with an empty container (Figure 29). The capacities of roll-on-roll-off containers typically range from 15 to 45 cubic yards.

Figure 29 - An example of a roll-on-roll-off container and vehicle (Grundon)

A range of skip types (open, closed (solid lidded), lockable) are used for bricks, concrete, aggregates, plastic, packaging, plastics, steel and wood (Figure 30). Their capacities typically range from 4 to 20 cubic yards. Viridor Waste use skip vehicles with the latest extendable reach system to allow for the placement of skips in awkward places

Figure 30 - An example of an open skip

Retailers producing large volumes of waste and recyclate (cardboard, paper, plastics etc) can benefit from using portable or static compactors (Figure 31). By compacting waste it reduces waste collection and disposal costs and is a more cost effective disposal option. Portable units are available as skips or containers and need to be removed off-site for emptying.

Figure 31 - Portable compactor (left) and static compactor (right)

A charge is levied by the waste contractor for each bin that is emptied or collected. The cost of collection is highly variable and is dependent on the type of material being collected and the size of the receptacle. Charges will also vary between waste contractors.

***Summary of services***

From the review of private waste management companies operating on Winchester High Street the key components of their services have been summarised. Typically, waste contractors:

- have the capacity and resources to provide a comprehensive waste management service which include the collection of waste and recyclate
- provide retailers with a choice of receptacle design and size according to the individual requirements

- provide a flexible collection service which includes frequent scheduled collections, next day and on-demand collections
- charge customers at competitive rates according to the bin size and type
- can choose not to enter into a contract with a retailer if it is not cost effective, e.g. the retailer does not produce enough waste and wishes for an irregular collection service.

There is limited information documenting the details of actual service agreements provided by contractors to individual retailers. Information obtained from the John Lewis Partnership can be used to highlight that larger retailers may use several different contractors to service their waste management needs. John Lewis's department stores have service buildings at each branch where waste is collected on a weekly basis using large roll-on-roll-off vehicles (Monger-Godfrey, 2004).

Table 18 - Summary of waste contracts operating on Winchester High Street

| | **Serco**[21] | **Sita**[22] | **Biffa**[23] |
|---|---|---|---|
| Waste type | Dry waste only | Dry waste and recyclate including cardboard, EEE, hazardous waste (industrial, automotive, industrial, office and general) paper and confidential wastes | Dry waste and recyclate including cardboard, compost, glass, fluorescent tubes, office paper we plastic and construction and demolition |
| Receptacle | n/a | Recycling sack, recycling (10kg)<br>Security sack (25kg)<br>Confi-bin (65kg),<br>Eurobin (240L, 660L, 1100L,)<br>HazXchange bins (60L)<br>Front end loader (4,6,8,10 cu yards)<br>Rear end loader (6,8,10,12,14,16,cu yards)<br>Skip (6,8,12,14 cu yards)<br>Rollonoff (10,20,25,35,40 cu yards) & compactor | Sacks<br>Eurobins (240L, 660L 1100L)<br>Front end loader (2.6, 5.2, 8 cu y<br>Rear end loader (12,14 cu yards)<br>Skip (7,12,20,35 cu yards)<br>Portable compaction skip 14 cu y<br>Portable compaction container<br>Static compaction unit |
| Cost | 120 litre £1.75<br>1100 litre £7.95 | Charges vary depending on waste type and size of receptacle.<br>£3.20 to £15 | Charges vary depending on wast and size of receptacle |
| Frequency of collection | Regular, occasional, on-demand and next day call out | Regular, occasional, on-demand and next day call out | Regular, occasional, on-demand next day call out |
| Vehicle type | RCV | RCV | RCV (sacks and bins) 26 tonnes<br>RCV (FEL and REL) 32 tonnes<br>Skip vehicle/portable compaction 17 & 18 tonnes |

[21] www.serco.com
[22] www.sita.co.uk
[23] www.biffa.co.uk
[24] http://www.veoliaenvironmentalservices.co.uk/

## *4.2 Waste generated by the retail sector*

The urban environment encompasses a wide range of retail activities producing a broad spectrum of waste and recyclate. Over 200,000 retailers operate within the UK contributing to 12% of all commercial and industrial waste produced (Envirowise, 2007). Despite the values of waste performance data to the industry, few studies have attempted to accurately classify the types of waste produced by high street retailers. Historically, waste compositional analysis has typically focused on analysing household waste (Parfitt, 2002; DEFRA, 2007a), however, with increased legislative pressure there is a need for retailers to take stock of the types of waste produced by their activities in order to recycle where and when feasible.

During 2002/3, the Environment Agency conducted a detailed survey of the commercial and industrial (C & I) sector to quantify the types and quantities of waste produced and the methods used for waste disposal or recovery. The survey estimated that 68 million tonnes of C & I waste was generated in England during the 2002/3 (30.3 MT commercial sector and 37.6 MT industrial sector) of which 19% was produced by the retail and wholesale sectors (Environment Agency, 2004). It is concluded within the survey that approximately half of all C & I is produced by SMEs (businesses employing less than 250 people) of which 70% is derived from the commercial sector.

Within the survey, the 'retail and wholesale sector' includes motor vehicles, parts and fuel, wholesale and other retail. The definition of retail in this instance encompasses a wide spectrum of activities which may not be representative of a typical high street urban environment.

A broad classification scheme was used to group waste into mixed waste, non-metallic, metallic, animal and plant waste, chemical, mineral waste, common sludges and discarded wastes types. Non-metallic and mixed wastes were identified as the two main waste types generated which accounted for 68% of the total waste stream (Figure 32). Analysis of waste management techniques identified that the majority of waste was either recycled (42%) or disposed of at landfill (37%) (Figure 33).

Overall, there has been a 16% increase in the amount of waste produced by the retail sector between 1998/9 and 2002/3 and a increase in reuse and recycling rates from 36% (1998/9) to 52% (2002/3) (DEFRA, 2007b). It is suggested within the Waste Strategy (2007), that retailers are taking action to reduce waste production through the provision of in-store recycling facilities which include facilities to recycle mobile phones, cans, glass, plastic bags and cardboard.

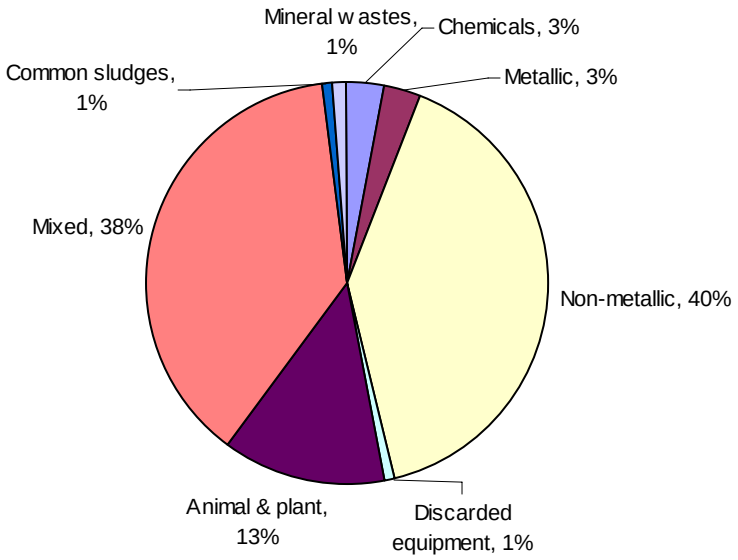



Figure 32 - Retail waste composition identified by the Environment Agency (2004)

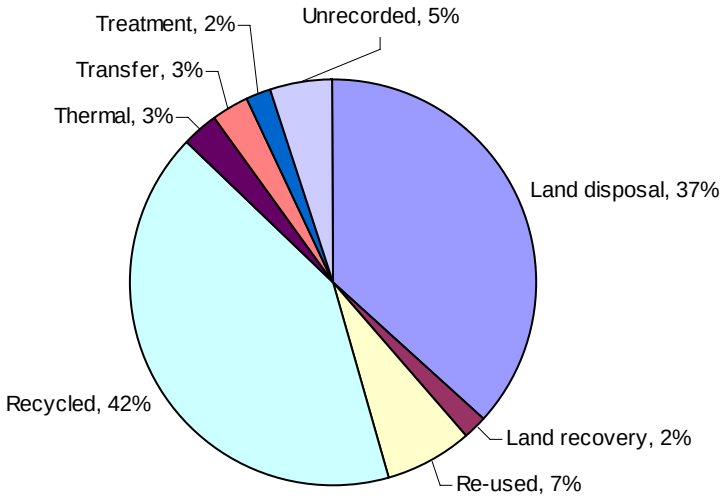



Figure 33 - Retail waste arisings by waste management identified by the Environment Agency (2004)

### 4.2.1 Audits of retail waste

Audits of the retail sector are generally incorporated in i) broader commercial and industrial studies as a sub-category, ii) surveys of high streets or shopping centres or iii) is documented by an individual retailer where the results are published as part of a 'corporate social responsibility' report or within general environmental performance reports.

The most informative and comprehensive studies identified have audited waste streams in Winchester High Street (Miracles, 2006), Westminster (Swap, 2002) and Cardiff city centre (Keep Wales Tidy and ESRC BRASS, 2004). Each study has used i) different methodologies, ii) sample sizes and iii) classification schemes which makes it difficult to draw analogies between the surveys.

The identification of waste is a difficult task which lacks any coherent structure or formal methodology for retailers to adhere to. 'WasteQUEST', which is a smart questionnaire designed by the University of Southampton and the Open University (funded by EPSRC and The Veolia Environmental Trust) to provide SMEs (which incorporate retailers) with a robust methodology for the auditing of commercial and industrial wastes. The compositional categories used in the audit identify the key waste streams which use 12 main resource streams with a cascading structure which is further subdivided into 25 main categories and a further 59 subcategories (Thomas *et al*. 2007, unpublished).

Surveys conducted in Cardiff city centre (Keep Wales Tidy and ESRC BRASS, 2004) and in Northern Ireland (Environment and Heritage Services, 2002) use the European Waste Catalogue (EWC) (which is now referred to as the List of Waste) to classify waste produced by the retail sector. The List of Waste consists of 20 chapters (chapter headings shown in Appendix 1) which incorporate the industry, material or process to which the waste is produced. There are over 800, 6-digit codes used to identify different waste streams. The codes form the basis of all national and international waste reporting obligations, e.g. waste licenses, permits and transportation of the waste (Environment Agency 2006; Hawkins and Shaw, 2004).

Keep Wales Tidy, in collaboration with ESRC (Economic and Social Research Council) BRASS [25] (Business Relationships, Accountability, Sustainability and Society), conducted a survey of 50 companies within Cardiff city centre from November 2003 till April 2004 (Keep Wales Tidy and ESRC BRASS, 2004). The survey was a subsidiary of a larger survey conducted by BRASS in partnership with the Environment Agency which investigated commercial and industrial waste arisings in Wales. The survey analysed waste produced by 50 companies within the Cardiff area, 2.48% of the 2011 companies listed in the Cardiff Business Directory (September 2003). The companies included within the survey sample were selected in terms of the Standard Industrial Classification of Economic Activities code UK SIC(92) (Office for National Statistics, 2003) (commonly referred to as the SIC code which classifies businesses by the type of economic activities they participate in. Table 19 shows that a wide range of retail activities were included in the survey including clothing retailers. The size of the company in terms of employee numbers were also a factor included in the sampling methodology (Table 20).
Table 19 - Summary of the types of retail outlets surveyed (from Keep Wales Tidy and ESRC BRASS, 2004)

[25] http://www.brass.cf.ac.uk/

| SIC code descriptions | No. of companies sampled |
|---|---|
| Retail sale in non-specialised stores (excluding CTNs) holding an alcohol licence with food, beverages or tobacco predominating | 10 |
| Other retail sale in specialised stores not elsewhere classified | 8 |
| Retail sale of adult's fur and leather clothing/ children's & infant's clothing/ other women's clothing/ other men's clothing | 6 |
| Retail sale of electrical household appliances and radio and television goods | 3 |
| Retail sale of books, newspapers and stationary | 3 |
| Retail sale of meat and meat products | 2 |
| Retail sale of bread, cakes, flour confectionary and sugar confectionary | 2 |
| Dispensing chemists | 2 |
| Retail sale of textiles | 2 |
| Retail sale of furniture, lighting equipment and household articles not elsewhere classified | 2 |

Table 20 - Size band of companies determined by the number of employees (from Keep Wales Tidy and ESRC BRASS, 2004)

| Size band | No. of employees |
|---|---|
| 2 | 1-9 |
| 3 | 10-19 |
| 4 | 20-49 |
| 5 | 50-99 |
| 6 | 100-249 |
| 7 | 250 |

Using the List of Waste, 143 different waste streams were identified resulting in the disposal of 4,996 tonnes of waste (100 tonnes per company) from retailers in Cardiff city centre. Packaging, paper and cardboard, plastic, glass, wood and biodegradable kitchen and canteen waste were the main types of waste generated. Packaging was the most prominent waste stream (3000 tonnes) of which 70% was paper and cardboard packaging. Biodegradable food waste (11%) and plastic (packaging and non-packaging) waste (17%) were also identified as key throughputs (Table 21).

The waste management techniques used for the disposal of each waste stream indicated that substantial quantities of recyclate, in particular, paper and cardboard (50.5%) and plastic (87%) are being landfilled, which could be diverted and utilised as raw materials within the recycling industry. Analysis of waste management options identified that 57% of the 143 waste streams were sent to landfill (61% was mixed waste). The extent of potentially recyclable waste that is sent to landfill is also demonstrated by the Dove Recycling study which is described later in this section.

Table 21 - Summary of waste produced by 50 companies in Cardiff city centre (from Keep Wales Tidy and ESRC BRASS, 2004)

| Waste type | Category | Containers & items (tonnes) | Amounts from mixed waste | Totals (tonnes) |
|---|---|---|---|---|

| | | | (tonnes) | |
|---|---|---|---|---|
| Packaging | Paper & cardboard | 1115.91 | 924.86 | 2040.77 |
| | Plastic | 101.66 | 711.99 | 813.65 |
| | Glass | 0.069 | 2.97 | 3.04 |
| | Wood | 0.63 | | 0.63 |
| | Metallic | 10.98 | 6.59 | 17.57 |
| Paper & card | | 187.01 | 10.51 | 197.52 |
| Plastic | | 47.22 | | 47.22 |
| Glass | | | 2.97 | 2.97 |
| Wood | | 0.004 | 0.81 | 0.82 |
| Biodegradable kitchen & canteen | | 402.06 | 347.46 | 749.52 |

A similar study was commissioned by the Environment and Heritage Service (EHS) to assess and evaluate the quantity of waste (Municipal and C & I) produced in Northern Ireland between 1999 and 2000 (Environment and Heritage Services, 2002). The survey conducted a sectorial analysis of waste using SIC codes and List of Waste codes which were used to classify the types and quantities of waste produced by the different commercial activities. During the survey period, 44,500 tonnes of waste was produced by the retail sector which contributed 9.8% to the C & I waste stream. The majority of the waste stream was classified as mixed waste (69%) with paper and cardboard (9%), edible oil and fat (5%) and plastics (5%) contributing a lesser extent. Packaging waste accounted for over 85% of retail waste of which mixed (49%), paper and cardboard (19%) and plastic packaging (18%) were identified as the main material types.

In 2002, SWAP was commissioned by the City of Westminster to establish baseline information on the sources, times of arising, quantities and composition of the waste stream (Swap, 2002). The study sampled waste produced from households, street cleaning activities and the commercial sector which included retail, during a 12 month period. The study was conducted over four sampling phases each lasting for three weeks to account for seasonal variations (Winter and Summer) in waste generation.

Of the 1317kg of waste collected and audited from 11 retailers in Westminster, cardboard (40%), paper (27%), plastic (13%) and putrescibles (9%) were identified as the predominant waste types. It is suggested that smaller fractions of waste which include glass, metals and putrescibles may have derived from the staff room. No seasonal variation was detected in the types of waste produced (Swap, 2002).

The study identified that 73% of the retail waste analysed could have potentially been recycled (Table 22) due to the quantities of corrugated card (37%), printed advertising material (10.3%), packaging film (6%) and white office paper (5%).

Table 22 - Potentially recoverable waste streams (from Swap, 2002)

| **Waste** | **Average recyclable (%)** |
|---|---|
| Corrugated cardboard | 37 |
| Printed advertising material | 10.3 |
| Packaging film | 5.7 |
| Kitchen compostable | 5 |
| White office paper | 4.9 |
| Newspaper | 3.1 |

| | |
|---|---|
| Glass bottles | 2.9 |

A larger survey was conducted of 100 businesses on Winchester High Street which included a wide spectrum of retail types (clothing, food, books, toys, jewellery, mobile phones, shoes and stationery) as well as estate agents, opticians and restaurants (Miracles, 2006). Each business was approached and shown a list of materials that may have formed part of their waste to which they had to estimate the approximate percentage that contributed towards their total weekly waste output. As with the other surveys reviewed, cardboard (46%), paper (28%), plastic (8%) and putrescibles food waste (2%) were the predominant waste types classified. It is suggested that approximately 74% of the waste generated by the businesses on Winchester High Street which could be directly recycled.

In 2007, the Local Government Association (LGA) commissioned the British Market Research Bureau (BMRB) to analyse a basket of 29 common grocery items from 8 retailers (including local retailers and market traders) to quantify the total weight of the basket that consisted of packaging and the proportion of which was recyclable. The survey revealed that overall approximately 5% of the total weight of the shopping baskets consisted of packaging (LGA, 2007). The proportion of waste packaging that was recyclable ranged from 60% at Marks and Spencer to 79% for local and market retailers; on average, 40% of packaging was identified as being non-recyclable. Lidl were identified as the retailer that produced the heaviest packaging (799.5kg) of which only 61% could be recycled (Figure 34). The survey is to be repeated every 6 months over a two-year period to establish trends in food packaging.

The LGA highlight that the UK will not meet EU recycling targets and subsequently face fines of up to £3 million unless supermarkets take more responsibility to reduce excessive packaging. The chairman of the LGA added that councils should work directly with supermarkets to find solutions to the problems and should also educate and change consumption patterns.

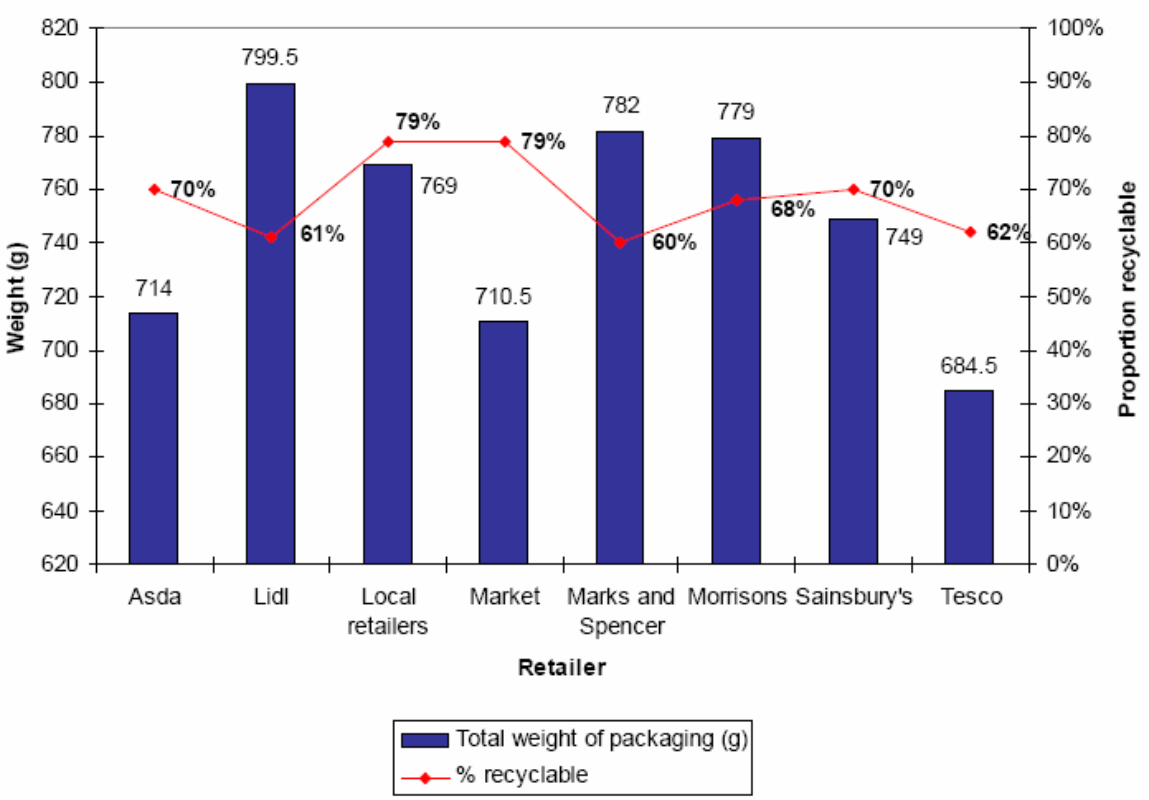



Figure 34 - Weight of packaging and proportion recyclable by retailer (Source: LGA, 2007)

The aforementioned case studies all highlight that packaging accounts for a significant proportion of waste generated by the retail sector of which paper, cardboard and plastic were identified as the main material types. Such waste streams have high recyclate content and value and can be recovered from the general waste stream. Putrescible waste or biodegradable kitchen and canteen waste was also identified a contributing waste type. Such waste which can contain animal-by-products

## 4.2.2 Packaging

The review has identified that packaging (cardboard, paper and plastic) is the most significant waste stream produced by the retail sector. In response to legislative pressures and the spiralling waste disposal costs associated with the Landfill Tax Escalator (increase disposal costs by £8 per year per tonne until 2010/11, (DEFRA, 2007c), retailers have been implementing systems to i) minimise waste and/or maximise material recovery; ii) using reusable alternatives; and iii) setting their own in-house waste performance targets.

***Courtauld Commitment***

In July 2005, WRAP launched the Courtauld Commitment which is an agreement with assenting grocery organisations (including retailers and brands) to reduce the quantities of packaging and food waste ending up in household bins (WRAP, 2007a). The Courtauld Commitment seeks to:

- design out packaging waste growth by 2008
- deliver absolute reductions in packaging waste by 2010
- identify solutions to the problems of food waste.

Through collaborations between retailers, brand owners, manufacturers and also their packaging suppliers, it is the intention that solutions and innovative designs can be developed across the *supply chain*. Such solutions include a reduction in the weight of packaging, an increase in recyclate content of packaging and use of reusable packaging (refills and also self-dispensing units). The Courtauld Commitment is a response to research undertaken by WRAP (on behalf of the Strategy Unit) which identified that as much as 50% of household waste originates from purchases from the top 5 retail supermarket chains. Since being launched in 2005, 24 major retailers representing 90% of the UK's grocery market and leading suppliers have joined the commitment (Table 23). WRAP is also seeking to encourage non-food retailers to sign up to the Courtauld Commitment. Examples of individual retailers' targets are summarised:

- ***Asda*** – reduce 25% of packaging by 2008
- ***Marks & Spencer*** – reduce 25% of packaging by 2012
- ***Morrisons***: reduce 15% of packaging by 2010
- ***Sainsbury's*** – reduce 5% of packaging by 2008
- ***Tesco*** – reduce 25% of packaging (including brand and own label) by 2010
- ***Waitrose*** – cut packaging waste growth by 15% in 2006 and devise targets to ensure that packaging levels remain below 2002 levels

Table 23 - Retailers and brands that have signed up to the Courtauld Commitment (from WRAP, 2007a)

| **Retailers** | **Brands** |
|---|---|
| Asda,<br>Boots,<br>Budgens,<br>Cooperative Group,<br>Londis,<br>Iceland,<br>Marks and Spencer,<br>Morrisons,<br>Sainsbury's,<br>Somerfield,<br>Tesco,<br>Waitrose | Heinz,<br>Unilever,<br>Northern Foods,<br>Britvic,<br>Cadbury Schweppes,<br>Coca Cola Enterprises Ltd,<br>Dairy Crest,<br>Duchy Originals,<br>Mars UK,<br>McBridge,<br>Nestle UK,<br>Premier Foods |

***Carrier Bag Agreement***

In February 2007, the Department for Food and Rural Affairs (DEFRA) launched the "Carrier Bag Agreement" which aims to reduce the overall environmental impacts associated with carrier bags by 25% by the end of 2008 (DEFRA, 2007d). It is suggested that a 25% reduction in carrier bags could reduce carbon dioxide by up to 58,500 tonnes per year. It is a joint initiative supported by the British Retail Consortium (BRC) and WRAP and provides retailers with the flexibility to commit to the agreement in ways best suited to their business and customers. The "voluntary" agreement includes 22 high street stores including Next, Boots, Tesco, Early Learning Centre, Waitrose and also 6 trade associations (The Guardian, 2007). In order to reduce the impact associated with carrier bags, retailers will be:

- encouraging customers to reduce the quantities of bags used
- increasing the recycled content of the bags
- facilitating the recycling of more carrier bags where appropriate.

Initiatives introduced by supermarkets are summarised as:

- Bag for life and other reusable shopping bags (Tesco, Sainsburys, Waitrose)
- Green points for re use of carrier bags (Tesco)
- Green tills which are carrier bag free (2 trials conducted by Waitrose)
- Bag-less store (trial at East Anglia Waitrose)
- Biodegradable bags (CO-OP)
- Pay for usage (Ikea, 10p per bag)

***Retail Innovation Programme (RIP)***

The Retail Innovation Programme is a waste minimization fund established to engage with retailers, brand owners and their supply chains with the aim of reducing the amount of packaging waste being disposed of in householders' bins. WRAP has part-funded and partnered projects across the supply chain including SMEs, packaging specialists, designers, retailers, brands and also educational institutions to facilitate and stimulate innovation that might not necessarily be driven by the market place (WRAP, 2007b).

Funded projects not only focus on the optimization of packaging but may also be used to improve the efficiency of in-store operations including the reduction of transportation costs and improving corporate social responsibility.

Completed projects funded by the Retail Innovation Programme include:

- Trials of lightweight glass bottles and jars (partners Faraday Packaging, British Glass, GRS and Coors Brewers (Grolsch Beer)
- Trials of lightweight, easy-open, steel food cans (Heinz and Impress Group BV)
- Trials of lightweight corrugated transit cartons for home delivered products by Kite Packaging.
- Trials of a reusable packaging system for a range of bulky home delivered products for Argos
- Trials of re-usable 'Carrierpacs' for home delivered kitchen worktops for B&Q.
- Development of a packaging minimization standard by The Soil Association

for organic products (partners Green and Black's and Duchy Originals)

- Setting new benchmarks for lightweight polyethylene terephthalate (PET) drinks bottles by Esterform for a range of carbonated drinks brands.

***Reusable packaging***

The Environment Technology Best Practice Programme (ETBPP) has produced a guide to reusable packaging, which details different packaging types and provides a methodology for changing to reusable containers (Table 24 - Types of reusable transit packaging (from ETBPP, 1998). The benefits of such a system include the following (ETBPP, 1998):

- Cost savings which include savings in the cost of raw materials, cost of compliance with the Regulations and waste disposal costs on an annual basis
- Compliance with the Packaging Regulations. Packaging which is reused is exempt from the Regulations after its first use
- Improved environmental performance
- Improved company image
- Participation in a more comprehensive waste-reduction programme

Table 24 - Types of reusable transit packaging (from ETBPP, 1998)

| | |
|---|---|
| *Pallets and pallet systems* | -Made from wood, rigid plastic or corrugated cardboard and can be used up to 200 times<br>-Pallet systems are large, usually collapsible boxes, which can be moved by a fork-lift truck |
| *Drums & intermediate bulk* | -Made of steel and plastic containers |
| *Separators, layer pads & collars* | -Separate goods and increase stability<br>-Made of either corrugated board or plastic and either flat or molded for a specific item, e.g. bottles or jars |
| *Slip sheets &"push pull" units* | -Plastic or corrugated sheets that can be placed under loads are used as alternatives to pallets<br>-Handled by a "push-pull" unit |
| *Plastic boxes* | -All types of plastic trays and crates including fixed, folding and wheeled |
| *Metal crates & collapsible wheeled stillages* | -Widely used in the UK |

Three feasibility studies have been funded by the RIP to explore the viability of replacing existing single-use packaging (thousands of tonnes are disposed of each year in the UK) with reusable bespoke packaging which offer significant business and environmental benefits (WRAP[26]). The reusable packaging was trialed at Argos (upholstered furniture[27]), B&Q (kitchen worktops[28]) and John Lewis and Electrolux

[26] WRAP. http://www.wrap.org.uk/retail/case_studies_research/case_study_1.html
[27] WRAP:- http://www.wrap.org.uk/docs/15203-06%20Argos%20CS%20 LoRes.pdf

(large kitchen appliances[29]) (Table 25). The main business benefits from the packaging are associated with a reduction in the level of product damages and returns. There is also an increase in customer satisfaction as there is no need to dispose of bulky waste which reduces the levels of packaging waste entering the domestic waste stream.

Table 25 - Summary of reusable packaging trials funded by the Retail Innovation Programme (from WRAP[30])

| Retailer/Manufacturer | Reusable packaging | Trial summary |
|---|---|---|
| Argos | Upholstered furniture | The reusable sofa packaging designed was an envelope of reinforced bubble wrap with a protective outer layer and inner lining with the capacity to be reused 7 times. Overall it reduced packaging whilst improving product protection. |
| John Lewis & Electrolux | Large kitchen appliances | Desk research study which examined the feasibility of replacing current disposable packaging used for kitchen appliances with an alternative reusable transportation and storage system. This could be used to transport returns and used appliances. Costs were modelled for 3 different designs:- i) solid box, ii) flexible/fabric with solid parts, iii) fully flexible/fabric. |
| B & Q | Kitchen worktops | "Carrierpac" was a bespoke design comprising of a polypropylene inner and outer components with adjustable handles. The Carrierpac could be used an average of 6 times (average) with an upper maximum of 18. Due to the high value item it was important that the Carrierpac eliminated product damage. |

Other examples of reusable packaging initiatives are used as case studies within Envirowise training publications[31].

*Boots:- Reuse of plastic transit trays*

The Boots Company has developed a system for re-using the plastic transit trays for the delivery and display of its sandwiches without the need for any alteration or

[28] WRAP:- http://www.wrap.org.uk/docs/15203-07%20BQ%20CS%20 LoRes.pdf
[29] WRAP:- http://www.wrap.org.uk/docs/1BL%20Usability%20Works%20TechReport%20Complete%2023rd%20April%2007.pdf
[30] WRAP:- http://www.wrap.org.uk/retail/case_studies_research/ case_study_1.html
[31] www.envirowise.gov.uk

redesign (Envirowise, 2004a). The trays are no longer used only once, but are re-used about three times. Broken trays are returned to the supplier for recycling.
The benefits have included:

- estimated savings of over £125,000/year;
- savings of approximately 200 tonnes/year of plastic;
- savings of approximately 270 tonnes/year of cardboard;
- reduction in the packaging obligation for Boots and its suppliers

*Securicor Omega Express, Macmillan Distribution Ltd and Waterstones:- Reusable tote box (Envirowise, 2004a)*

Initially launched as a pilot scheme, a partnership approach between a distribution company (Securicor Omega Express), a book publisher (Macmillan Distribution Ltd) and a book retailer (Waterstone's) was adopted to design a custom-built re-usable tote box as a replacement for cardboard cartons. The benefits of the new tote box, which are spread across the retail supply chain, include:

- elimination of the need for 21,720 cardboard cartons (initial trial saved £7,000/year and 15 tonnes/year of waste);
- an estimated 95% reduction in the amount of paper packaging used as in-fill;
- reduced damage to stock during transit;
- reduced cost of compliance with the packaging waste regulations.

*Debenhams:- Reusable packaging (Envirowise, 2004b)*

The introduction of re-usable packaging by Debenhams plc to transport stock from its suppliers to its warehouses and department stores has improved operating efficiency and reduced waste costs. In its search for ways to improve efficiency and reduce the risk of injury to warehouse staff, the Debenhams' logistics team began by looking at the existing use of packaging. The team found that stock arrived at the warehouses from suppliers in cardboard boxes and was then unpacked into new or re-used cardboard boxes for onward transport to the stores. This process was inefficient and required staff to handle goods in bulky cardboard boxes, often with an uneven load. The team selected two types of transit packaging - roll cages and plastic totes – for the new packaging system. The durable, plastic totes can be stacked easily for storage and transport back to the warehouse. They protect stock from damage, and are easier and safer for the staff to handle. Wheeled roll cages are used for larger items. Debenhams is now working with its suppliers and concession holders to widen the scheme to give efficiency benefits for the supply chain.

*Sainsbury's:- Switching to pallets from roll cages (Envirowise, 2004b)*

Sainsbury's are gradually phasing out the use of roll cages and are replacing them with pallets. The change over has resulted in an increase of up to 40% in the load carried per vehicle and a reduction in product damage. The use of pallets also provides Sainsbury's with more options for back-hauling products and used packaging from stores.

### 4.2.3 Individual retailers and recycling initiatives

To ascertain the variations in waste and recyclate produced by different retail sectors, annual, environmental or corporate social responsibility reports have been reviewed for a sample of high street retailers which include i) supermarkets, ii) electrical retailers, iii) clothing outlets and iv) general outlets. However, such information is only available from larger retailers. Analysis of these reports and associated documentation also provide an insight into the innovative ideas used to recover materials.

***Supermarkets***

Traditionally, supermarkets have generated waste from the sale and non-sale of a wide range of food and household items (e.g. fish, meat, dairy, groceries, bakery, tinned, frozen goods, and toiletries). As the range of products being sold has diversified to now include clothing ranges, electrical and electronic equipment and furniture, the waste types emanating from such activities would have changed. The waste management practices of 4 of the 5 big UK supermarkets (Morrisons, Waitrose, Asda, Sainsbury) have been reviewed to identify the i) types of waste recycled, ii) recycling rates and iii) initiatives to reduce and recycle waste (Urban Mines, 2007).

In 2005/6, Morrisons produced 177,972 tonnes of waste of which 72.4% was recycled (Morrisons, 2006). Cardboard and paper (63.5%), plastic polystyrene (4.7%) and animal by product waste (meat, fish and oil from the rotisserie was sent to be processed for bio-fuel) were the main waste types recovered. The remaining 27.6% of waste was sent to landfill, equating to 2.5 tonnes of waste per store per week (Morrisons, 2006). Morrisons has signed the Courtauld Commitment which demonstrates their commitment towards reducing packaging and food waste and they have developed initiatives to increase recycling rates including a carrier bag recycling scheme which identified the potential to recover approximately 3 tonnes of plastic per annum at participating stores.

During the 2006/7 financial period, Waitrose generated 40,814 tonnes of waste which equated to 5.7 tonnes disposed per million pounds of sales (John Lewis Partnership, 2007). Landfill was used for 51% of the waste generated with the remainder being recycled. Waitrose has signed the Courtauld Commitment which demonstrates their commitment towards reducing packaging and food waste. Food waste generated from some of the Waitrose stores is donated to Fareshare services and it is the intention that such schemes will be eventually rolled out across all stores. In-store carrier bag recycling is also being tried in Southampton and Sheffield (John Lewis Partnership, 2007).

Asda (Walmart) separate a wide range of materials including cardboard, plastic packaging, hazardous wastes (paint and fluorescent tubes), animal by product waste (sent for rendering and sold to soap manufacturers and remaining waste is used to produce dog food) and waste photographic chemicals (precious metals recovered e.g. silver). The main types of waste currently recycled from the stores are cardboard (140,000 tonnes representing 8% of the UK market), plastic packaging (5500 tonnes) and oil (1.8 million tones which was sent for manufacturing into bio-diesel) (Asda, 2006). Asda have signed the Courtauld Commitment which demonstrates their commitment towards reducing packaging and food waste. Asda is working towards "zero waste" for all stores by 2010 where waste generated is either reused, recycled or composted. Asda is the first UK supermarket to open a zero waste supermarket in Canford Heath, Dorset (Asda, 2006).

During 2005/6, J Sainsbury generated 219,831 tonnes of waste of which 38.7% was landfilled. Of the 61.3% that was diverted from landfill, cardboard recycling accounted for 81.7%, plastic 5.1% and meat and fish waste 7% which was sent for rendering (J Sainsbury, 2007). J Sainsbury has introduced a number of initiatives to reduce the amount of waste generated and increase recycling rates and they have also signed the Courtauld Commitment. Targets have been set to i) reduce waste sent to landfill by 50% relative to sales by 2010 against 2005/6 baseline and ii) reduce packaging by 5% relative to turnover by 2010 against a 2004/5 baseline. They are currently working with suppliers to replace cardboard packaging with returnable, reusable transit packaging. It is estimated that one reusable crate equates to 21 cardboard boxes and to date 8400 tonnes of cardboard have been saved through the reuse of crates within the supply chain. Compostable packaging (sourced from maize or sugarcane) is also used within the "So Organic" range. Alternative disposal methods are being investigated to manage food waste which include composting and anaerobic digestion (J Sainsbury, 2007)

***Electrical Retailers***

Electrical retailers supply a wide range of products to the market from small items e.g. MP3 players, kettles, toasters to larger white goods e.g. fridge freezer, washing machines, cookers.

In 2003/4, the Dixons Group Plc (Dixons, 2004) was Europe's largest specialist retailer of consumer electronics (e.g. Currys, Dixons, PC World and The Link) and generated 2611 tonnes of recycled packaging waste during 2003/4. Cardboard (78%), paper (9.2%) and polystyrene (11.1%) were the main types of packaging recycled (Dixons, 2004). Dixons is also a participator on 'Foneback', a mobile phone recycling scheme coordinated by Shields Environmental, which involves the five main mobile phone operators e.g. O2, Orange, T-mobile, Virgin Mobile and Vodaphone). Foneback extract the metals from the phones and reuses them, and mixed plastics are sent to Sweden to a specialist recycler. The metals (gold, platinum, silver and copper) in the phones are also recycled. Phone batteries pose a particular threat to the environment. One cadmium battery could pollute 600,000 litres of water. When disposed of via Foneback, these metals are also reused - in the case of nickel into irons and saucepans. If the handset is in full working condition it may be sent to Romania for reuse.

***Clothing Retailers***

Next Plc primarily retail clothing although larger stores may sell homecare and a small range of electrical products. In 2005, 31,935 tonnes of waste was generated of which 47% was recycled consisting of cardboard (42.7%) and plastic (4.1%). Next Plc returned over 18 million hangers from their stores and successfully recycled 60% of them saving 354 tonnes of virgin materials. Balers and compactors have been introduced at 102 stores for cardboard and polythene collection and space-efficient compacting methods have been introduced at high street stores. Next Plc conducted a small trial in 2005 which investigated the potential benefits of reverse hauling of recyclable waste; however, no results have been reported.

***Others***

Marks and Spencer (M&S) operates 450 stores within the UK which generate on average 40,000 tonnes of waste per year (Marks and Spencer, 2006). In 2005, 66,483 tonnes of packaging was used by the retailer which consisted of plastic (49%), glass (24%) and cardboard (22%). M&S has developed a wide range of waste minimisation and in-store recycling initiatives and has set a target to reduce the amount of waste for disposal by 10% by 2010 per £1 million sales. The company demonstrates its commitment to reducing packaging and food waste through the Courtauld Commitment.

M&S is the first major retailer to commit itself to sending plastic from London retail outlets to the first polyethylene terephthalate (PET) recycling plant in the UK which will generate plastic to be used for food packaging. The facility will process 35,000 tonnes of waste and is due to open in December 2007 (Marks and Spencer, 2007).

Lightweight foamed plastic tray technology has been introduced to reduce the amount of packaging used in ready meals and where possible use recycled plastic packaging for salad snacks and drinks. Hangers have been modified by replacing sticky labels with plastic sizing inserts for the majority of ranges to enable more hangers to be recycled.

In 2007 the company launched “Plan A”, which is a 5-year, 100-point plan which is designed to tackle some of the challenges facing M&S and the environment. Plan A addresses, climate change, raw materials, healthy eating, fair partners and waste.

Woolworths is a retailer selling primarily entertainment products (e.g. CDs, DVDs, computer games), confectionary, children’s clothing, toys and household utensils. Cardboard, polystyrene, plastic, toner cartridges and fluorescent tubes are all materials separated for recovery (Woolworths Group Plc, 2006). In 2005, cardboard (17,253 tonnes) and plastic (311 tonnes) from CD and video cases were the main types of recyclate separated from Woolworths’ waste stream. Woolworths’ distribution centre which is operated for Woolworths by Gist (a specialist logistics company which also handles onward distribution of toys, homeware, electrical and seasonal products) has a recovery centre onsite which handles cardboard and polystyrene collected from the stores. It is subsequently baled and then transported to Snodland in Kent.

## *4.3 Recyclate markets*

Cardboard, paper and plastic have been identified as the main types of waste stream generated by the retail sector. This section will explore the key characteristics of each waste type and investigate the end markets.

It is well documented that the UK has encountered difficulties improving its recycling performance as it is a market driven waste management strategy. At present the poorly developed end markets for recyclate (new and existing products) act as a barrier which is impeding the capacity to increase recycling rates within the UK (Watts *et al*., 2002).

*"For the cycle to be complete it is essential that a demand exist for the recycled products…new markets may emerge, but the transition may prove somewhat turbulent" (*Tietenberg, 1996 *in Watts et al. 2002).*

Other factors are also impeding the recycling performance (Greater London Authority, 2004):

- Lack of stable markets has resulted in a reluctance for investments to be made in the recycling and processing industry
- Financial restrictions
- Public perceptions of recycling needs to be more sustainable
- Recycled products have a reputation of being of poorer quality than those using virgin materials

In order to stimulate and generate effective markets for recyclate within the UK a "comprehensive and inter-related set of measures is required" (Watts *et al*., 2002). The following measures have been propagated by AET Technology (1999 in Watts *et al*. 2002):

- Standards for recyclate
- Standards for the recycled content of products and agreements with industry,
- Guidelines for industry on best practice and for using recyclate to make new products
- Initiatives to encourage the purchasing of recycled products
- Eco-labelling
- Economic instruments

The Waste Strategy (England and Wales) published in 2000 and updated in 2007 (DEFRA, 2007b) reflects the government's commitment to improving the markets for recyclate. The waste strategy not only set the precedent for developing traditional and alternative markets for recyclable materials, but raised its priority through the creation of the Waste Resources Action Plan (WRAP) (Watts *et al*., 2002). WRAP was launched to focus on market development and associated issues on a national level and to provide an outlet for the communication and dissemination of information relating to market development programmes. Similar organisations, including the Creating Welsh Markets for Recyclate (CWMRE[32]) group, have been set up to tap into the opportunities of manufacturing products made from recyclate and bringing them into contact with other players in the recycling loop.
Despite the progress made since its publication, the UK's recycling and recovery performance is still inferior to European counterparts. In the latest version of the strategy, the UK government directs its efforts to encouraging key stakeholders, e.g. producers, retailers, consumers, local authorities and the waste management industries to share responsibility to meet and exceed the landfill diversion targets for biodegradable municipal waste and non-municipal waste (2010, 2013 and 2020). The collection and recovery of key materials have been targeted, which include paper, food, glass, aluminium, wood, plastic and textiles, as it is considered that there are significant environmental benefits associated with their diversion from landfill. The development of recyclate markets still remains an integral element of the strategy and the government seeks to stimulate the level of investment into market development in order to maximise the value of the recyclate (DEFRA, 2007b).

Since the introduction of the Waste Strategy in 2000, market development initiatives have become more prominent in the UK, Europe and America. Watts *et al*. (2002)

[32] http://www.walesenvtrust.org.uk/content.asp?id=106

identify how the Clean Washington Centre (CWC) demonstrates best practice in regional market development. The organisation was founded in 1991 to develop markets, technologies and end uses for recycled materials working in partnership with local government, industry and businesses (Clean Washington Centre, 2001). CWC have subsequently published best practice guides in terms of collection, handling and end use applications for the recycling of plastics, glass, wood, scrap tyres and rubber. The direct end use applications identified by CWC are summarised in Table 26 - it must be noted that technologies documented within the guides may now be out of date.

Table 26 - Summary of direct end use applications identified by the Clean Washington Centre Research (from CWC, 2001)

| **Material** | **Direct end use applications** |
|---|---|
| Wood | Mulch & Landscaping<br>Soil Amendments<br>Compost Bulking Agent<br>Direct Land Application<br>Biofuel Combustion<br>Miscellaneous - Biofilter Media, Animal bedding |
| PET plastic | Formulation and Processing<br>Blending<br>Compounding<br>Melt filtration options and alternatives<br>Thermoforming of recycled PET |
| HDPE plastic | Packaging products (blow-moulded bottles);<br>Extruded products (drainage pipe);<br>Sheet and film products (blown film bags, extruded film products);<br>Pallets<br>Plastic lumber products |
| Glass | Construction Aggregates<br>Glassphalt<br>Filtration<br>Industrial Minerals<br>Portland Cement<br>Landscaping |
| Scrap tyres | Miscellaneous products<br>Shoe Soles<br>Mud flats<br>Floor mats<br>Hoses |

A study conducted by Enviros Consulting (2000) summarises some of the key achievements of CWC. In 1991 recycling was not economical as it cost US $30 more per tonne than landfill. However, by 1998 due to CWC and the development of higher added value markets and investment, Seattle achieved a 48% recycling rate and recycling now made savings of US $52 per tonne.

### 4.3.1 Development of local markets

WRAP and Remade have been the main drivers behind the development i) of both local and national recycling markets and ii) schemes to facilitate the collection of recyclate within the UK. In 2000, the Recyclate Market Development (ReMaDe) Network UK was launched to “ensure that an integrated approach to recyclables

market development was achieved across the country" (Remade Essex, 2007a). A group of regional programmes were subsequently developed to coordinate the development of activities, exchange tools of best practice and also to disseminate findings from projects. In addition to the UK's 6 ReMaDe regional groups (North West, London, Essex and East of England, Kent & South East England, Scotland and Wessex) other members of the network include Clean Merseyside Centre, Urban Mines and WRAP (Remade Essex, 2007a). ReMaDe operate along the material supply chain and work with both commercial and public sector organisations in order to support and diversify markets locally and nationally.

In November 2003, WRAP launched the Regional Market Development Fund (RMDF); a £10 million fund to provide support for local and regional products contributing to the development of markets for recycled materials in England (Wrap, 2007c). Biodegradable municipal waste was identified as a "priority waste stream" although the programme supported cross material projects. The main projects funded by the RMDF are summarised in Table 27. Recyclate markets are largely about creating diversity of outlets and stimulating market demand that help improve the value of recyclate.

Table 27 - Summary of projects funded by the RMDF (from Wrap, 2007c)

| **Region** | **Initiative** |
|---|---|
| East of England | Polythene plastic recycling (Chase Plastics) |
| South East | Developing horticultural markets for compost in Kent. |
| South West | Developing markets for container and plate glass in rural areas (Cornwall). |
| South West | Farm film collection in Somerset. |
| South East | Hampshire Soils Manufacturing using Compost, CD&EW and quarry waste. |
| South East | Paper Magic closed loop paper recycling scheme at schools. |
| Yorkshire and Humber | Reducing the waste disposal in tomato crops through the use of sustainable wood based growing media. |
| North West | Smithfields Market – transform the New Smithfield Wholesale Market into Europe's first zero waste wholesale market. |
| South east | Use of compost as a mulch in horticultural market (mature fruit tree production). |
| East of England | UK CEED project to trial the recovery of commercial and industrial wastes from the Peterborough area using an Ecotrade Centre (primarily for small traders). |
| South East | Develop end markets for green waste compost in the Thames Gateway area specifically for brownfield regeneration activities. |
| South West | Investigate the best practicable method of glass collection in Cornwall including the collection of whole glass containers for use in a local manufacturing process and on vehicle densification for glass going into standard reprocessing applications. |
| North West | Undertake research to demonstrate that compost can be successfully used to remediate land and establish healthy soils capable of sustaining community woodland. |

Section 4.2 has identified that paper, cardboard and plastic are the most common waste types produced by the retail sector. This section provides an overview of the markets for these recyclates.

## 4.3.2 Paper and cardboard markets

In 2004, 6.2 million tonnes of paper was manufactured within the UK of which 74% of the source materials were derived from recycled paper and cardboard (Wasteonline, 2006). Despite the advances made in cardboard recycling, over 6 million tonnes of paper and cardboard is only being used once. Cardboard consists of cellulose fibres which are created from wood pulp. If the cardboard is soaked and agitated, the fibres can be released, re-pulped and the cardboard can subsequently be recycled. This recycling process can be repeated up to 5 times before the fibres shorten and disintegrate. The main advantages associated with the production of recycled paper and cardboard are that it uses between 28-70% less energy compared to the virgin process.

The financial value of cardboard, as with all materials, is highly volatile and is controlled by market conditions, both nationally and internationally. Finding a waste merchant to collect separated cardboard may prove to be difficult when the market is depressed. Businesses can increase the value of the cardboard by using balers or compactors which can i) reduce transportation costs, ii) enable more cardboard to be stored at any one time, and iii) reduce the frequency of collection. Merchants will typically stipulate whether they require the material to be supplied baled or loose. Such information will determine the nature of the collections provided by waste contractors and local authorities.

Within the UK, paper and cardboard is recovered in four main grades and is used in seven sectors of production (Table 28).

Table 28 - Summary of the main grades of cardboard and papers and their material uses (Adapted from Remade Scotland, 2007)

| **Grades** | **Material utilisation of recovered fibres** | **Used (tonnes)** | **Produced (tonnes)** |
|---|---|---|---|
| Class 1 - Corrugated & Kraft | Corrugated case materials | 1,786,075 | 1,691,514 |
| | Packaging papers | 72,832 | 108,266 |
| Class 2 - Mixed Grades | Packaging board | 200,812 | 189,286 |
| | Plasterboard | | |
| Class 3 - Newspaper and magazines | Newsprint | 1,491,745 | 1,135,919 |
| Class 4 - High Grades (white office paper) | Tissue | 451,218 | 794,993 |
| | Printings and writings | 196,929 | 1,518,513 |

Domestic production of paper and cardboard has slightly declined in the UK as demonstrated by the closure of 8 mills in 2006. Remade Scotland (2007) indicates that increased energy and production costs are factors that will have a negative impact on the industry. There has, however, been a significant increase in the quantities of recovered paper and cardboard exported which have increased by 500% over the 5 years between 2000 and 2005 to 3.28 million tonnes. It is suggested that this growth can be correlated to overall increases in supply and decreases in domestic production. In 2005, the UK exported 3.2 million tonnes of

recovered fibres and imported 0.3 million tonnes (Figure 35). The majority of exported paper and cardboard is shipped to be used by the growing Asian markets in China (46%) and Indonesia (10%) (Remade Scotland, 2007).

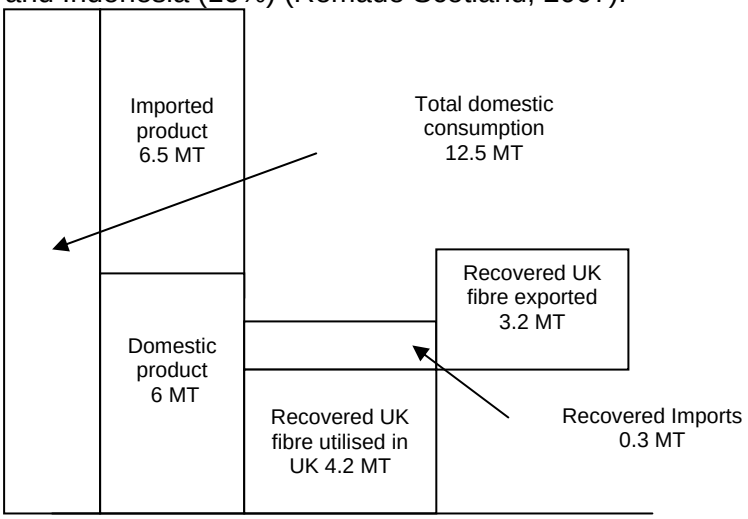



Figure 35 - UK paper market (Adapted from Remade Scotland 2007)

The future security of the paper and cardboard market within the UK is dependent on continued (Remade Scotland 2007):

- demand from the Asian markets associated with the growing economy
- investment in reprocessing and manufacturing at a level that meets the demand
- barriers to trade which include quality standards applied to recyclate.

It is predicted that the production of paper and cardboard will remain relatively stagnant with consumption rising moderately. The level of material imports are expected to rise moderately.

The UK domestic mill, import and export paper and cardboard prices for October 2007 are summarised in Table 29.

Table 29 - UK domestic mill, import and export paper prices for October 2007 (Source: Letsrecycle.com, 2007a)

| | **UK Domestic Mill Price (£ per tonne)** | **Merchant Prices (£ per tonne)** | **Export prices (£ per tonne)** |
|---|---|---|---|
| Mixed papers | 40 - 45 | 3 - 15 | 55 - 60 |
| Old kls (cardboard) | 60 - 65 | 8 - 20 | 68 - 70 |
| News and pams | 65 - 70 | | 72 - 75 |
| News and pams (for de-inking) | | 15-25 | |
| Over-issue news | 68 - 73 | | |
| Sorted office waste | 90 - 95 | | |
| Coloured letter | 98 - 103 | | |
| Coloured best pams | 98 - 102 | | 102 - 107 |

| | | | |
|---|---|---|---|
| Light letter | 105 - 115 | | |
| White letter | 130 -138 | | 152 - 157 |
| Computer paper | 135 - 140 | | |
| White office paper | | 35-50 | |
| Mixed coloured office waste | | 10-25 | |

### 4.3.3 Plastic markets

Within the UK in excess of 4,000,000 tonnes of plastic are used each year of which packaging is the largest consumer, accounting for 35% of all plastic consumption (Wasteonline, 2006). A breakdown of use of plastic is shown in Figure 36.

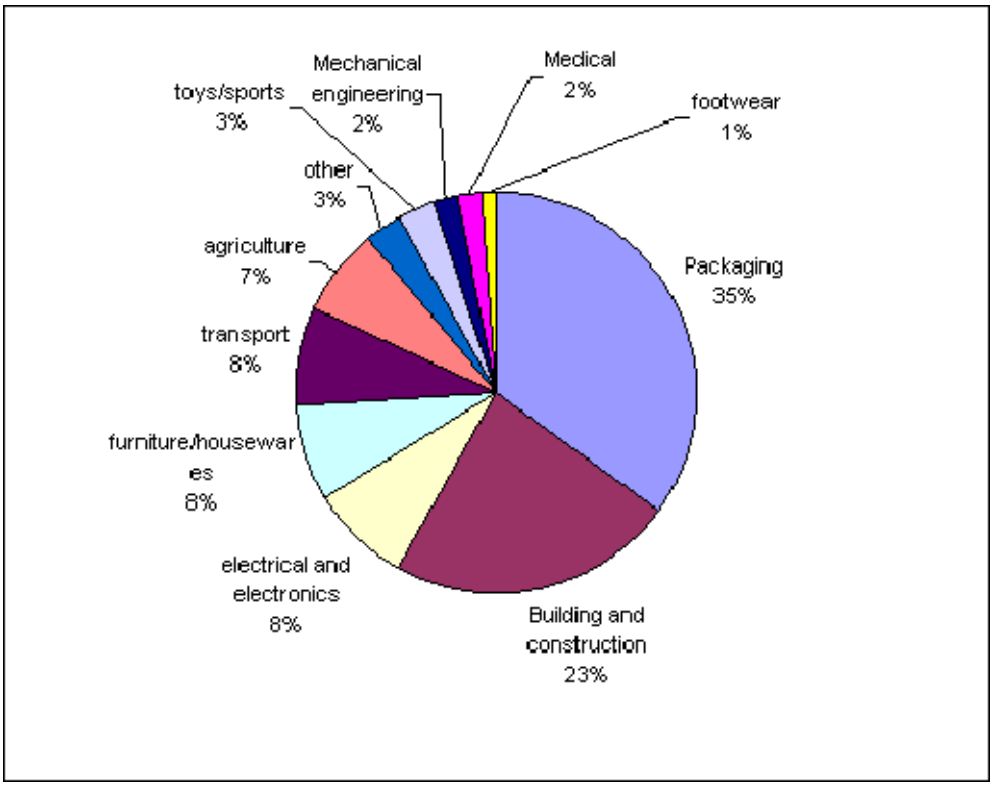



Figure 36 - Domestic consumption of plastic in 2005 (Source: Wasteonline, 2006)

Plastics consist of a wide variety of polymers (or resins) that have different characteristics and end uses. There are essentially two types of polymers:

- *thermosetts,* e.g. formica and bakelite that can be heated and formed once
- *thermoplastics,* which can be heated and formed many times and account for 95% of all plastics

The plastic polymers used and their end markets are summarised in Table 30, of which LDPE (24.3%), PVC (18.8%) and PP (18.5%) are the main polymers consumed within the UK. (RECOUP, 2007)

Table 30 - Summary of plastic polymers sources and consumption (from RECOUP, 2007)

| **Plastic** | **Source** | **Consumption** |
|---|---|---|
| PET - Polyethylene terephthalate | Fizzy drink bottles and oven-ready meal trays. | Fibre fill for jackets and pillows, the production of fleeces, and pellets back into bottles |
| HDPE -High- | Bottles for milk and | bottles, Crates & general mouldings |

| | | |
|---|---|---|
| density polyethylene | washing-up liquids. | Imitation wood products, pipes & ducting, water butts & compost bins, car windscreen |
| PVC - Polyvinyl chloride | Food trays, cling film, bottles for squash, mineral water and shampoo. | Road cone bases, cable ducts, conduit and ducting |
| LDPE - Low density polyethylene | Carrier bags and bin liners. | Shrink wrap, industrial sacks, carrier bags, imitation wood products, damp-proof membranes, packaging film and traffic cones |
| PP - Polypropylene | Margarine tubs, microwaveable meal trays. | Packaging, textiles, automotive industry, domestic appliances, furniture, houseware, building |
| PS – Polystyrene | Yoghurt pots, foam meat or fish trays, hamburger boxes and egg cartons, vending cups, plastic cutlery, protective packaging for electronic goods and toys. | Plant pots, video cassettes, loose fill packaging and replacement hardwood. |
| Other | An example is melamine, which is often used in plastic plates and cups | |

*Polyethylene terephthalate* (PET) has a well established market as the polymer has many uses. The largest demand for the polymer is in the textile industry where it is used in the manufacturing of carpets, pillows, quilts and clothing. It can also be rolled into sheets to produce cassettes (VCR and audio) and is one of the commonest consumer plastics used.

Closed Loop Recycling is currently building the UK's first food grade plastic recycling facility, in Dagenham. Bottles and food packaging waste from suppliers, including Marks and Spencer, will be processed into a high quality PET which will subsequently be used within the remanufacturing and food packaging industry. There is a high global demand for good quality PET to be used by the beverage and food packaging companies e.g. Coca Cola. The new plant will be representative of a closed loop recycling system (London Remade, 2007) (Figure 37).

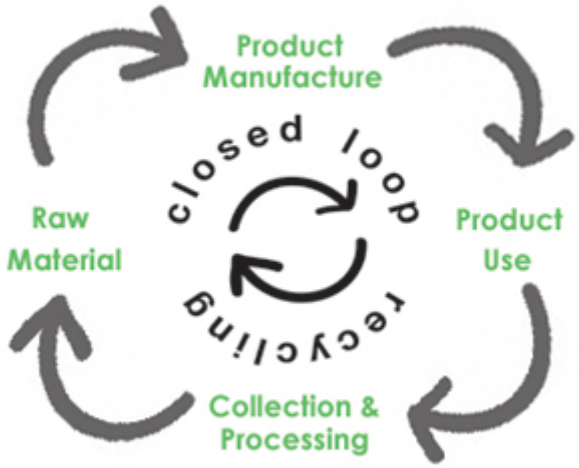



Figure 37 - Closed Loop Recycling (Source: London Remade, 2007)

Due to its natural color, ***High-Density Polyethylene*** (HDPE) is the most valuable polymer which can be processed into any color when it is recycled. The commonest end use for recycled HDPE is in the manufacturing of bottles; however, it is also used in the production of film, tubes and pipes, other packaging crates and containers (RECOUP, 2007).

WRAP (2007d) and associated partners (including Dairy Crest and Marks and Spencer) have conducted a large-scale HDPE recycling trial which has developed a revolutionary technology to recycle post consumer HDPE milk bottles back into milk bottles that meet food packaging standards.

Extensive research has been conducted by the PVC industry which has been supported by WRAP to improve the sustainability of the market through the creation of Vinyl 2010 commitment. The commitment is designed to increase the recycling of post-use PVC across Europe and a new organisation called Reconvinyl has subsequently been created.

***Low Density Polyethylene*** (LDPE) is chemically similar to HDPE but is more flexible. Most polyethylene films (PE), which include carrier bags, are made from LDPE. *Polyethylene films* (PE) are the most common type of plastic used in packaging. The recycling market for PE is well established with collation shrink (21.8%), heavy duty sacks (13.5%) and pallet shrink (10.9%) being the main types of films recycled. Some retailers, which include Tesco, are using reverse logistics to deliver film back to central facilities where films, trays and other packaging is returned for reuse or recycling (RECOUP, 2007).

***Polypropylene*** (PP) is used in a range of packaging application and sectors as it is an unusually resistant polymer. It is used in the production of packaging (especially for food), crates, textiles, in the automotive industry, domestic appliances and is commonly used for plastic mouldings, e.g. bottle tops and bottles.

***Expanded polystyrene*** (or EPS) is mainly used in packaging because it is lightweight and has excellent impact protection and insulating properties. However, compared to other recyclates, it is not a high profile target for recycling. In 2006, 4,670 tonnes of EPS packaging was recycled in the UK, equalling 29.3% of the

amount that is manufactured in the UK[33]. Businesses are advised to compact EPS waste before disposing of it to reduce its volume, which is 90% air. Alternative management techniques have been introduced including the "Styromelt "Thermal Densification System" which reduces the EPS to 95% of its volume by heating it to melting point which releases the air[34]. A liquid is produced which solidifies to a block when cooled which can subsequently be recycled. The thermally densified blocks can be recycled to produce a range of new products including coat hangers, picture frames, CD cases. As the incineration of EPS generates a large quantity of usable energy they are also sold to incinerators or used for energy recovery. Markets are also emerging to use the blocs for the production of fuels which includes LPG.

EPS take-back schemes with electrical retailers and the food packaging sector have been established by the EPS Recycling Group. The supplier typically collects the EPS packaging from the customer, transports it to a central depot where it is compacted before being sold to a recycling merchant. Suppliers are encouraged to participate in such schemes due to the financial benefits associated with reduced waste disposal and transport costs.

EPS can be manufactured into a range of products including plant pots, videos, cassettes, loose fill packaging and replacement hardwood lumber. The supply of EPS within the UK can be increased if food retailers are encouraged to return EPS packaging.

Since 2000, there has been a steady increase in the export of plastics in which double the quantity of material recovered in the UK is exported. As with other material markets, this increase has been attributed to the developing Asian market. The UK is also a net importer of plastics in particular PE (36%) and PVC (24%). The future security of the plastic market within the UK is largely dependent on:

- the ability to overcome barriers to utilising recovered plastics in food contact packaging
- ensuring that waste plastics are used in the production of building and construction products.

It is predicted that there will be an increase in the level of recovered plastics used in packaging materials, plates and sheets, tubes and pipes and building products in the UK between 2006 and 2010. The greatest proportion of demand and growth is predicted within the plastic building product sector partially due to increases in large-scale productions, e.g. 2012 Olympic Games.

The market prices for plastic film and bottles recorded during October 2007 are summarised in Table 31 and Table 32.

Table 31 - Price per tonne for plastic film in October 2007 (clean uncontaminated baled material delivered to a merchant) (Adapted from Letsrecycle.com, 2007b)

| Polymer | Description | October 2007 Plastic film (£ per tonne) |
|---|---|---|
| HDPE (high density polyethylene) | mixed colour/printed | 135 - 170 |
| | single colour/natural | 210 - 240 |

[33] http://www.eps.co.uk
[34] http://www.styromelt.com/

| | | |
|---|---|---|
| LDPE (low density polyethylene) | mixed colour/printed | 175 - 205 |
| | single colour/natural | 200 - 240 |

Table 32 - Price per tonne for plastic bottles in October2007 (Adapted from Letsrecycle.com, 2007c)

| Polymer | Oct 2007 Plastic bottles (£ per tonne) |
|---|---|
| clear and light blue PET | 110 - 130 |
| coloured PET | 60 - 80 |
| HDPE natural | 210 - 240 |
| HDPE mixed colour | 140 - 180 |
| PVC | 10 - 25 |
| mixed | 100 - 120 |

***Reusable plastics***

Plastics are used in a wide range of application some of which become waste shortly after purchase e.g. food packaging while other have properties that enable them to be reused repeatedly. The use of plastic packaging has become more widespread within the retail sector since the introduction of recycling and recovery targets set out in the Packaging Waste Directive. As a result the number of plastic crates (which can last up to 20 years) used by the major supermarkets has increased from 8.5 million (1992) to 35.8 million (2002).

## *4.4 Recycling collections for SMEs*

### 4.4.1 Participation of SMEs in recycling contracts

An online survey of representatives from 601 SMEs and 201 larger corporate businesses (250+ employees) was commissioned by Taylor Intelligence in September 2007 (Taylor Intelligence, 2007) as part of the "Recycling in UK plc – A state of the workplace report". The report explored and evaluated the awareness and preparedness of different business groups for the **Producer Pre-Treatment Requirement** which was introduced on 30th October 2007, and also general current recycling activities adopted by businesses. Under the Producer Pre-treatment Requirement (discussed in more detail in Section 6.2), no waste can be sent to landfill unless it has been pre-treated. Consequently, businesses are obligated to separate out recyclate from general waste streams for collection or to send waste to a sorting facility for separation.

The key findings from the "Recycling in UK plc" survey are summarised in Table 33. The research highlights that, in general, SMEs are not aware of the Producer Pre-treatment Requirements and do not have the facilities or contracts in place to separate and recover recyclate from the general waste stream. As a result, there is clearly a market for both private contractors and local authorities to provide commercial recycling collections to SMEs. The Waste Strategy 2007, which has introduced a strategic objective to encourage local authorities to assist SMEs to recycle, also demonstrates the need. The report recommends that recycling

contractors need to actively promote their services as a proportion of both SMEs (11%) and corporates (16%) found it difficult to find a recycling contractor.

Table 33 - Summary of key findings from the Taylor Intelligence (2007) survey of SMEs and larger corporate businesses

| SME (2-250 employees) | Corporate (250+) |
|---|---|
| -17% were aware of the Producer Pre-treatment Requirement,<br>-13% use private recycling contractors,<br>-28% use local authority recycling services,<br>47% neither use a private or local authority contractor,<br>-34% of which take recyclate home,<br>-11% found it difficult to find a contractor,<br>-13% not using a contractor were unaware of recycling services in their area,<br>-12% not using a contractor stated that the service was too expensive,<br>-46% spent no money on recycling,<br>-10% spent more than £500 on recycling per annum,<br>-25% of SMEs do not have recycling bins,<br>-3% set recycling targets,<br>-1% show recycling performance as a KPI. | -45% were aware of the Producer Pre-treatment Requirement,<br>-61% use private recycling contractors,<br>-22% use local authority recycling services,<br>-16% found it difficult to find a contractor,<br>-15% not using a contractor stated that the service was too expensive,<br>-6% do not have recycling bins,<br>-9% spend more than £100,000 on recycling per annum,<br>-35% set recycling targets,<br>-27% show recycling performance as a KPI. |

Despite the acknowledged benefits associated with recycling, there are numerous barriers which discourage SMEs from separating recyclate from their waste streams (Keep Wales Tidy and ESRC BRASS, 2004; Greater London Authority, 2004).

- Inadequate free space on-site to separate waste
- Waste contractors will only provide a collection service once a sufficient quantity of material has been stored
- Adequate suitable storage space for waste to be stored until there is a sufficient quantity to be collected by the waste contractor
- Additional costs associated with recycling collections could be prohibitive especially when there are few free recycling services available
- Recycling companies not wanting to collect from them as they produce lower quantities of waste
- Unaware of opportunities to recycle.

In order in increase the level of participation of SMEs in recycling services, collections need to be made easy, convenient and cheap to participate (Greater London Authority, 2004). Research conducted for the Greater London Authority (2004) recommends that the development of schemes for SMEs should:

- focus on exploiting economies of scale where clusters of neighbouring business are encouraged to participate together in a recycling service,
- focus on the collection of mixed dry recyclables which reduces the need for source separation on-site.

It is identified that there are few alternative waste disposal options available to SMEs other than landfill and as a result this sector is particularly suffering from the spiralling waste disposal costs (Remade Essex, 2007a). This, coupled to legislative pressures and government targets, is creating a niche for the development of commercial recycling schemes for smaller businesses.

### 4.4.2 WRAP SME Recycling Trials

WRAP has developed an SME Recycling Programme the first stage of which was launched in 2006 and consisted of a series of 12 nationwide feasibility trials to collect various materials from SMEs (Wrap, 2007e). The trials ran for 6 months with the aim of developing a cost effective and convenient recycling service for SMEs which includes collection schemes for small retailers (construction and commercial food industries, business parks and offices). The trials were designed to address a range of issues including different collection techniques, frequency of collection, pricing schemes and the most effective ways to encourage SMEs to sign up to a recycling service (Table 34).

After completion, the results from the trials were evaluated and were used to formulate three good practice models which have been developed into demonstration trials (Wrap 2007f).

a) Multi-material recycling service for a range of SMEs primarily offices (9 trials),
b) City centre cardboard and paper recycling collection service (4 trials)
c) Glass container collection service for the hospitality businesses (3 trials),

The demonstration trials were scheduled for completion in August 2007 but have yet to be reported. They will hopefully enable WRAP to develop the good practice models for a larger numbers of SMEs and service providers across a wider geographical location. The results from the trials will also provide a better understanding behind:

- the reasons why SMEs may not be segregating waste for recycling
- logistical arrangements required for waste collection and disposal
- the lack of internal resources
- the lack of capacity to implement recycling segregation and collection

Details of the three groups of demonstration trials are summarised in Table 34.

Table 34 - Summary of SME trials being funded by WRAP

| **Industry** | **Location** | **Trial** |
|---|---|---|
| Small retailers | London | First Mile will be targeting small city based retailers to develop recycling collections for businesses with little of no storage |
| Commercial food waste | Bexley | Bexley council to work with local restaurants and takeaways to develop convenient collection services |
| | Bristol and Bath | ECT to collect kitchen waste from restaurants, pubs, cares and takeaways |
| | West Yorkshire, East Lancashire and Greater Manchester | Urban Mines to manage the trial which focuses on collecting and composting food waste from commercial food manufacturers and processors. |

| | | |
|---|---|---|
| | Oxford | Oxford Brookes University will developing on-site composting at 6 hotels |
| Industrial Estates | Stockport | Axion Recycling and Stockport Metropolitan Borough Council are to target 12 industrial estates to encourage the recycling of paper, cardboard and plastic through shared collection facilities on the estates |
| | Wakefield | Groundwork Yorkshire and the Humber will be developing recycling facility for businesses on an industrial estate |
| | Bridgend | Collection of mixed recyclables (paper, glass, cans, plastic and cardboard) from industrial estates in Brackla and Litchard |
| | Edinburgh and Lothian | LEEP recycling and Changeworks will be approaching 15 business parks and industrial estates to collect mixed recycling. Businesses will be offered 1,100 litre bins or desk high boxes for smaller quantities, regular or on demand collections |
| Construction industry | Warrington, Manchester & Peterborough | Axion Recycling will offer smaller building companies 3 recycling services (timber, glass, plasterboard, cardboard packaging, plastic and aggregates) depending on the size of the sites they are working on:- i) drop off, ii) collection by skip, iii) collection in bulk bag. |

***Multi-material recycling trials***

The *nine multi-material recycling trials* are being conducted by local authorities, waste management companies and also social enterprises (Table 35). To accommodate for the SME market (e.g. limited storage capacity), sacks are used for the collection of a wide range of recyclate. The majority of schemes require businesses to separate different recyclate into different sacks which may be colour coded. Collections are flexible to meet the individuals needs (e.g. daily, weekly, fortnightly, monthly or on demand). Dove Recycling and "The Laundry" schemes have been reviewed in detail as they are deemed to be relevant to the urban environment.

Table 35 - Summary of the schemes being instigated as part of the multi-material recycling service for a range of SMEs

| **Organisation** | **Details** |
|---|---|
| Hampshire County Council and *Dove Recycling* | -First month collections free to ascertain how much recyclate<br>-Separate paper, clean flattened cardboard and drinks cans in to polypropylene sacks, and plastic bottles and film into plastic bins.<br>-also collect all working and non-operational computer equipment, mobile phones and fluorescent tubes |
| *The Laundry* | -Weekly collection of paper and plastic bottles in colour coded sacks and bundles of cardboard |
| Brampton Skip Hire | -Weekly collections<br>-SMEs asked to purchase 50 sacks<br>-Paper, cans/tins and plastic bottles all in different sacks<br>-Cardboard flattened |
| Bryson Recycling | -Regular collections (weekly, fortnightly of monthly) |

| | |
|---|---|
| | -Paper, plastic bottles, cans/tins all in separate sacks, cardboard flattened<br>-Or can use 240 or 1100 litre bins |
| Can Do Recycling | -Daily, weekly or monthly<br>-Paper (reusable sacks), cans, plastic bottles and film (clear sacks), cardboard flattened |
| Greater Manchester Waste Ltd | -Weekly or twice weekly<br>-Separate paper and cardboard in one sack or bin, plastic and cans in another<br>-Introductory rate for first 2 months |
| Greenlight Environmental Ltd | -Weekly or fortnightly<br>-Recyclable materials co-mingled into their own bin<br>-Paper, cardboard, aluminium, steel and plastic bottles |
| Perry's Recycling | -Regular or on-demand collection<br>-If have 10 or more sacks to collect it is FOC<br>-Separate out paper, flattened cardboard, drinks cans and put in sacks |
| Waste Savers | -Weekly, fortnightly or monthly collection<br>-Separate into paper, cardboard, plastic bottles, cans, toner and ink cartridges and mobile phones into sacks |

*Dove Recycling*

In 2005 Dove Recycling launched a commercial recyclable waste collection trial in Winchester (Miracles, 2006). . Each participating business was charged a collection fee of £6.50 per week, for which they received one or two collections per week, depending on their needs. Each collection consisted of a maximum of three 50-litre bags. Dove Recycling provides a flexible collection service which is delivered weekly, fortnightly, or on-demand. On the day of collection customers are required to place receptacles in a centralised location ready for collection. The waste was taken away by Dove Recycling to their premises, using an electric vehicle (Figure 38), where it was bulked into containers and then disposed of at a local recycling site.


Figure 38 - Dove Recycling collection vehicle (Source: Dove Recycling)

During October 2005, a total of 965kg of recyclable waste was collected by Dove Recycling. Although their client base consisted of 35 Winchester businesses, collections were made from only 15 of them during October, implying that not all businesses required a regular collection service or that there had been start-up problems for some of them, e.g. they decided not to go ahead with it (Miracles, 2006).

Table 36 - Summary of the types of receptacles and recyclate collected by Dove Recycling (from Dove Recycling[35])

| **Receptacle** | **Material used for** |
|---|---|
| Paper bags | Office paper, envelopes, magazines, newspapers, paper |
| Cardboard bags | All clean flat-packed cardboard |
| Convert bins | Rinsed plastic or empty drinks cans |
| Bulk bins | Clean bulk quantity of flat-packed cardboard |
| Confidential waste bags | Paper only |
| Drop front wheelie bins | Bulk bagged recyclables, e.g. paper and cardboard |

There was evidence from Dove's contacts with the businesses that many of them signed up to the scheme primarily because Dove was using an electric van to collect the waste. The businesses believed that their involvement with such a scheme created a good impression with the public and was therefore a useful public relations

[35] http://www.doverecycling.co.uk/index.php

exercise in addition to the environmental benefits of having their waste recycled. Another consequence of using an electric vehicle is that is has relatively low running costs so the collection service can be offered at a competitive rate.

In addition to recycling collections, Dove Recycling also provide i) expert advice on a range of balers and ii) a free 2-week trial period including installation and full training.

*"The Laundry"*

The Laundry (a joint venture between London Recycling Ltd and BioRegional) is a kerbside paper collection scheme that was launched in 2003 with the aim of increasing the recycling of office paper, particularly among smaller offices in central city locations (Wisions, 2006). It is suggested that approximately 60% of business paper is produced by SMEs although inadequate storage space hinders recycling.

The Laundry operates a pay-per-use collection scheme for designated streets in Soho, Clerkenwell, Holborn, Covent Garden and the City, where recyclables are collected on Thursdays at designated times (Table 37). Customers are required to put their bags out up to half an hour before the collection time. If a street is not on the Laundry route it can be added when 3 companies in the same street show an interest in the scheme.

Table 37 - Example of collection times allocated to streets within The Laundry Scheme (from The Laundry[36]).

| **Street** | **Area** | **Collection Time** |
|---|---|---|
| Adam Street | Covent Garden | 10:00 AM |
| Albemarle Street | Mayfair | 10:30 AM |
| Albemarle Way | Clerkenwell | 12:30 PM |
| Aldersgate | Holborn | 10:00 AM |

During 2005/6, 300 tonnes of paper was collected, with an average of 26 tonnes being collected each month. Since 2002, 700 offices have joined the scheme, 99% of which had not previously recycled.

For waste to be collected by The Laundry, customers are required to purchase sacks (blue for all types of paper and orange for aluminum drinks cans and plastic bottles), or stickers for bundles of cardboard which can be purchased directly (Table 38).

Table 38 - Summary of costing of sacks and stickers required for The Laundry recycling scheme (from The Laundry[37])

| **Items** | **Purchase costs** | **Delivery costs** |
|---|---|---|
| Blue sacks for paper | 95p each in packs of 50 | £4.95 per order, under 100 items are delivered by bicycle. |

[36] http://www.thelaundry.biz
[37] http://www.thelaundry.biz

| | | |
|---|---|---|
| Orange sacks for cans and plastic bottles | 95p each in packs of 20 | Delivery within 2 working days. |
| Stickers for cardboard | 95p each in packs of 20 or 50* | |
| Bins | £12 each | £4.95 these are delivered on a Monday |

***City centre cardboard and paper collection recycling service (4 trials)***

There are four schemes being trialled as part of the development of city centre cardboard and paper collection services. A summary of the schemes particulars highlights that they provide SMEs with a flexible collection (e.g. daily, weekly, bi-weekly) service, therefore meeting the needs of individual businesses. To accommodate for the lack of space, sacks and stickers which are attached to bundled cardboard are used for the collection of cardboard and paper. However, bins are available for those with enough space to accommodate them. Unfortunately, there was only limited information available about the four schemes listed in Table 39.

Table 39 - Summary of the schemes being instigated as part of the city centre cardboard and paper collection recycling trials

| **Organisation** | **Detail** |
|---|---|
| GPM Network Ltd Newcastle | -Paper and Cardboard<br>-Multi-material recycling business collecting daily, weekly or biweekly<br>-Smaller SMEs can pay as you go<br>-Wide range of receptacles depending on available space<br>-Wheeled bins can be emptied for one off fee |
| Leep Recycling | -Paper, cardboard, plastic bottles and cans<br>-Offer daily, weekly, fortnightly and on demand service<br>-SMEs provded with labels for bundled cardboard, sacks for cans and plastic bottles |
| Durham Company | -Paper and cardboard<br>-Twice weekly collection service<br>-SMEs provided with labels for bundled cardboard and sacks for paper, 1100 litre bins available if space allows |
| Preston City Council | -Paper and cardboard<br>-Daily collections (Monday – Saturday)<br>-SMEs provided with labels for cardboard, sacks for paper and wheeled bins available if space allows |

## 4.4.3 Commercial Recycling Services for SMEs

***BasRap***

BasRap is another example of a commercial recycling service that was launched specifically for SMEs. Initially it was started as a partnership project between Onyx, Remade Essex and Basildon Green Business Forum (BGBF) but it has now grown to such an extent that it has become financially viable and that, from March 2004, Onyx run the scheme commercially (Remade Essex, 2007b). Onyx provides 1100 litre eurobins to participating SMEs which are emptied on weekly. Any business that required 5 or more 1100 litre bins were issued with a rear-end loader (REL) service.

Remade Essex (2004) have produced a framework document which outlines a basic mode the can be used to replicate the BasRap scheme.

*Phase 1 – Research Phase*

- Assess service coverage area to enable demand to be quantified
- Review and identify materials available for collection and the reprocessing capacities
- Data collection
- Reprocessing/merchant availability
- Duty of care
- Sourcing a service provider
- Administration and funding
- Review of the competition in the waste management sector in area
- Calculate the costs associated with operation of a scheme

*Phase 2 – Service design*

- Quantify the charges for the service
- Calculate number of collections required for service to be provided at a minimum and also to be financially viable
- Establish current service contract requirements
- Identify appropriate containers, and consider i) multiple containers, ii) larger containers, iii) bin share
- Specify i) collection service, ii) material quality
- Identify contamination issues
- Storage of collected materials
- Promote the benefits to the service provider

*Phase 3 – Service commencement*

- Recruit businesses to the service
- Ensure that contamination is minimised and a high quality of materials are collected
- Promote benefits
- Marketing

The BasRap model highlighted that to make collections viable, high enough volumes of recyclate must be collected. it is important to issue suitable container types and sizes to accommodate the frequency of collections. The following factors need to be considered:-

- Space available,
- Ease of handling
- Equipment required for lifting
- Alternative sizes for smaller producers
- Types of materials to be collected
- Does the size of the bin hold enough materials for a weekly collection

To ensure that businesses made a saving from participating in the scheme, BasRap benchmarked costs against Basildon District Council (BDC) general waste collections charges for the comparable container sizes. The charges levied for general waste collections by BDC varied significantly between £4.75 to £8.50 VAT, BasRap subsequently charged £3.50 +VAT which enabled a 99% take up rate to the scheme. An overview of the costs of operation of the scheme in its first year of commencement are summarised in Table 40.

Table 40 - Analysis of first-year costs (from Remade Essex, 2004)

| | 1st quarter | 2nd quarter | 3rd quarter | 4th quarter |
|---|---|---|---|---|
| No. of bins serviced | 50 | 70 | 90 | 110 |
| No. of bin lifts | 650 | 910 | 1170 | 1430 |
| Lift charge (£) | 3.50 | 3.50 | 4.03 | 4.03 |
| Lift revenue (£) | 2,275.00 | 3,185.00 | 4,715.10 | 5,762.90 |
| Av. kgs per lift | 35 | 35 | 35 | 35 |
| Material revenue (£) | 227.50 | 318.50 | 409.50 | 500.50 |
| Gross revenue (£) | 2,502.50 | 3,503.50 | 5,124.60 | 6,263.40 |
| Av. collection (hrs) | 3 | 3.30 | 4 | 4.3 |
| Cost per lift (£) | 4.03 | 3.36 | 3.08 | 2.85 |
| Cost of collection (£) | 2,619.50 | 3,057.60 | 3,603.60 | 4,075.50 |
| Profit loss (£) | 117.00 | 445.90 | 1,521.00 | 2,187.90 |

Two case studies which include a small high street retail outlet and a small national retail outlet are used to demonstrate the costs and waste-to-landfill saving that could be achieved by SMEs participating in commercial recycling schemes such as BasRap (Remade Essex, 2004).

*Small retail outlet*

A waste audit conducted at the small retail outlet (1 full-time and 2 part-time members of staff) identified that cardboard (80%), polystyrene chips (15%) and mixed office paper (5%) were the main waste types produced by the business. Two black sacks of waste were produced, on a weekly basis, which were deposited in a neighbour's bin. Contribution in the scheme resulted in a reduction in disposal costs by £3.97 per week in addition to an 80% reduction in the total waste landfilled.

*Small national retail outlet*

A waste audit conducted for a small national retail outlet (5 full-time and 3 part-time members of staff) identified that cardboard (50%), mixed paper (25%), plastic wrap (10%) and house card price displays (5%) were the main waste types produced. It was identified that approximately half of the waste produced by the business could be recycled by BasRap, therefore 2 Eurobins were replaced by recycling containers. Contribution in the scheme resulted in a reduction in disposal costs by £5.30 per week in addition to a 60% reduction in the total waste landfilled (Table 41).

Table 41 - Summary of financial savings and savings to landfill experienced by a small retail outlet and a small national retail outlet participating in BasRap (from Remade Essex, 2004)

| | **Small retail outlet (before)** | **Small retail outlet (BasRap)** | **Small national retail outlet (before)** | **Small national retail outlet (BasRap)** |
|---|---|---|---|---|
| Waste disposal | 1x1100 litre eurobin | 1x1100 litre eurobin | 4x1100 litre eurobin | 2x1100 litre eurobin (waste)<br>2x1100 litre eurobin (BasRap) |
| Collection | Once a week | Once a week | Once a week | Once a week |

| | | | | |
|---|---|---|---|---|
| Cost | £8.50 per week | £4.03 per week | £6.50x4 =£26.00 per week | £3.85x2=£7.70 per week £6.50x2=£13.00 per week =£20.70 |
| Financial Savings | | £3.97 per week | | £5.30 per week |
| Savings to landfill | | 80% total waste away from landfill | | 60% total waste away from landfill |

***NORWRAP***

Based on the success in Basildon, Onyx has expanded the service into neighbouring regions (Southend-on-Sea, Rayleigh, Wickford, Brentwood, Grays and Tilbury). The framework has also been adopted in Norfolk (Thetford, Great Yarmouth, and Norwich) in the Norfolk Waste Recycling Assistance Project (NORWRAP) which uses accredited waste contractors to collect and recover recyclate from commercial premises (Table 42), (NORWRAP, 2005)

*Thetford*

Pearsons Ltd provides a weekly or fortnightly collection of paper and card. A range of bin sizes are available (240l, 660l and 1100l) and charges are levied at £3.50 per lift per week.

*Great Yarmouth*

There are three contractors operating the NORWRAP scheme in Great Yarmouth; East Coast Waste Ltd, GYB Services Ltd and Norfolk Environmental Waste Services Ltd.

Table 42 - Summary of NORWARP services provided in Great Yarmouth (from NORWRAP, 2005)

| | **East Coast Waste Ltd** | **GYB Services Ltd** | **Environmental Waste Services Ltd** |
|---|---|---|---|
| Material | Paper, card, wood, glass bottles and jars | Mixed paper and cardboard | Office paper, junk mail, cardboard, plastic bottles, steel and aluminium cans |
| Bin | Skips or caged vehicle collections | 1100l bin | 1100l bin |
| Cost of collection | Price varies (e.g. 2 cubic yard skip £2) | £4.50 per week plus £1 per week bin rental | £4.75 per week plus £1 per week bin rental |
| Frequency | Weekly or ad-hoc | Weekly, fortnightly on-demand | N/A |

*Norwich*

The Norwich scheme is currently being developed to include the city centre and industrial areas. Unfortunately no further information was available about the scheme at the time of writing.

***Papersave***

The "PaperSave" scheme, funded and developed by SITA Environmental Trust and numerous county councils (e.g. Surrey County Council, Reigate and Banstead Borough Council, Epsom and Ewell Borough Council) provided SMEs with weekly or fortnightly collections of mixed paper and cardboard (Surrey County Council, 2005, Sitatrust, 2005). Funding for the scheme was allocated for 9 months in order to establish a high number of participating businesses which would enable contractors to reduce collection costs to a level that would be attractive to SMEs. The first scheme was located on the Holmethorpe Industrial estate in Redhill and was serviced by Reigate and Banstead Borough Council; the second scheme was based in Epsom Town Centre and was operated by a private contractor, SITA Recycling UK (Sitatrust, 2005).

On the industrial estate 38% of SMEs approached decided to participate in the scheme compared to 30% on the high street. It is suggested that participation levels were higher on the estate due to:

- businesses being aware of the recycling scheme several months in advance of recruitment where as those on the high street were not aware of the scheme until the mail shot was distributed
- increased waste awareness due to higher disposal costs associated with the production of larger quantities of waste and the requirement of larger bins
- more incentive to reduce disposal costs

After completion of the pilot scheme, participating SMEs were asked to comment on i) what they thought were the main advantages and disadvantages of the Papersave scheme, and ii) whether they wished to continue with the scheme after the pilot phase. The main advantage of the scheme from both the industrial estate (44%) and high street (37%) participants was that it was "good for the environment" (Sitatrust, 2005). The other advantages of the scheme were that it saved space, made it easy to recycle and saved money. The main disadvantages of the scheme were due to the lack of flexibility with collections (only once a week) and the poor level of service.

In total, 26% of SMEs on the industrial estate and 35% from the high street did not want to continue with the scheme post pilot. The majority of non-participants from the industrial estate (70%) stated that the service was too costly as it increased their overheads by £20 per month; others found alternative means of disposing their recyclate (20%). However, on the high street non-participants were not willing to pay for the service (52%) and again found the service too costly (22%) (Sitatrust, 2005).

The Papersave scheme identified that businesses are willing to participate and pay for recycling although many factors must be considered before embarking on such a scheme:-

- Recruitment of businesses
- Proximity of contractors to business
- Accessibility of receptacles
- Timing of collections

- Volume of materials to be collected
- Flexibility in frequency of collections
- Size of receptacles
- Support

### 4.4.4 Summary of SME trials and schemes

The trials reviewed have been specifically implemented for the SME market. The i) materials separated, ii) receptacles used, iii) collection frequency and iv) costs associated with the schemes have been summarised.

***Materials***

Paper, cardboard, plastic, cans are the main types of recyclate that were targeted in the reviewed trials.

***Receptacles***

It is widely accepted that limited space is one of the major barrier hindering SMEs from participating in commercial recycling schemes (Miracles, 2006). Schemes specifically designed for the SME market seek to remove this barrier by collecting waste in sacks rather than bins. All of the schemes reviewed required customers to dispose of recyclate into designated prepaid sacks. However, those that provided a collection for cardboard typically requested that it was either bundled or flattened and labelled with a prepaid sticker.

Schemes operated by Dove Recycling, Brampton Skip Hire, Can Do Recycling, Greater Manchester Waste Ltd and Waste Savers also stipulated that different recyclates were contained within separate sacks e.g. cardboard separate from plastic and cans. The Laundry used colour coded sacks to distinguish between different materials.

Durham Company, GPM Network Ltd and Bryson Recycling permit the use of wheeled bins if space permitted their use.

***Frequency and cost of collection***

The frequency of recyclate collection varies between schemes although typically SMEs are provided with weekly, fortnightly or monthly services. Can Do Recycling and Preston City Council both provide regular daily collections, providing a service for those who produce significant volumes of recyclate. One-off collections are also provided.

The charges levied for the collection of recyclate depend on the type of receptacle used, e.g. sack or bin. The majority of schemes require participants to purchase pre-paid sacks, where the cost of collection is incorporated within the overall cost of the sack. As they are typically sold in bundles, SMEs are required to purchase a certain number of sacks before they can actively benefit from the collection service. This initial financial outlay may deter those businesses producing minimal amounts of recyclate. A multi-material recycling trial managed by Perry's Recycling seeks to provide SMEs with free collection if 10 or more sacks are collected.

The cost of the sacks varies between schemes. A recycling service provided by 'The Laundry' sells sacks and stickers in bundles of 20 (orange sacks for cans and plastics) and 50 (blue sacks for paper) at a cost of 95 pence each, and an additional £4.95 is levied for their delivery.

For SMEs that are allocated with wheeled bins, charges are levied each time the bin is emptied and the cost will depend on the size of the bin. Services provided by BasRap and NORWRAP typically use 1100 litre eurobins and charge between £3.50 and £4.75 per collection. Two of the contractors operating the NORWRAP scheme also charge an additional £1 per week for the rental of the bin.


Figure 39 - *Receptacles used by The Laundry recycling scheme (Source: The Laundry[38])*

## *4.5 Local authority commercial recycling schemes*

Local authorities can set up their own trade waste collections and under the ***Controlled Waste Regulations***, they can charge businesses for these services. Generally, businesses will arrange a collection contract with a private waste management company but some authorities have started up rival services even though trade recyclate cannot contribute towards recycling targets.

Local authorities that do provide a trade recycling service either i) combine commercial and domestic collections together or ii) specifically collect commercial waste separately.

### 4.5.1 Joint commercial and domestic collections

Within the UK there are few examples of waste collection authorities facilitating the collection of domestic and commercial wastes. McLeod and Cherrett (2006) [39] reviewed the operating procedures associated with a joint commercial and domestic waste service managed by the New Forest District Council (NFDC - a waste collection authority). NFDC have been operating a commercial waste scheme for over 10 years using the same fleet of vehicles as the domestic collections.

[38] http://www.thelaundry.biz/order
[39] Unpublished report to the Department for Transport

***Materials Recycled***

Within the New Forest, waste and recyclate (collected in two separate rounds) are collected from SMEs who have pre-registered with the council and have acquired a 'duty of care' certificate. SMEs are also provided with collection services for i) semi-rigid materials for example cardboard which can be collected if formed into bales of around 100 litre volume are attached with a NFDC plastic sack and ii) glass which operates as part of the bring-site collection rounds (Miracles, 2006). Residual waste is collected on a weekly basis from 13 rounds and the proportion of commercial waste collected on these rounds ranges from 0.1% to 3.2% (average 1.7%). Similar detailed data relating to the proportions of recyclate were not available although NFDC have estimated that 97.5 tonnes of commercial recyclable waste was collected 2005/6.

The service has a wide range of customers which are primarily small shops who do not want a large scale commercial collection. It is suggested that the sacks are not suitable for larger businesses who typically produce more waste and prefer storing waste within bins or skips. Since its operation there have been no reported problems with trade collections impacting on domestic capacity e.g. variable trade waste volumes resulting in lack of capacity on the vehicle to collect domestic waste.

***Cost of collections***

A 26-tonne RCV is used (narrower vehicle maybe used in rural locations) to collect plastic sacks which are used for the majority of waste and recyclate collections although 1100 litre containers are available for commercial recyclable collections at a charge of £6.50 per collection (Miracles, 2006). Sacks have to be purchased from NFDC and a sliding charge is used depending on the number of sacks and the frequency of collections provided. For residual waste the cost is £1 per sack for up to 10 sacks to be collected each week which is reduced to 50p per sack for collections of 60 or more sacks per week. Businesses are provided with an incentive to separate their waste as the collection of recyclate is charged at a cheaper fixed rate of 50p per sack which is subsidised by the residual commercial waste collections. SMEs have to purchase Council Trade Recycling Stickers and attach one to each sack (50 for £20). The scheme is subsidised by the residual waste collections to enable a lower fee to be charged for the collection of recyclate which is designed to make it more cost effective for businesses to recycle their waste. .

***Impact of collecting additional waste***

Waste collection round modelling was used to demonstrate the potential costs and benefits associated with adding commercial recycling collections to 8 existing domestic collection rounds (16 loads). Data relating to domestic rounds (volumes of waste, property numbers and routes taken) was obtained for case study sites roads in Fleet and Farnborough; this was used in conjunction with commercial recyclable waste data from NFDC and Winchester High Street. The model was used to estimate the i) collection costs, ii) collection and delivery revenue and iii) recyclate sales revenue associated with the collection of different weights of recyclate from commercial premises on 8 rounds.

The ability of an existing domestic round to collect additional waste is dependent on the spare capacity in the RCV. Spare capacity is needed in terms of physical space and in terms of the time allocated for collection due to time constraints associated with the crews shift length and the operating hours of waste facilities. A total spare capacity of 11.3% (14.4 tonnes) was estimated for the 8 modelled rounds and one

hour and 16 minutes available time was estimated for each round. The modelling incorporated different amounts of commercial waste (3.9T, 7.4T, 14.4T[40]) onto the existing domestic rounds to measure i) the associated impacts in terms of journey distance, added time, revenue and costs; ii) the point at which extra waste collection generated additional trips to the waste disposal facilities (in addition to existing 2 trips per round). A collection weight of 18.4T, which was greater than the existing spare capacity (14.4T), was included to analyse the impacts of requiring additional vehicles (Table 43).

Table 43 - Impact of introducing commercial recyclable waste onto domestic rounds (from Miracles, 2006)

| **Commercial waste (tonne/fortnight)** | **Commercial waste (% overall load)** | **Rounds** | **Loads taken to waste disposal site** | **Distance (km)** | **Time (hh:mm)** |
|---|---|---|---|---|---|
| 0 | 0% | 8 | 15 | 373.6 | 53:55 |
| 3.9 | 1.7% | 8 | 15 | 420.2 | 56:29 |
| 7.4 | 3.2% | 8 | 16 | 397.5 | 57:08 |
| 14.4 | 6.3% | 8 | 17 | 427.2 | 60:28 |
| 18.4 | 8.0% | 9 | 19 | 428.9 | 62:01 |

The key findings are summarised:

- Additional commercial waste loads of 3.9T and 7.4T could be accommodated using existing domestic collection rounds
- 1 and 2 additional trips to the waste disposal sites were generated from the addition of 7.4T and 14.4T respectively but were still contained within the 8 rounds
- An additional round and 19 loads were required for the collection of 18.4T
- Additional commercial waste loads increase round duration from 2 hours 34 minutes (3.9T) to 8 hours 6 minutes (18.4T)

Participating businesses benefit from local authority collections in the following ways:

- Reduced waste disposal costs, as it becomes cheaper to recycle waste than to pay for landfill tax for the disposal of general waste.
- Joint collections enable local authorities to provide a service which may not be available to SMEs or businesses that do not produce much waste as private waste contractors may deem collections to not be cost effective.
- Recycling can be used as a marketing tool to demonstrate a business's environmental performance and credentials.

The total costs of collection were estimated and compared to the estimated revenue costs derived from the payments made by businesses for the collection and merchants purchasing the collected recyclate. This analysis suggested that local authorities make a significant financial loss by combining the collection of commercial waste with existing domestic rounds (Table 44). The total revenue that may be derived from collecting recyclable commercial waste based on collection and delivery revenue (selling recyclate to merchants). Collection revenue generated by businesses was estimated at £7 per tonne (calculated on cost per sack and

[40] 3.9T equates to 1.7% of the total waste collected which is equal to the mean figure found from the NFDC data, and 7.4T to 3.2% of the total waste collected which equates to the maximum proportion of commercial waste on a NFDC round. 14.4T was the modelled spare capacity

approximate volume to weight relationship for recyclate 1400 litre per tonne). This low fee is designed to make recycling more attractive and cost effective to businesses as it is a cheaper option than disposing residual waste. Delivery revenue was calculated from current indicative prices paid for each individual recyclable material.

Table 44 - Example of the potential financial losses associated with joint collections (from Miracles, 2006)

| Commercial Waste (tonne/fortnight) | Commercial waste (% overall load) | Annual revenue* | Increased annual cost+ | Net loss per annum |
|---|---|---|---|---|
| 3.9 | 1.7% | £1702 | £9693 | £7991 |
| 7.4 | 3.2% | £3229 | £4971 | £1742 |
| 14.4 | 6.3% | £6283 | £11149 | £4866 |
| 18.4 | 8.0% | £8028 | £11502 | £3474 |

*Annual revenue derived from collection and delivery revenue

+Annual costs derived from operational costs of £8 per km derived from Jacobs Babtie, (2005)

## 4.5.2 Separate local authority recycling schemes

To encourage recycling within the commercial and industrial sector, local authorities are increasingly trialling recycling schemes. In order to identify the key characteristics of such schemes, 10 local authority schemes funded by BREW have been reviewed by the Environmental Advisory Service[41].

- Alnwick District Council
- Ashfield District Council
- Basildon District Council
- Bath and North East Somerset Council
- Chichester District Council
- City of London
- Ellesmere Port and Neston Borough Council
- London Borough of Hackney
- Medway Council
- Wealdon District Council

In each instance the services provided by the authorities in terms of the; i) materials recovered, ii) receptacles used, iii) frequency and cost of collection are all discussed.

***Materials recovered***

Despite the different types of recyclate produced by the retail sector (as identified in section 4.2), local authorities typically collect limited types of materials. These services can be summarised as those offering:-

- Collections of one type of recyclate e.g. glass, cardboard
- Mixed recyclate collections which
    - Include glass
    - exclude glass

[41] http://www.eas.local.gov.uk/PanelCaseStudies.asp?cat=1648

It is predicted that the local recyclate markets and available waste recycling facilities will have an impact on what types of materials are targeted. Local authorities that operate, or have access to a Materials Recycling Facility (MRF) have the resources available to collect mixed recyclate. The advantages of mixed recyclate schemes are that retailers are not required to spend time separating out different waste streams which is perceived to be a disadvantage associated with single stream recycling schemes. As with any collection of recyclate, contamination needs to be minimised.

***Receptacles***

It is apparent that the type (sacks, wheeled bin and eurobins) and capacity of receptacles (240 litres to 1100 litres) used for the collection of recyclate varies between local authority (Table 47). Despite the range available, individual authorities typically use a preferred type and size of receptacle and therefore offer businesses a limited choice. Alnwick (360 litres), Ashfield (660 litres), Basildon (1100 litre eurobin), Chichester (1100 litre wheeled bin) and City of London all provide one size of wheeled bins or eurobins to collect recyclate (Table 47). London Borough of Hackney and Wealden District Council were the only authorities reviewed that offered businesses with a range of bin capacities which include 240, 340, 660 and 1100 litre wheeled bins and eurobins. The number of bins used by a business will depend on the quantity of recyclate produced, this will vary between businesses. Typically, a business is allocated with their own bin although in Chichester businesses can share 1100 litre bins if they wish to.

Due to the rigidity of bins they are suitable for a wide range of recyclate which include glass; however, sacks are only really suitable for paper, card and cardboard. Alnwick also sell tape which can be used to bundle cardboard for collection

***Frequency and cost of collection***

Any waste collection scheme whether operated by a private contractor or a local authority needs to provide a service that accommodates individual retailer needs. The collection frequency needs to be appropriate to the types and quantities of waste produced. Retailers producing a significant amount of cardboard would benefit from a frequent collection e.g. twice weekly where as an SME would potentially find it more suitable to have fortnightly collections.

Local authorities differ from waste contractors as they offer limited windows for recyclate to be collected which may be on a weekly or fortnightly basis. As demonstrated by Alnwick District Council, such collections may be further restricted to certain days e.g. Tuesday or Wednesday. The availability of vehicles, staff and finances are major factors impacting on the frequency of local authority recycling collections. Infrequent and unsuitable collections are factors that could potentially deter retailers from participating in local authority schemes making the flexibility associated with private waste contractor services more appealing.

Businesses participating in commercial recycling schemes are charged for the collection of recyclate from their premises. Schemes that use wheeled bins will charge businesses a fixed rate for each bin that is emptied. As Table 45 demonstrates, the charges made for emptying bins varies between local authorities. It is suggested that the variability in price is a reflection of the:

- facilities available to each authority e.g. MRF, transfer station
- level of treatment required, e.g. separation
- associated transportation costs

For those schemes that use sacks, the collection costs are charged to the customer at the time of purchase. Charges are either issued per sack e.g. Bath charges 82p each or for bundles e.g. City of London charge £27.50 for 25 sacks. In Alnwick charges allocated to business encompass a recycling charge that is levied by Sita for the material taken to the transfer station.

Table 45 - Summary of charges made for the emptying of wheeled bins

| | **Alnwick (excluding VAT)** | **City of London (excluding VAT)** |
|---|---|---|
| Waste type | Mixed glass, paper, card and cardboard | Paper, cardboard, glass, cans and plastics |
| 240 litre | £2.04 not available new | £2.80 |
| 360 litre | £2.67 | £4.00 |
| 660 litre | £4.58 not available new | £6.40 |
| 1100 litre | £5.97 not available new | £7.50 |

In order to encourage businesses to participate in such schemes, the charges levied for recyclate collection are at a cheaper rate than general waste collections (Table 46).

Table 46 - Waste disposal and recycling collection costs levied by Alnwick

| **Container size** | **Refuse for disposal (net of vat)** | **Refuse for Recycling (net of vat)** |
|---|---|---|
| 240 litre | £3.60 | £2.04 not available new |
| 360 litre | £5.00 | £2.67 |
| 660 litre | £8.84 | £4.58 not available new |
| 1100 litre | £13.04 | £5.97 not available new |
| Blue Bags/Tape | £78.98 (52 bags) | £38.78 (132 metres) |

This is further demonstrated by Enviros Consulting (2005), who report various case study examples of local authority trade waste schemes and their charging structures. Peterborough City Council offers an 1100 litre recyclables bin collection contract for £300 per annum which entitles businesses to a weekly collection. The same service for normal refuse would cost a business £509 per annum. The London Borough of Southwark provides a trade waste recycling collection service for materials including glass, cans, paper via a range of receptacles. The council charges for receptacles on a per lift basis, with an additional weekly charge for rental of each container type. Weekly charges for renting a 660L Euro bin for residual waste are £1.55 with a per lift additional charge of £4.70. If the business uses the bin for recycling paper or cardboard, the weekly collection charge is £1.48 and per lift charge £2.70 providing an incentive to separate out materials.

By setting up trade waste collection schemes, local authorities can also reduce heavy vehicle traffic and improve local collection services. Commercial and retail premises in a typical business district may receive waste collections from both the collection authority and private contractors' vehicles. Often a number of different contractors may visit the same premises to collect the occupants' commercial or trade wastes.

Using a collection authority vehicle could minimise the number of separate visits made and make the transport process more efficient.

In addition to providing services for the collection of trade recyclate, some local authorities also provide advice and support to local businesses in waste reduction, resource efficiency and general environmental awareness which consist of (Environmental Services Association)[42]:-

- Workshops and seminars on waste management, resource efficiency and transport
- Free environmental reviews and audits
- Environmental advice
- Waste management and resource efficiency clubs

***Summary of services***

The commercial recycling schemes provided by local authorities typically provide a limited service in terms of the range of materials collected, the types of receptacles used and the frequency of collection. In this respect they cannot necessarily compete with the services provided by private waste contractors.

[42] http://www.esauk.org/

Table 47 - Summary of commercial recycling schemes provided by local authorities

| | **Alnwick District Council**[43] | **Ashfield District Council**[44] | **Basildon District Council**[45] | **Bath and North East Somerset Council**[46] | **Chichester District Council**[47] |
|---|---|---|---|---|---|
| Waste type | Mixed glass, paper, card and cardboard | Glass | Cardboard, paper and plastic | Paper and cardboard | Cardboard |
| Receptacles used | 360 litre bins (paper and card kept in separate bin to glass) | 660 litre | 1100 litre eurobin | Sacks (paper) 80p each, Wheeled bin (cardboard or loose) | 1100 litre wheeled bin |
| Cost | 360 litre bin £2.67 | N/A | N/A | Cardboard collection is free for existing customers | N/A |
| Frequency of collection | Once a fortnight (Tuesday or Wednesday). Paper collections separate to glass. | Weekly | N/A | N/A | Weekly or fortnightly (3 collections per fortnight) |

[43] http://www.alnwick.gov.uk/supporting/released/2006-9/7789/Commercial%20waste%20recycling%20FAQs2.doc
[44] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A781FDF3&cat=1648
[45] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A781FEA9&cat=1648
[46] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A7820291&cat=1648
[47] http://www.chichester.gov.uk/index.cfm?articleid=5184

| | **City of London**[48] | **Ellesmere Port and Neston Borough Council**[49] | **London Borough of Hackney**[50] | **Medway**[51] | **Wealden District Council**[52] |
|---|---|---|---|---|---|
| Waste type | Paper, cardboard, glass, cans and plastics | Cardboard, office paper, plastic wrap, plastic mug, cans, glass and scrap metal | Glass | Paper, cardboard and glass | Glass, cans, newspaper and magazines |
| Receptacles used | Bins | Paper sacks, dustbins or wheeled cages (depending on material type) | 240,660, 1100 litre wheeled bins and eurobins | Clear sack, wheeled bin (paper and cardboard), skips and roll on roll off for large containers | 240, 360, 660 1100 litre wheeled bin |
| Cost | £27.50 (exc VAT) 25 sacks<br>£2.80 (exc VAT) per 240litre bin<br>£4.00 (exc VAT) per 360 litre bin<br>£6.30 (exc VAT) per 660 litre bin<br>£7.50 (exc VAT) per 110 litre bin | N/A | N/A | N/A | £1.20 per 240 litre<br>£3.30 per 360,660 and 1100 litre |
| Frequency of collection | Minimum weekly /daily or one off | Weekly ( 6 days a week, 7am-6pm) | N/A | Daily or weekly | N/A |

[48] http://www.cityoflondon.gov.uk/NR/rdonlyres/B8D044C2-8E5A-4101-8792-A0E8558A7914/0/SUS_RC_charges.pdf
[49] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A7820134&cat=1648
[50] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A7820145&cat=1648
[51] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A7820A29&cat=1648
[52] http://www.eas.local.gov.uk/CaseStudy.asp?id=SX9452-A781FF25&cat=1648

## *4.6 Supply chain partnerships*

"Retail therapy", a concept developed by Envirowise, focuses on the collaboration of supply chain partnerships to minimise waste (Envirowise, 2007). Retailers, their key suppliers, and Envirowise work together to address the waste issues occurring in the supply chain in order to maximise the financial benefits associated with waste reduction. Envirowise provide an independent forum for companies to meet with their suppliers to work together to find solutions to waste problems which may include: better delivery logistics; smarter packaging design; and reusable transport packaging. All companies participating in the "Retail Therapy" scheme are offered free on-site reviews, to identify ways to increase performance and minimise waste (referred to as FastTrack waste minimisation visits), and are invited to intend workshops.

To date, Envirowise has worked with the following retailers and their suppliers to reduce waste, minimise supply chain costs, minimise damaged goods and improve the local environment: Allied Distillers, Boots, Halfords, WHSmith, The Body Shop, Co-op, Virgin, Somerfield and Brakes (a food service company).

***Allied Distillers Ltd***

Allied Distillers Ltd (part of Allied Domecq plc) (ADL) is a marketing-led brands business whose products include Beefeater Gin, Ballantines and Tia Maria (Envirowise, 2004c). After implementing a waste minimisation programme in-house, ADL decided that the natural progression was to look at their supply chain and to see how they could influence waste production. As a result they worked with Envirowise and 7 of their key suppliers (Field Packaging, Gilmour and Dean, GlobalCap Montgomery, Kappa Packaging, Lithoprint, the Malcom Group and United Glass) to encourage resource efficiency. The project was supported by the Department of Trade and Industry, and other government organisations. The suppliers attended training workshops, on-site waste reviews were conducted, and each supplier outlined their proposed waste minimisation action plans, which were all based on overall target savings of 1% turnover.

The supply chain partnership identified that £1.2 million per year could be made in cost savings. Some of the key actions set out in the suppliers' action plans were:

- Internal plastics reprocessing
- Sale of cardboard boxes for re-use rather than recycling
- Packaging rationalisation
- Renegotiations of wastes handling and disposal contracts
- Encourage re-usable packaging
- Use of re-usable plastic layer pads instead of cardboard will incur savings of £21,600/year
- Recycle pallets that are beyond repair

***Boots Plc***

Boots Plc and 11 of their suppliers including Labelsco, Peri-dent and Denman International have taken part in the Retail Therapy programme (Envirowise, 2004d). Boots is a major retailer of health and beauty products with over 3000 product lines and 5000 suppliers. The management of its supply chains is an integral function of the company's operations. Some of the key initiatives introduced through the programme are summarised:

- Peri-dent made savings of £11,700 per year through a range of waste reduction initiatives including the replacement of disposable packaging and 50% of waste being recycled rather than being sent to landfill.
- Denman International made savings of £5,500 per year by baling and recycling cardboard.
- Labelsco made savings of £20,925 per year by purchasing a compactor which reduced staff handling costs and the number of skips lifted. The recovery of paper and film waste, which was sent to a waste to energy plant, saved a further £8,725 per year.

# 5. Key questions for improving returns and waste collection logistics

This sections aims to identify the key questions to be answered in this study, with the aid of focus groups, in terms of improving the logistics associated with return goods and waste collection.

## *5.1 Within supply chain co-ordination*

This section aims to identify opportunities for individual supply chains to co-ordinate their waste collection and return goods operations with their urban deliveries. The following questions are considered to be key questions to be addressed within this study:

- ***Is there spare capacity on the existing delivery rounds?***
  For a single-drop delivery round it seems likely that the delivery vehicle would have sufficient capacity to accommodate any waste packaging or return goods; however, for a multi-drop delivery round, it may be problematical to take on board waste and/or return goods, as they may get in the way or there may be contamination issues, particularly where food is involved. Vehicle capacity is not the only issue here: there also needs to be spare time available for the crew to load the waste and/or return goods.

- ***Do the delivery vehicles visit frequently enough to service the waste collection/return goods demands?***
  If the retail store only has a small area set aside for waste then they might require a frequent waste collection service.

- ***Which materials may be collected?***
  Any materials to be collected would likely have to be relatively clean to avoid getting the delivery vehicle too dirty. The most suitable materials, therefore, would be 'clean' waste, such as uncontaminated paper, cardboard and plastics, or return goods such as clothing, electrical equipment etc. By contrast, it seems less desirable to use delivery vehicles to collect general waste, particularly if it includes food waste. A related question is whether or not mixed materials may be collected, e.g. different waste types or waste collected at the same time as return goods (see ***Where will recyclable materials be sorted?)***. The materials would also have to be relatively easy to load onto the delivery vehicle (see ***What equipment is needed?***).

- ***What equipment is needed?***
  For waste collection, a range of bins, compacting and baling equipment, lifting mechanisms and waste collection vehicles are typically used in practice, as described in section 4. If special equipment such as these are needed to load waste onto the collection vehicle then this might preclude the use of delivery vehicles.

- ***Where do the waste and/or return goods have to be delivered to?***
  The answer to this question affects the suitability of using the delivery vehicle to pick up the waste and/or return goods. Recyclable waste may be ultimately destined for a number of different end markets, as was described in section 4.3; however, the requirement here might be for the delivery vehicle to take the waste

to a transfer station or to a recyclable materials merchant or to a materials recycling facility (MRF). Alternatively, larger stores might initially take waste back to their own facilities, at depots, distribution centres or dedicated recycling facilities, as was seen in section 2.8 for Asda, Sainsbury's and Next. The answer to this question clearly depends on the type of waste (mixed, sorted etc.). For return goods the situation may be even more complicated unless all return goods are delivered to a single point. In section 3.6 a number of different returns networks were discussed, with different destinations (e.g. regional distribution centre, national distribution centre, supplier's premises).

- ***Where will recyclable materials be sorted/consolidated?***
  This question has similar consideration to the one above.

- ***How stable / regular is the demand for waste and return goods collection?***
  Ideally, there should be a regular and stable flow of return goods or waste movement to allow effective scheduling of delivery vehicles. If the demand is highly variable then it may be difficult to accommodate on delivery vehicle rounds. If end markets for certain recyclable materials are depressed (section 4.3) would this affect the volume of waste? (perhaps not) or where the waste has to be taken to (e.g. would a merchant be likely to stop, temporarily, or otherwise, taking certain waste types if the market is depressed?). In section 3.1 it was pointed out that return goods tend to be difficult to forecast and are exception driven.

- ***How to organise reverse logistics?***
  In section 3.6 it was noted that Estée Lauder invested around $1.3million on a reverse logistics software system to help manage these returns.

Other questions that have been identified, to be answered at the focus groups planned in this study, are:

- Are waste contracts generally different in centralised systems compared to decentralised?

- How do returns and waste pass back through supply chains?

- How common a problem is vehicle incompatibility with the goods/waste to be moved?

- Could commercial waste collections be reduced if stores were holding recyclate for the supplier to collect the next day?

- Are delivery vehicle schedules 'convenient' for waste collection given the stores daily work schedule?

- Are van take-back schemes the way forward, i.e. many small back-loads of recyclate/returns as opposed to fewer HGV take-backs? What would the impact of this be in terms of mileage?

- Are roll cages used for returning packaging waste? / How is waste presented for collection by the delivery vehicle?

- To what extent do cleaning visits remove recyclate?

- In principle, large organisations could take-back the recyclate on behalf of other, smaller companies on the high street. What would the benefits be if they were will to do this?

## *5.2 Cross supply chain co-ordination*

The purpose of this section is to identify opportunities for different supply chains to co-ordinate their waste collection and return goods operations. Some examples of this already happening in practice for reverse logistics were given in section 3.7.3 and for waste collection in section 4.6. It seems likely that in order for different supply chains to co-ordinate their waste collection or return goods operations the companies involved would have to be willing to work together and they would to have some commonalties in their ways of working.

The willingness of retailers to work with one another in terms of sharing distribution resources is an important factor to consider. Stephens and Wright (2002) argued that retailers should be able to integrate their distribution systems more than they do, as distribution does not contribute much, if anything, to their competitive advantages over one another. However, they noted that, in 2000, a spokesman for Asda had stated that they would not deliberately work with their competitors in the distribution market. Similar arguments would apply to working together in reverse logistics and in waste collection.

There are many different shapes and sizes of lorries, vans and cars used in distribution and some vehicles may be specialized in terms of on-board equipment or facilities (e.g. refrigeration), which might inhibit joint working to some extent; however, the requirements for carrying 'clean' waste or return goods are not particularly exacting so most delivery vehicles would be able to collect waste or return goods as long as the vehicle capacity is sufficient to satisfy the demand.

In order for different companies to coordinate their waste collection or return goods collection from stores there might have to be some commonality in their vehicle use, in terms of schedules, practices etc. Section 2.5 showed that delivery times varied widely between different companies; however, there appeared to be a peak delivery time to stores between 5a.m. and 9a.m. If different stores had common delivery times then they might be more able to participate in joint waste collection or return goods collection schemes, as their staff would be working to common timetables.

Companies already using their own delivery vehicles to transport waste and recyclate away from their stores, as discussed in Section 2.8, may seek to collaborate and provide a similar service to neighbouring companies. However, any company collecting waste and recyclate on behalf of another company are required to register their intent with the Environment Agency and obtain a Waste Carrier License at a cost of £144 for 3 years. Companies failing to register could be prosecuted unless they are exempt organisation (e.g. charity or voluntary organisation, government department or council) or are transporting i) only their own waste (except building or demolition waste), ii) waste which is *only* animal-by-products, mines and quarries waste or agricultural waste (www.netregs.gov.uk).

# 6. Barriers to supply chain co-ordination

This section provides a discussion of the barriers which may make supply chain co-ordination, both within supply chain and cross supply chain, difficult to achieve in practice. Various other barriers have already been discussed in this report: barriers to collaborative distribution were summarised in section 2.1.4; barriers to reverse logistics were considered in section 3.8; while barriers to recycling were reported in section 4. Barriers may relate to legislation, policy, economics, operations or other factors.

## *6.1 Fundamental differences between different supply chains*

The DfT (2007a) listed a number of operating constraints that might be barriers to back-loading, and suggested how these barriers might be overcome (see boxes below).

| Operational constraint | Reasons why constraint is a barrier to back-loading | Possible solutions |
|---|---|---|
| Restrictions arising from customers wishing to carry goods in liveried vehicles | Many companies that outsource their logistics request dedicated services (vehicles bearing their livery and only carrying their products)<br>Potential customers may be concerned about goods being carried by competitors' vehicles | There is increasing evidence that contractors are being allowed to transport another company's goods and of own account operators (with a standard Operator's Licence) picking up another company's loads. A shipper or customer is less likely to be concerned if they can save money and the goods arrive on time. As the manager of a large food manufacturer said: "I would be happy to see my goods delivered in trucks branded by a competitor if it saved me £1 million and they arrived on time." |
| Priority given to outbound delivery service | Risk of the vehicle picking up a back-load not returning on time and thus failing to meet the requirements of an outbound customer (a reputation for delivering on time is often seen as an important marketing advantage) | A back-load should only be accepted if it fits existing operations. Flexibility within the fleet can help to maintain performance. This may mean allowing some vehicles to return empty or partially loaded while taking advantage of others that are not 100% utilised<br>Knowing where your vehicles are and whether they are running to schedule should help you to mitigate problems. Back-loads must be taken seriously as you have entered into a contractual agreement with a customer |
| Transport capacity | There may be no spare vehicle capacity to pick up back-loads. Fleets with barely adequate capacity to meet outbound deliveries will have even less resources available to pick up return loads. The problem is accentuated by:<br>→ Inflexibility of a supplier insisting on times inconvenient to back-loading<br>→ Over-zealous self-imposed restraints, e.g. over-generous time allowed for returning vehicle<br>→ Delays during delivery, e.g. congestion on the road network | There are a number of ways of overcoming the restraints imposed by capacity issues:<br>→ Develop efficient booking-in systems to spread loading and unloading of vehicles throughout the day<br>→ Take advantage of seasonal fluctuations and undertake more back-loading in quiet periods<br>→ Improve communication between vehicles and the operations centre<br>Back-loading can improve fleet flexibility. For example, you can unload products that have come in on your own vehicles during slack periods. However, using trailers as long term storage will reduce fleet flexibility and utilisation. Back-loading a supplier's goods can relieve them of the need to make the delivery to their customer's premises |
| Unreliability of collection and delivery operations | Risk of potential delays at loading and off-loading points for back-load (e.g. drivers may have to queue, orders may not be ready or invoices could be lost). Such concerns can lead to further exaggerated restrictions on driver hours and tight scheduling of outbound deliveries | Vehicle tracking and dynamic re-routing systems can provide effective tools to allow operators to foresee potential problems and to take appropriate action |
| Inadequate knowledge of available loads | You may not know how to find appropriate back-loads that match the origin and destination of the return trip<br>Back-loads may be available but do not match the route of the return journey, adding unacceptable time and mileage to the journey | Numerous services are available to locate back-loads (see Section 4 and Section 7) |

| | | |
|---|---|---|
| Lack of co-ordination between purchasing and transport/logistics departments | Separate management of the sourcing of supplies and the distribution of finished product increases the likelihood that inbound and outbound movements are not co-ordinated. This may lead to missed opportunities for back-loading | Improve integration between departments<br>Examine inward and outward movements to identify duplicate transport movements and to provide higher delivery standards |
| Incompatibility of vehicles and products | Existing vehicle sizes or body types may not be appropriate for potential back-loads.<br>Return items or back-load materials have to be removed every time a delivery is made<br>Consignment requires particularly specialised vehicles (e.g. in the chemical, fertiliser, cement and paper industries)<br>Risk of cross-contamination of products | Plan both original vehicle specifications (please see the Freight Best Practice publication 'Truck Specification for Best Operational Efficiency') and in-service allocation<br>Close monitoring and planning of both fleet and deliveries will help to allocate vehicles compatible with products for both the outbound delivery and back-load |
| Need to recover handling equipment/packaging | This limits the back-loading capacity of the vehicle | Capacity can be increased by:<br>→ Compacting and baling packaging materials at the point of collection<br>→ Using collapsible containers |
| Limited or poor information provided for the delivery | Inadequate information on a back-load can lead to confusion, delays and, in extreme circumstances, non-payment because loads are not collected or delivered to the customer's satisfaction | It is important to receive written confirmation containing all essential information before taking on the work in case of any problems. This should include:<br>→ Customers, order or delivery code and what the load is<br>→ Correct times, dates and locations<br>→ Contact details including out-of-hour telephone numbers<br>→ Insurance and claims information<br>→ Waiting times and rates<br>→ Conditions of carriage<br>→ Cancellation rates |

## *6.2 Producer responsibility and legislative factors*

The UK Government promotes a "producer responsibility" policy which underlies the approach taken in implementing the EC directives described below (DEFRA, 2006). All these producer responsibility directives were identified in the European Union's Fifth Environment Action Programme as "priority waste streams" because of growing concern about their impact on the environment. In these directives, responsibility is clearly placed on producers to bear the costs of collection, sortation or treatment and recycling or recovery.

Such legislative actions can drive companies to utilise reverse logistics to recover products and certain types of waste from downstream supply chain stakeholders, and ensures the compliance with existing and future legislation (Bettac *et al.*, 1999).

The EC directive on **Packaging and Packaging Waste** (94/62/EC) seeks to reduce the impact on the environment by introducing recovery and recycling targets for packaging waste, and by encouraging minimisation and reuse of packaging. The directive set member states mandatory recovery and recycling targets, the first of which were to be met in 2001. A revised packaging directive (2004/12/EC) was published in February 2004, which set new recovery and recycling targets, as a percentage of all packaging waste arising in the UK, to be met by 31 December 2008 (Table 48). The EC directive on packaging and packaging waste has been implemented into UK law under the Environment Act (1995):

- Producer responsibility obligations (packaging waste) regulations (1997)
- Packaging (essential requirements) regulations (1998)

Table 48 - Directive or national targets that the UK government are required to meet in 2008

| Recovery | Target |
|---|---|
| Overall recovery | 60% |
| Overall recycling | 55% |
| Paper | 60% |
| Glass | 60% |
| Metals | 50% |
| Plastic | 22.5% |
| Wood | 15% |

These regulations affect any business which handles more than 50 tonnes of packaging per annum and has a turnover of more than £2 million per annum, if it is involved in one or more of the following activities:

- manufacturing raw materials for packaging;
- converting raw materials into packaging;
- filling packaging (i.e. putting goods or products into packaging);
- selling packaged goods to the final user (which can be other businesses or the public);
- performs a "service provision";
- importing packaging / packaging materials / packaged goods into the UK for any of the above activities.

These regulations are intended to encourage the minimisation of packaging and packaging waste, provide incentives for reuse and increase the recovery and recycling of packaging waste. Each year there are recovery and recycling targets for UK businesses to meet (Table 49). These are designed to enable the UK to meet the recovery and recycling targets in the **Packaging and Packaging Waste** directive by 31 December 2008. As currently published (DEFRA, 2006), there is a business recovery target of 68% in 2008 to meet the directive target of 60%. The business targets are higher than the EC directive targets because "not all businesses that handle packaging in the UK are obligated under the Regulations (smaller businesses which do not satisfy the threshold tests are not obligated)" (DEFRA, 2006).

Table 49 - Business targets from 2006 to 2010

| Recyclate | 2006 (%) | 2007 (%) | 2008 (%) | 2009 (%) | 2010 (%) |
|---|---|---|---|---|---|
| Paper | 66.5 | 67 | 67.5 | 68 | 68.5 |
| Glass | 65 | 69.5 | 73.5 | 74 | 74.5 |
| Aluminum | 29 | 31 | 32.5 | 33 | 33.5 |
| Steel | 56 | 57.5 | 58.5 | 59 | 59.5 |
| Plastic | 23 | 24 | 24.5 | 25 | 25.5 |
| Wood | 19.5 | 20 | 20.5 | 21 | 21.5 |
| Overall recovery | 66 | 67 | 68 | 69 | 70 |

Under the regulations, obligated businesses must provide evidence of payment for the recovery and recycling of a specified proportion of packaging waste (including

wood, aluminium, steel, cardboard and plastic) through electronic [53] Packaging Recovery Notes (PRNs) and electronic Packaging Export Recovery Notes (PERNs). PRNs are issued by the accredited reprocessor to highlight how much packaging has been recovered or recycled and PERNs are issued by accredited reprocessors outside of the UK where packaging has been exported. As the majority of businesses are not able to meet their packaging waste obligations, PRNs and PERNs can be purchased on the open market to the value of their obligation. The funds raised from the sale of PRNs and PERNs are invested by the reprocessors back into the industry. Failure of businesses to purchase the correct quantities of PRNs can result in prosecution by the Environment Agency. The market values of PRNs in October 2007 are summarised in Table 50.

Table 50 - Package Recovery Note (PRN) prices for September and October 2007 (Source: Letsrecycle.com, 2007d)

| | **September 2007**<br><br>**(£ per PRN/per tonne of material)** | **October 2007**<br><br>**(£ per PRN/per tonne of material)** |
|---|---|---|
| Glass | 18 - 24 | 19 - 25 |
| Paper | 1 - 3 | 1 - 2 |
| Aluminium | 30 - 50 | 50 - 90 |
| Steel | 7 - 10 | 4 - 7 |
| Plastics | 12 - 15 | 12 - 14 |
| Mixed — energy recovery | 1 - 3 | 1 - 2 |
| Wood | 1 - 3 | 1 - 2 |

Businesses have the option to join a packaging compliance scheme (e.g. Valpak Ltd, Veolia Environmental Services, Biffpack) who take over individual businesses recovery and recycling obligations (e.g. purchase of PRNs/PERNs and reporting on compliance to the regulator). Those wishing to participate in a compliance scheme will need to pay a registration fee and supply data detailing the quantities of packaging handled.

Throughout 2007, the Environment Agency is rolling out an online system which will simplify data submission and also issues electronic evidence of compliance with the regulations (Environment Agency, 2007). The National Waste Packaging Database facilitates the:

- Registration for producers registering directly with an agency
- Registration for compliance schemes
- Issuing of Electronic Packaging Waste Recovery Notes (ePRNs) and Electronic Packaging Waste Export Recovery Notes (ePRNs)
- Submission of quarterly returns by reprocessors and exports

The introduction of the regulations has led to a significant improvement in packaging recycling in the UK, increasing from 27% (1997) to 57% (2006). The UK must achieve the directive targets summarised in Table 48 by 31st December 2008 after which it has to ensure that at least this level of recovery is sustained. A consultation paper has been presented by DEFRA, the Scottish Government and the Welsh Assembly (the consultation period closes on Friday 30th November, 2008) which reviews the existing UK targets for 2008 (and 2009 and 2010), proposes new targets

[53] As of February 2007 ePRNs and ePERNs are the only evidence the agencies will accept for the fulfilment of producers obligations

for 2012 and assesses whether existing targets can deliver those set out in the Packaging and Packaging Waste Directive (DEFRA, 2007e). The UK government identifies that increased recovery of packaging waste is integral to meeting the landfill diversion targets and improving recycling and recovery from waste.

In the News, 30th Nov 2006: ***Non-recycling packaging producers caught out***

**Companies that produce or use significant amounts of packaging to sell their goods are still being caught avoiding their legal obligations to pay for recycling.**
Almost a decade after producer responsibility for packaging was brought into UK law, "free riders" – firms that avoid their recycling requirements under the legislation – are still coming out of the woodwork.
A wine and spirit merchant in Essex was landed with fines and costs amounting to nearly £55,000 last week for failing to pay for packaging waste recovery from 1997 to 2004.
Oxfordshire hamper company Clearwater Hampers was fined £4,000 this week for failing to meet the producer responsibility regulations in 2004.
And, Dorset food company DB Foods Ltd was ordered to pay £3,000 for not registering as a producer with the Environment Agency in order to carry out its producer responsibility.

Source: letsrecycle.com website
http://www.letsrecycle.com/materials/packaging/news.jsp?story=6309 viewed 17/01/07

The EC directives on **Waste Electrical and Electronic Equipment (WEEE)** (2002/96/EC) and on the **Restriction of the Use of Certain Hazardous Substances (RoHS) in Electrical and Electronic Equipment** (2002/95/EC) aim to reduce the quantity and environmental impact of waste from electrical and electronic equipment and increase its reuse, recovery and recycling. The directives affect producers, distributors and recyclers of electrical and electronic equipment – including household appliances, IT and telecoms equipment, audiovisual equipment (TV, video, hi-fi), lighting, electrical and electronic tools, toys, leisure and sports equipment.

Increased recycling of such electrical and electronic equipment will limit the total quantity of waste going to final disposal. Producers will have responsibility for taking back and recycling electrical and electronic equipment. There is an incentive for manufacturers to design electrical and electronic equipment in an environmentally more efficient way, which takes waste management aspects fully into account (Europa, 2006).

A proposal for a UK National Clearing House (NCH) to be set up to organise producer responsibility for WEEE was given strong support by industry stakeholders during the third round of consultation carried out by the Department for Trade and Industry (DTI), which concluded at the end of October 2004 (DTI, 2004a). However, the DTI considered the proposal to be too complex, and have since issued further consultation including the development of a network of 'designated collection facilities' (DCFs), possibly utilising the 1400 or so civic amenity (CA) sites and household waste recycling centres (HWRCs) (Bridgwater and Anderson, 2003). In order to free up space and resources for these new recycling activities, it might be advantageous if a subset of the waste categories handled by the HWRC, such as green waste, could be collected locally through bring-sites, or enhanced kerbside schemes (Cherrett *et al.*, 2006).

The implementation of the WEEE Directive would also include, among other features, a distributor take-back scheme for retailers, which would establish a network of designated collection facilities (NetRegs, 2006). Retailers who sell or distribute

electrical and/or electronic equipment onto the UK market would have an obligation under the WEEE directive to ensure take-back of these products at the end of their lives from consumers. It is proposed that retailers should be given a choice of methods to meet this obligation, either through offering in-store take-back of old products when a direct replacement was sold to a customer, or through joining a retailer take-back compliance scheme which must offer alternative take-back arrangements. The latter would be expected to accept all WEEE and not just on a like-for-like basis and would therefore have greater implications in terms of transport. Businesses which collect WEEE from private householders (e.g. at the same time as making a delivery) and transport it will, as now, need to be registered with the Environment Agency as waste carriers.

Such facilities could ease the problems associated with handling and tracking the return of goods to manufacturers via retail outlets, which are generally designed to send products out, not to pull them back in. However, to meet the requirements set out in this legislation there are additional transportation impacts and added complexities involved in the distribution process, including the need for extra warehousing space, extra sorting and recycling work, the possible need to break goods down into their component parts, and the requirement to track each aspect of the process (DfT, 2004b). Nevertheless, case-study analyses imply that effective reuse of certain electrical and electronic equipment can be highly profitable and commercially viable (Bettac *et al.*, 1999).

The EC **Hazardous Waste Directive** (91/689/EEC) (HWD) was implemented to manage wastes containing hazardous properties which may be harmful to human health and or the environment. The HWD was transposed into UK legislation in 2005 through the Hazardous Waste (England and Wales) Regulations and List of Waste (England) Regulations.

Producers of hazardous waste as identified in the List of Waste (formerly European Waste Catalogue) must register with the Environment Agency before they can move such material from their premises. Exemptions from registration apply if i) less than 200kg of hazardous waste is produced in a 12-month period, ii) *and* the premises is a shop or office which is used for the collection of WEEE, and iii) if a registered carrier is used to remove hazardous waste from where it was produced. However, if premises are not exempt, they must register even if less than 200kg of hazardous waste is produced. The mixing of hazardous wastes (e.g. different category of hazardous waste, non-hazardous waste or any other substance of material) is strictly prohibited at any point in the management chain, e.g. producers, carriers and consignees (unless a permit is issued which allows mixing). A duty is also issued to the holder of the waste to separate mixed wastes where and when it is technically and economically feasible to do so.

When hazardous waste is moved from any premises (including those that are exempt from registration) it must be transported by a registered or exempt waste carrier, accompanied with a consignment note which contains the producer's details and details of the waste and transferred to a facility that holds a suitable Pollution Prevention and Control permit.

The consignee is required to keep detailed records which include where the waste is deposited and provide quarterly reports to the Environment Agency detailing quantities and origins of wastes that they have received. Such documentation enables the movement of hazardous waste to be tracked and managed responsibly until it reaches authorised disposal or recovery facilities.

The EC **Animal By-products Regulation** (1774/2002/EC) has been implemented to protect the health of humans, animals and also the environment. It provides rules for the collection, storage, handling, transportation, processing, use of and disposal of animal by-products (ABPs). This includes raw meat and fish, former foodstuffs and catering wastes generated from a range of sources which include those generated by the retail sector (catering, retail, wholesale, manufacturing and distribution premises, convenience stores, food markets and bakers). The permitted waste management options of ABP are determined by the risk category assigned to the waste.

Any waste of animal origin only becomes an animal by-product when it is no longer intended for human consumption. Within the retail sector this includes i) products that have passed their sell-by date, damaged, soiled or contaminated (e.g. any packaging that is significantly contaminated with ABP, e.g. blood) and ii) catering waste which are generically Category 3 waste types (except for ABP produced by butchers) (Table 51). This category of waste must be disposed of at approved premises which include rendering, incineration, or disposal at a composting or biogas plant; landfill is an option once the waste has been pre-treated.

Table 51 - Animal By-products Regulation in terms of categories and waste management techniques

| | **Typical ABPs** | **Legal disposal** | **Legal recycling/recovery** |
|---|---|---|---|
| Highest Risk<br><br>Category 1 | Carcases and materials infected and catering waste from international transport | Rendering in approved followed by incineration/landfill. Catering waste from international transport must be landfilled | Cannot be recycled or recovered |
| High Risk<br><br>Category 2 | Diseased animals and animals not slaughtered for human consumption | Incineration or rendering followed by incineration/landfill | *Rendering* followed by use as fertiliser/treatment in a biogas or composting plant. Fish for composting. Rendered fats used in a oleochemical plant to produce tallow derivatives |
| Not specified<br><br>Category 3 | Material that is fit, but not intended for human consumption (including catering waste) e.g. raw meat, fish and eggs , lightly cooked meat and fish ,meat and fish products that require cooking before consumption | Incineration or rendering incineration/landfill | *Rendering* followed by use as feeding stuffs of fertiliser. Use in pet food/technical plant. Treatment in a *biogas/composting plant*. Fish for composting. Rendered fats used in a oleochemical plant to produce tallow derivatives |

The EC **End-of-life Vehicle (ELV)** Directive (2000/53/EU) is concerned with cars, vans and certain three-wheeled vehicles. It aims to reduce the amount of waste from vehicles (cars and vans) when they are finally scrapped. In particular, it includes tightened environmental standards for vehicle treatment sites, requires that last owners must be able to dispose of their vehicles free of charge from 2007 (and requires producers to pay all or a significant part of the free take-back from this date), sets rising reuse, recycling and recovery targets and restricts the use of hazardous substances in both new vehicles and replacement vehicle parts.

Another EC Directive which will impact on the transportation and other requirements of reverse logistics is the Directive on **Distance Contract** (97/7/EC), which stipulates that anyone who makes a purchase on the Internet or by phone, fax or via mail order is able to change their mind about the purchase during a "cooling-off" period of seven working days after the goods are received; no explanation for the rejection of goods is required. The onus of returning such goods is likely to lie with the potential customer, and many of these returned goods will be transported back to the original retailer or manufacturer by traditional delivery services. However, it is likely that more of these rejected items will be recovered through dedicated reverse logistics processes as they become more prevalent, particularly in response to the WEEE Directive and others described above.

The **EC Landfill Directive (99/31/EC)**, which was transposed into UK law through the Landfill Regulations, was implemented to prevent, or where possible minimise, the negative impacts associated with the landfill of waste. The directive has introduced stringent targets for the diversion of bio-degradable municipal waste from landfill, the banning of certain waste types being landfilled, e.g. tyres and the mixing of hazardous and non-hazardous waste.

On the 30th October 2007, a further requirement of the Landfill Directive was implemented which is referred to as the **Producer Pre-Treatment Requirement** in which businesses will no longer be able to send non-hazardous waste to landfill without pre-treatment (Biffa, 2007). The requirements aim to reduce the impact of landfill and increase material recovery and recycling. Under the directive, "pre-treatment" is defined as being carried out when the waste has been through a "three-point test" in which all three points must be satisfied:

1) it must be a physical, thermal or chemical or biological process, including sorting;
2) it must change the characteristics of the waste,
3) it must do so in order to,
    a. reduce its volume, or
    b. reduce its hazardous nature, or
    c. facilitate its handling, or
    d. enhance its recovery.

The responsibility of pre-treatment rests with the waste producer (which is similar to the Duty of Care) and can be satisfied by segregating waste in one of two ways:

- waste that would otherwise be mixed is segregated and collected separately for recycling (e.g. separate container for at least one recyclable material), **or**
- mixed waste is collected and sent to a sortation facility where recyclate can be recovered. This would be an appropriate option for waste that is deemed unsuitable for recycling or where available space could limit separation.

For waste that is not destined for landfill, the treatment requirements are not applicable. There is no clear guidance as to the proportion of waste that would need to be recovered, only that it is "significant" and "consistent". Those businesses that do not recycle under the Requirement will have to pay increased waste disposal costs in the future.

Biffa (2007) provide some examples to demonstrate "pre-treatment".

*"An office has a paper recycling scheme in place. The residual waste that is collected for disposal to landfill is considered to be pre-treated as its weight has been reduced from what it would have been if there was no office paper recycling scheme in place."*

*"An office has the toner cartridges from its printers collected for recycling. The residual general waste is considered to have satisfied the pre-treatment requirements."*

*"A pub has a separate container into which it places its empty bottles. The general waste is then considered to have been pre-treated."*

*"A small industrial unit has a front-end loader container for its waste. Its waste cardboard is kept separate and collected in bundles for recycling. The general waste is considered to have satisfied the pre-treatment requirements."*

*"A site places all of its waste into a container which is then emptied by a compaction vehicle. The waste is NOT considered to be pre-treated and will then have to be treated at a separate facility before delivery for disposal to landfill."*

*"A large factory site with an office block has office paper recycling. However, there is no separation of any waste from the production line for separate treatment. The residual office waste would be considered to have satisfied the pre-treatment requirements but the production line waste would not and would have to be collected and treated in a separate facility for disposal to landfill."*

Research conducted by Taylor Intelligence (2007) highlights that SMEs and larger corporate business are ill-prepared, and to some extent unaware of the obligations that they face. In light of the regulations it is suggested that there are significant commercial opportunities for the collection of recyclate from SMEs and to a lesser extent corporate businesses. The potential for reverse logistics processes to recover recyclate has not been addressed.

### 6.2.1 Economic factors

The question whether product recovery is economically attractive or not has to be viewed within the legal framework in which the firm operates. However, as Buellens (2004) points out, a company that is considering adopting a reverse logistics or product recovery programme may be able to overcome any technical or legal difficulties, but might be dissuaded from adopting such processes due to the financial implications. Resources make reverse logistics programs more efficient and more effective, but there is recompense only when the resources are used in such a manner as to develop innovative capabilities/approaches to handling returns (Richey *et al.*, 2005). Nevertheless, late entrants into reverse logistics have the advantage that they can utilise knowledge and experience from early adopters, and should be able to manage available resource in a more profitable way (Richey *et al.*, 2004).

Conservative estimates put overall reverse logistics costs at $100 billion annually in the U.S. (Aberdeen Group, 2006).

However, the existence of a reverse logistics programme has been shown to bring direct monetary gains to companies by reducing the use of raw materials, by adding value with recovery, or by reducing disposal costs (Rogers *et al.*, 2001; De Brito *et al.*, 2003). Marien (1998) cites Eastman Kodak (reusable cameras) and Hewlett-Packard (printer toner cartridges returned for refilling) as early examples of companies using reverse logistics as part of 'investment recovery'.

Some other retail-related issues that reverse logistics can affect in a financially beneficial way are (DfT, 2004b):

- customer service – good returns policies may give a retailer an advantage over less liberal competitors
- effective inventory utilisation – removing old or slow-moving stock and replacing with newer, more desirable products can help promote sales
- recapturing product value – if unsold products can be quickly and effectively disposed of (for example, sold on by auction, or to Jobbers – someone who buys surplus or unwanted merchandise from one source, and profits by selling it on), some of the value may be reclaimed
- security of technology – by recovering all its own products, a company can prevent competitors accessing sensitive technologies, and thus may retain an advantage in the marketplace

### 6.2.2 Social factors and extended responsibility

"Extended Responsibility", or "Corporate Citizenship" concerns a set of values or principles that drive an organisation to become responsibly engaged with particular activities, including reverse logistics. An enhanced "green" reputation – being seen to be concerned about, and proactive towards environmental issues – has become an important marketing element and can improve customer relations. Many companies now have extensive programs on responsible corporate citizenship where both social and environmental issues become the priorities.

During their review of reverse logistics case studies, De Brito *et al.* (2002) identified eight non-economic incentives to stimulate or enforce the acquisition or withdrawal of products for recovery, including:

- **'New for old'** – a new version of a product is only available if the original is returned
- **Lease or rent contracts** – products are not sold, and ownership remains with the supplier
- **Easy and simple method of supply** – a combination of pick-up systems, where (parts of) products to be recovered are collected at the location where they are disposed, and bring systems where the disposer has to bring the goods to dispose at a certain location
- **Timely and clear information** – appropriate information regarding the methods of returning products can help raise the level of product returned
- **Appeal to the environmental consciousness of people** – usually requiring high levels of advertising for little return
- **Appeal to the charity's consciousness of people** – if an organisation receives some monetary reward for collecting product returns, consumers might be more likely to donate such items

# 7. Performance

Supply chain performance measures were discussed by Harris (2007), from which Figure 40 is taken (performance measures originally given by Beamon, 1999). She concluded that there seems to be a lack of consistency in definitions of performance from author to author and from industry to industry and, consequently, it is difficult to compare different supply chains. For example, some measures, such as 'quality of service' and 'flexibility', can clearly be interpreted in a number of different ways.

| Performance measure classification | Performance measure (measured over product and process life cycle, except where indicated) |
|---|---|
| Resource use | Total energy consumed<br>Total material consumed (e.g. water, timber, steel, etc.) |
| Product recovery | Time required for product recovery |
| Remanufacturing | Percent recyclable/re-useable materials (volume or weight) available at end of product life |
| Re-use | Percent product volume or weight recovered and re-used |
| Recycling | Purity of recyclable materials recovered<br>Percent recycled materials (weight or volume) used as input to manufacturing<br>Percent product disposed or incinerated<br>Fraction of packaging or containers recycled<br>Material recovery rate (MMR)1<br>Core return rate (CRR)2<br>Ratio of virgin to recycled resources<br>Ratio of materials recycled to materials potentially recyclable<br>Materials productivity: economic output per unit of material input |
| Product characteristics | Useful product operating life<br>Total mass of products produced |
| Waste emissions and exposure hazard | Total toxic or hazardous materials used<br>Total toxic or hazardous waste generated<br>Solid waste emissions<br>Percent product (weight or volume) disposed in landfills<br>Concentrations of hazardous materials in products and by-products<br>Estimated annual risk of adverse effects in humans and biota<br>Waste ratio: the ratio of wastes to all outputs |
| Economic | Average life-cycle cost incurred by the manufacturer<br>Purchase and operating cost incurred by the consumer<br>Average total life-cycle cost savings associated with design improvements |
| Economic/emissions | Eco-efficiency: adding the most value with least use of resources and the least pollution. Generally, ``The ability to simultaneously meet cost, quality and performance goals, reduce environmental impacts, and conserve valuable resources" |

Figure 40 - Extended supply chain performance measures (Source: Beamon, 1999)

Five key performance indicators (KPIs) for freight deliveries were proposed by McKinnon (1999) and have subsequently been incorporated into Freight Best Practice guidance (DfT, 2006a):

- **Vehicle fill** - measured by degree of loading against actual capacity by weight, by volume or by unit loads carried.

- **Empty running** - in absolute terms the relocation of empty vehicles, but including legs where returns and packaging were carried.
- **Time utilisation** - measured by seven categories of use, including being loaded or running on the road.
- **Deviations from schedule** - covering any delay deemed to be significant, with causes such as congestion en route or waiting at delivery point.
- **Fuel consumption** - actual fuel used, correlated to factors such as loading and airflow management equipment.

On behalf of the Department for Transport, SCALA Consulting is undertaking the 2007 and 2009 KPI surveys focused on the food and drink sectors[54]. This will likely be based on the five KPIs set out above but may include others, as suggested by the companies who respond to the surveys. It will be some time, however, before any results from these surveys will be available.

[54] http://www.scalagroup.co.uk/2007_survey.html

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**Appendix 1 - List of wastes** (Environment Agency, 2006)

**01** Wastes resulting from exploration, mining, quarrying, physical and chemical treatment of minerals

**02** Wastes from agriculture, horticulture, aquaculture, forestry, hunting and fishing, food preparation and processing

**03** Wastes from wood processing and the production of panels and furniture, pulp, paper and cardboard

**04** Wastes from the leather, fur and textile industries

**05** Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal

**06** Wastes from inorganic chemical processes

**07** Wastes from organic chemical processes

**08** Wastes from the manufacture, formulation, supply and use (MFSU) of coatings (paints, varnishes and vitreous enamels), adhesives, sealants and printing inks

**09** Wastes from the photographic industry

**10** Wastes from thermal processes

**11** Wastes from chemical surface treatment and coating of metals and other materials; non-ferrous hydro-metallurgy

**12** Wastes from shaping and physical and mechanical surface treatment of metals and plastics

**13** Oil wastes and wastes of liquid fuels (except edible oils, 05 and 12)

**14** Waste organic solvents, refrigerants and propellants (except 07 and 08)

**15** Waste packaging; absorbents, wiping cloths, filter materials and protective clothing not otherwise specified

**16** Wastes not otherwise specified in the list

**17** Construction and demolition wastes (including excavated soil from contaminated sites)

**18** Wastes from human or animal health care and/or related research (except kitchen and restaurant wastes not arising from immediate health care)

**19** Wastes from waste management facilities, off-site waste water treatment plants and the preparation of water intended for human consumption and water for industrial use

**20** Municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions