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Home Delivery and the Impacts on Urban Freight Transport: A Review

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Abstract

This review paper discusses the latest developments in internet shopping, home delivery and the potential impacts on city logistics and alternative vehicle use. The review has illustrated the rapid changes during the past few years and the potentially important impacts on patterns of transport within urban areas. Some of the changes result in increased pressure for road traffic networks in sensitive areas (for example residential areas). At the same time the changes also provide opportunities for the use of vehicles powered by alternative fuels thereby supporting certain sustainability strategies. However, the changes are complex and patterns are not the same from one country to another thus the impacts on city logistics are also varied.

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Keywords: Internet shopping; home delivery; city logistics; impacts; alternative vehicles.

1. Introduction

The concept of city logistics is related to consolidated urban freight delivery. Home delivery can be part of the city logistics concept but the fact is that hardly any of the providers of city logistics services provide such service.

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Home delivery is growing since the rise of internet shopping and could become an attractive market for providers of city logistics.

Internet shopping or home delivery is one of the trends that have an impact on freight traffic in urban areas. Several contributions to previous editions of the city logistics conference dealt with this topic.

- Second city logistics conference, paper by Visser, Nemoto & Boerkamps (2001)
- Fourth city logistics conference, paper by Visser & Hassall (2005)
- Fourth city logistics conference, papers by Crainic, Errico, Rei & Ricciardi (2011), Teo, Taniguchi & Qureshi (2011) and Durand & Gonzalez-Feliu (2011)

Other relevant reports are published by BESTUFS (2001), Browne (2001), Weltevreden & Rotem-Mindali (2009) and SUGAR (2011). The number of papers and publications on home delivery related to internet shopping is limited.

Internet shopping by consumers or B2C e-commerce has an impact on consumer behaviour. The market share of internet shopping grows and substitutes traditional shopping. This is more evident by the fact that by 2020 up to one third of the total shops at shopping centres in countries like the Netherlands will be closed down due to the economic crisis and competition from web shops (KiM, in press; Javelin Group, 2011). Internet shopping is intertwined with express delivery to homes and therefore has an impact on urban freight transport: more at homes, less at shops. Also consumers make use of the internet (f.i. by ebay) to buy from and sell goods to other consumers (C2C e-commerce). Although a lot of the goods are picked up by the buyerthemselves, a lot of goods (two thirds in the Netherlands) are delivered to the home by express delivery. Home delivery can be an interesting market for city logistics (Visser & Hassall, 2005).

In this review we will discuss the facts on internet shopping (B2C) (section 2) and how it increases the demand for home delivery (section 3). We describe how the logistics and the impacts on the demand for transport related to home delivery is changing (section 4) and how the use of new types of vehicles leads to better and more environmental friendly deliveries (section 5). This review paper is based on recent publications on this topic.

2. Facts on Internet Shopping (B2C)

In this section we give a short introduction on internet shopping and present the facts as published in the EC, NL, UK and Japan.

2.1. Definitions

Internet shopping refers to the purchase of good or services by consumers by the internet. Often the terms, internet retailing (Cushman & Wakefield, 2013) or E-commerce are used. E-commerce, however covers any commercial transaction between organisations and persons in society. As Nemoto, Visser & Yoshimoto (2001) point out, many transactions between stakeholders take place by applying ICT, including Business-to-Business (B2B) and Business-to-Government (B2G). Four types of stakeholders are identified, namely shippers, consumers, governments and logistic service providers (including carriers).

Some e-retailers open stores for display purposes only, where consumers could get information on goods, or try them on in the fitting room. There is no buying/selling at the stores. Buying/selling is done over internet, mostly via consumers' smart phones. This practice is called 'offline to online' or O2O.

The paper focuses on consumers, in particular on consumers buying physical goods (not services) using the internet from online stores (Business-to-consumer, or B2C). Also insurance and travel tickets are bought by the internet, but they are not related to the physical movement of goods. CDs and books are becoming more and more replaced by digital alternatives and therefore become services instead of goods. Also more goods are bought digitally. Websites, like eBay increase the trade of second hand goods or home made products) between consumers (C2C) but this is not the focus of this paper.

2.2. Facts on internet shopping

According to the Euromonitor (Cushman & Wakefield, 2013) the global non-store internet retail sales, or internet shopping reached 579 billion US$ in 2012, which accounts for 4% of total global retail sales. This means a $83 online retail spend per capita. The global online retail market showed a 14.8% growth from 2007 to 2012, while the total retail growth was just 0.9% over the same period.

In Europe more than four out of ten EU consumers (43%) have purchased goods and services over the Internet in 2011 (European Commission, 2012). This includes goods as well asservices, such as travel bookings, concert tickets and insurance. Since 2004 the proportion of Internet shoppers has risen in Europe by 23 percentage points from 20%. Consumers are most likely to buy online in the UK (71%), Denmark (70%), the Netherlands (69%) and Luxembourg (65%). Online shopping is much less common in most Eastern and Southern European countries. The lowest levels of online shopping are recorded in Romania (6%), Bulgaria (7%) and Italy (15%).

In 1998 only 41 million euros was spent at internet shops in the Netherlands. In 2011, the Dutch home market for internet shopping was 9 billion euros. This is about 9-10 per cent of the total retail sales in the Netherlands. Compared to 2.8 per cent in 2005, internet shopping gained a significant market share. These figures do not include goods that are bought by the internet from other countries.

The size of e-commerce in B2C market in Japan is 9.5 trillion yen or 91 billion US$ in 2011. Its share is 2.83%, which represents a 0.37% increase from the preceding year (METI, 2012). The share has been increasing year by year, because more people use the internet and shop by the internet than before. The Japanese Ministry of Internal Affairs and Communication estimates the number of ‘internet users’ and ‘internet shopping users’ based on a questionnaire survey (MIC, 2011). The internet user ratio (the number of internet users divided by total population aged 15 and over) was 81 per cent in 2010. The Internet shopping user ratio by internet user is 46 per cent, and then internet shopping user ratio by total population is around 37 per cent.

In the UK online shopping accounted for 10.4% of all retail spending in March 2013. This is equivalent to approximately £30 billion per year (ONS, 2013). The growth in the proportion of total retail sales accounted for by online shopping has been rapid in recent years (see Fig. 3). The number of users is continuing to increase over time. Survey work carried out in 2011 indicated that online spending as a percentage of total retail spending was higher in the UK than all other European countries (CRR, 2012). The substantial growth in online retail spending is continuing with an increase of 20% in the average weekly spend between March 2012 and March 2013. Most important in terms of online retail spending in the UK is the non-store retailing sector, with online spending accounting for 68% of total spending in this sector in March 2013. In the food sector 3.4% of total spending was online in March 2013 (ONS, 2013). Survey work in 2010 showed that there were 6.1 million users of grocery home delivery operations and 13.5 million users of clothing home delivery operations in the UK (Verdict, 2010).

Online shopping remains largely domestic. Consumers are more likely to purchase online from national sellers/providers (39%) than from sellers located in other EU countries (10%) (European Commission, 2012). But this will probably change in the future.

It is likely that the purchase goods by the internet will increase further. The following factors play a role:

- New demand: aging of the population
  - Older people discover the convenience of internet ordering
  - Young people used to the internet and remote ordering by the internet
- Traditional shopping (brick & mortar) is hit by the economic crisis and the competition of internet shops: number of stores reduced.
- Certain goods, such as groceries are just starting to be sold by the internet: now a small share but this will increase, considering the above mentioned factors.
- The use of smart phones to purchase goods online.

Figure 1 shows the forecasts for 2020 by the Javelin Group (2011).

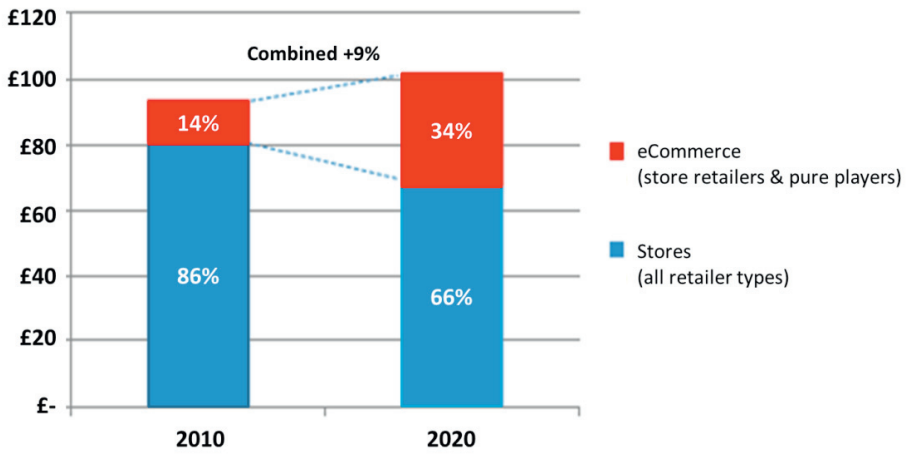

Fig. 1. Sales by stores and eCommerce forecast 2010-2020 in billion UK pounds (Source: Javelin Group, 2011)

3. Demand for Home Delivery

3.1. Home delivery

Products purchased on the internet have to be delivered to the customer. Since most e-tailers don't have physical shops (bricks-and-mortar), these products have to be delivered to homes or other appointed destinations. Home delivery is however not the only option. We see more and more the use of pickup points.

Home delivery is not only related to internet shopping. Long time ago, a lot of the daily goods were delivered to homes by retailers. Before the rise of internet, mail order companies delivered to homes and retailers delivered large goods, such as furniture and large electronic goods, televisions or dish washers. Today mail order companies and traditional retailers (bricks & clicks) are also part of the internet shopping community. Retailers still deliver large goods to homes but little information is available on these volumes.

Today home delivery can be either a delivery to one's home address, to another address (at the office, next door or family) or to a pickup point (post office, store or other pickup point).

In the Netherlands about 78-84% of the goods were delivered to homes in 2007 (Weltevreden, 2009).

3.2. Issues regarding home delivery

Although home delivery is highly appreciated by consumers, there are some issues related to this service. Home delivery is considered an issue by different actors, including customers, carriers and e-retailers. Consumers mention the following issues:

(i) not on-time, not at home, not delivered,(ii) elivery charge too high, delivery time too long, and
(ii) forced to stay at home (about 50% stay at home).

Carriers mention:

(i) additional costs for repeated delivery (12% of deliveries have to be delivered a second time),
(ii) non-deliverables: 2% of the goods cannot be delivered.

Most home delivery services only inform the customer on what day the goods are to be delivered and use a time frame of 9.00 am until 17.00 or 19.00 pm. For deliveries of parcels that fit within a mailbox this is not a problem. For larger goods such a large time frame causes the 12% chance of failure of delivery. A study in the UK reported that failed first-time home deliveries accounted for approximately 12% of all first-time deliveries and that this figure was the same as in 2010. To put this figure in perspective, the study estimated that UK retailers generated around 740 million online orders in 2012 and that approximately one billion parcels and packets were dispatched in the UK. It was estimated that these failed deliveries cost companies and customers approximately £850 million in 2012. In addition it is estimated that consumers returned 22% of orders received in 2011 (IMRG, 2012). Larger web shops often offer more choice on time and date of delivery to make it easier for the customer and to reduce the chance of failure. But it is only the carrier who can give a more precise information on time of delivery. With new ICT technology it is easier to give more accurate information on the time of delivery but the carriers hardly implement such new technology. An alternative for home delivery is the use of pickup points. This we discuss this in section 4.

3.3. Impact on total volume of freight and passenger traffic

For society the impacts on traffic by increasing home delivery is of interest. Several authors (Braimaister, 2002; Weltevreden & Rotem-Mindali, 2009; TNO, 2010) expect that home delivery means more freight traffic but on the other hand less traffic related to shopping or in other words that internet shopping will substitute a move to a shop by a delivery by a van at home. In reality the situation is more complicated: people tend to combine different purchases in one shopping move. So maybe they still go shopping but buy less in shops. On the other hand parcel delivery services bundle different deliveries in one round trip. More deliveries per round trip means a more efficient delivery.

Freight transport is influenced by e-commerce. In the traditional distribution system, manufactures, wholesalers and retailers make big-lot deal and the volume of freight transport between them is thick, resulting efficient utilization of trucks and other resources. The last-mile transport is conducted by consumers' passenger trips with the purpose of shopping, although there are emerging concerns that older people without a driving capability cannot go shopping.

In the case of e-commerce, however, thick freight transport is used in a limited way while direct delivery to consumers covers all the other parts. Usually small-lot orders are consolidated by the parcel delivery companies. The thick inter-city freight transport is de-consolidated at their terminals, and last-mile transport is conducted by small vans or trucks.

Small-lot delivery is often criticized for causing increased traffic. But as the last-mile freight transport substitutes passenger shopping trips, it is likely that the total volume of freight and passenger traffic in terms of vehicle-km would not be changed so much. The important question here is what are the suitable city logistics policies to promote efficient last-mile delivery in urban areas.

Figure 2 shows some consideration on freight transport increasing but also reducing factors (BESTUFS, 2001).

General trend		
E-commerce reinforces the general trend in logistics towards smaller consignments, single orders and thus higher delivery frequency		
Logistics models	**Transport increasing factors**	**Transport reducing factors**
	+	-
Use of existing logistic channels (Parcel service, post)	+ larger distances and higher mileage due to global shopping and single order processing	– better bundling and trip optimization thanks to large volumes of goods
New logistic channel: shelf picking	+ only restricted bundling possibilities	– shorter distances for last mile distribution (making it possible to deliver e.g. by bike)
New logistic channel: dedicated warehouse	+ higher freight mileage because new distribution centre has to be served + possibly large distances to pick-up points and homes	– better consolidation and trip optimisation
Distribution to pick-up points (including workplace)	+ higher freight mileage due to high number of pick-up points + possible influence on modal choice (might use car for work-journey instead of public transport) + consumers might substitute former shopping trips by other (longer) journeys	– replacement of shopping trips if pick-up point is at a location regularly visited anyhow (e.g. workplace) – better consolidation and bundling if delivered to central pick-up points – trip optimisation as delivery can be at any time of the day – assembly of different orders at the pick-up point (replacing a number of single shopping trips)
Home delivery	+ higher freight mileage (replacing shopping trips) + consumers might substitute former shopping trips by other (longer) journeys + reverse logistics	– replacement of individual shopping trips by bundled goods transports – potential in overall traffic reduction depends on ability to bundle transports, set up efficient delivery trips and make full use of vehicle

Fig. 2. Factors of influence on freight traffic related to internet shopping (Source: BESTUFS, 2001)

The expectation is that internet shopping will increase. This means more deliveries and more freight vans in residential areas. There are some concerns about the growing number of freight vehicles in residential areas, like congestion issues, environmental concern and traffic safety. Although it is possible that a further increase of internet shopping will lead to more freight traffic, there are some aspects to this matter we would like to discuss in the next section.

Box 1: Home delivery in the Netherlands

For the Netherlands we collected some information and made some assumptions on home delivery. The people in the Netherlands made approximately 3.4 billion trips to go shopping in 2011, 44.3 % of these were made by car (as driver or as a passenger). The total travel distance was 15.4 billion vehicle kilometres (2012), or 8.8% of total vehicle kilometres in 2011.

We estimated the total travel distance in 2011 for home delivery by vans on 670 million vehicle kilometres, or 3.8 % of the total travel distance by vans. The number of home deliveries is estimated on 100 million parcels in 2011 (based on OPTA, 2011). In case these 100 million deliveries substitute a movement to a shop, these 100 million (on 3.4 billion moves) represent 3% (in vehicle kilometres) of the total trips for shopping. Compared to the total traffic performance (170 billion vehicle moves), substitution by home delivery does not have a significant impact on traffic. However more freight traffic in residential areas can be a traffic safety issue.

4. Consolidation and Building

The classic split of the freight transport market is shown in Figure 3. Home delivery is usually the area of mail and parcel operators as well as couriers.

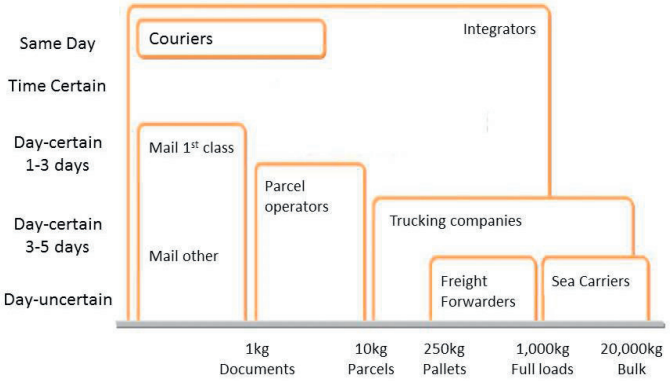

Fig. 3. The freight transport market (Source: TNT Express)

All web shops outsource their logistics to these carriers. These carriers consolidate the deliveries of the web shops and provide consolidated delivery of the goods.

In the case of the Netherlands there are a limited number of carriers who provide home delivery services. Home delivery services in the Netherlands is provided by PostNL , Selektvracht (DHL) , DPD, TNT Express, GLS and some small parcel delivery services. PostNL is by far the largest provider of home delivery services with a market share of about 62%. Selektvracht is the second largest with 14% market share. Certainly PostNL and Selektvracht are able, because of their size to organise their deliveries as efficient as possible.

In particular when providers have a large market share they are able to bundle. This is discussed by Visser & Hassall (2005). Boyer, Prud'Homme & Chung (2009) show that more deliveries per trip reduce number of vehicle kms per delivery. Consolidation therefore makes home delivery more efficient. We can draw the conclusion that more home deliveries does not necessarily mean less efficient deliveries.

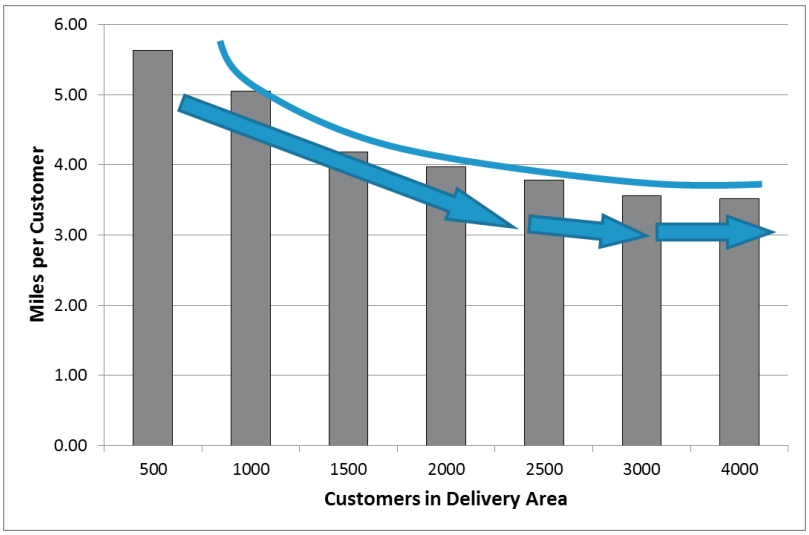

Fig. 4. The impact on customer density on the average distance per stop in miles per customer (Source: Based on Boyer, Prud'Homme & Chung, 2009)

Box 2: Same day service for time-sensitive consumers in Japan

In Japan internet consumers seem more time-sensitive. They are apt to change the e-retailers and move to other internet sites if they notice it takes time for home delivery. It is partly because they have been accustomed to next day service and delivery time specification service provided by the major parcel delivery companies like Yamato and Sagawa from several decades ago. Therefore, e-retailers compete in introducing the same day delivery service with the help of parcel delivery companies.

In the case of Yamato, the biggest parcel delivery company transporting 1.4 billion parcels and 2.2 billion mail items in 2011, the next day service is provided by a huge network consisting 70 terminals, 3,900 branch offices and 260 thousand agencies (convenience stores). Parcels are picked up until the evening by small vans and transported from the branch offices to the terminals. Between the terminals the sorted and consolidated parcels are transported once a day around midnight by large trucks (25 tons gross weight), de-consolidated early in the morning at the terminals, then transported to the branch offices, and delivered to homes.

Same day service is a new challenge for e-retailers and parcel delivery companies. Recently Yamato has proposed a concept of 'gateway terminals' in order to involve more e-retailers. This newly added transport system includes gateway terminals with automatic sorting machines and 24-hour transport operation between gateway terminals by trailers. They also request e-retailers to leave their goods on the stock floor in the gateway terminals, or to transfer the ordered goods immediately from their own distribution centers nearby the terminal.

A likely scenario of same day service; a consumer in Osaka, for example, makes his/her order at 2 a.m. The ordered goods are picked up in the gateway terminal in Tokyo, sorted by destination, and loaded into the trailer bound for the gateway terminal in Osaka by 5 a.m. It takes eight or nine hours from Tokyo to Osaka, the goods arrive before 2 p.m. They are de-consolidated at the gateway terminal in Osaka, transferred to the branch office by 6 p.m., and delivered to the consumer by 8.p.m.

Amazon/Japan, the second largest e-retailer in Japan, has a different strategy from other e-retailers. They are planning to establish ten large distribution centers in Japan (out of 60 centers in the world) in order to provide a same day service without the help of major parcel delivery companies, but outsourcing only the last-mile delivery to the local small carriers. They regard logistics management as important, assuming that logistics would be a critical success factor in e-commerce business. Both e-retailers and parcel delivery companies are rushing to build new distribution centers or terminals in large cities and these actions require consistent city logistics policies in Japan.

5. Pickup Points and Click and Collect

Consolidation makes transport more efficiently. Possible options for more consolidation are:

(i) Cooperation by shippers to consolidate deliveries,
(ii) By receivers (shopkeepers), such as Binnenstad service in the Netherlands, and
(iii) Cooperation by carriers on urban or national level (green city distribution in the Netherlands).

In practice outsourcing to one provider is the most common way to consolidate and to generate efficiency gains. There are two interesting developments related to consolidation we like to discuss here, namely the increasing number of pickup points and the introduction of click & collect by traditional retailers.

5.1. Pickup points

Pickup points are locations for picking up goods that are ordered by mail or by internet. At least two different types of pickup points can be distinguished. Most common are parcel service points (PSP= staffed pickup points). This type of pickup point you find within supermarkets and stores). Not so common are pack stations (unmanned pickup points, using lockers). Unmanned pickup points can be found in Germany and France but they are not so common. In the Netherlands there have been some initiatives but so far no unmanned station has been installed. The number of pickup points is increasing in the Netherlands, from 900 in 2006 to about 4500 in 2013.

Pickup points provide an alternative for delivery to the home when the delivery at home has failed and when goods need to be returned. Web shops promote the use of pickup points by charging no or less transport free when people pick up their goods at a pickup station instead of a delivery to the home. Delivery of goods at a pickup is usually a consolidated delivery and therefore more cost efficient. Pickup points need a certain critical volume to become financially feasible. Therefore, the increase of internet shopping has made a denser network of pickup points possible.

In Japan consumers can designate convenience stores as their pick up points. Those who hope to use this service have to register as a member, and designate a branch office or an agency among 24-hour convenience stores. When the ordered goods arrive at the pick-up point, the event of arrival is e-mailed to the consumer. They can pick up the goods within three days of the date of arrival.

5.2. Click & collect by large retailers

A high number of traditional retailers also have a web shops. This is called multi-channelling. Larger retailers combine ordering by internet with picking up goods at their stores (click & collect). In this way customers have a much wider choice of products to choose from and have the certainty that the products are available when they pick them up. By multi-channelling and click & collect traditional retailers are able to compete with web shops. Particularly in the UK, traditional retailers, like TESCO, are very successful on the web shopping market. Click & collect also makes use of a consolidated delivery at the stores and is therefore cost-efficient. However it still requires a visit to the shop by the customer.

6. Options for More Sustainable Home Delivery

Home delivery has different aspects in common with city logistics. It concerns both delivery within urban areas, relatively short distances per trip and in general with smaller freight vehicles, van or light trucks. Important differences are the delivery size (one package versus more deliveries per address), the location of the address (residential address versus shopping center).

In a number of areas, low emission zones are introduced (see www.lowemissionzones.eu), mostly shopping areas with city centres. This affects traditional urban freight transport. Trucks are banned in a number of residential areas. But there are no restrictions for lighter trucks and vans.

It would make home delivery more sustainable when home deliveries are organised on a local level as with city logistics for two reasons. First to have a more consolidated delivery and second to make use of more environmental friendly vehicles.

Also within the perspective of climate change the reduction of CO_2 is relevant. The European Whitebook on Transport (European Commission, 2011) on urban freight is to have an almost CO_2-free urban distribution by 2030. This is ambition is quite ambitious, considering the current expectations with respect to CO_2. The current CO_2 emission by vans and trucks has changed little since 1980 (see Figure 5) while PM10 and SO_2-emissions decreased significantly during that period (Moorman & Kansen, 2011).

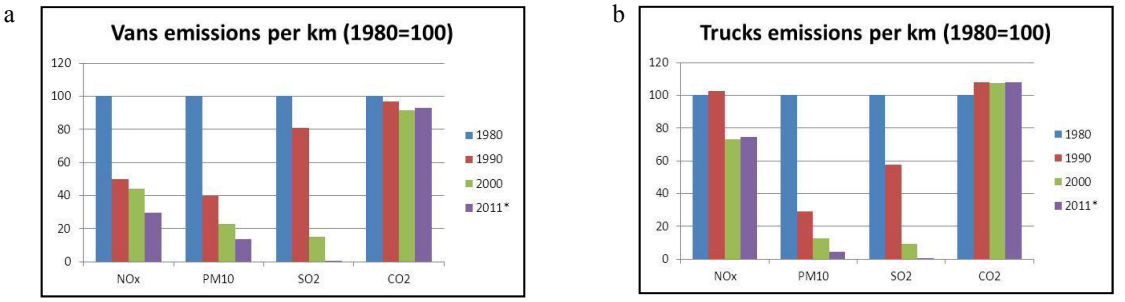

Fig. 5. (a) Vans and (b) trucks emissions of NO_x, PM10 and CO_2 between 1980 and 2011 [indexed, per km] (Source: Moorman & Kansen, 2011)

The situation regarding CO_2 emissions for vans will change. As part of the strategy to reduce CO_2 emissions from light-duty vehicles, in 2011 the EU adopted legislation setting CO_2 emission targets for new vans sold on the European market. The law is similar to that for new cars. The Vans Regulation limits CO_2 emissions from new vans to a fleet average of 175 grams of CO_2 per kilometre by 2017 – with the target phased in from 2014 - and 147 g/km by 2020. The regulation is currently undergoing amendment in order to implement the 2020 target. These cuts represent reductions of 14% and 28% respectively compared with the 2007 average of 203 g CO_2/km.

There is no legislation yet for trucks/heavy duty vehicles. Although this regulation will help, the EU ambition will not be met.

Figure 6 shows current trend in CO_2-emssions, but also for NO_x and PM10.

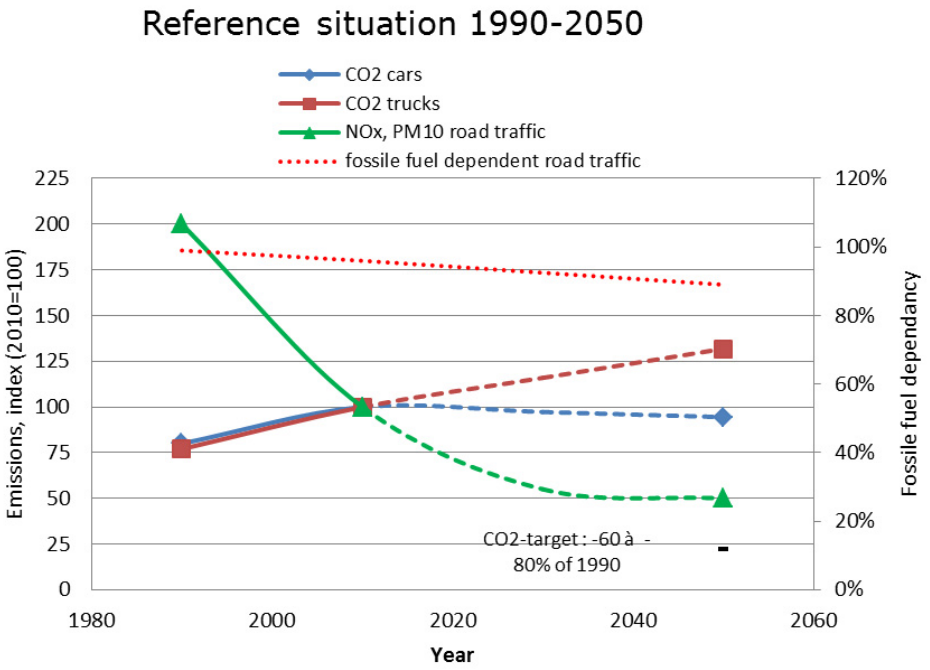

Fig. 6. Forecasts for CO_2, NO_x and PM10 –emissions and oil-dependency of traffic in the Netherlands (Source: Moorman & Kansen, 2011)

Emissions of CO_2 and atmospheric pollutants from road transport can be considerably reduced by 2050 using currently known technologies, while at the same time making road transport much less dependent on oil. A 60 to 80 per cent reduction in CO_2 emissions from 1990 levels is possible.

Emissions of atmospheric pollutants (NO_x, PM10) are already being considerably reduced by current policies, but further reductions are possible. Moorman & Kansen identified four possible strategies for doing this:

1. KILOMETRES: reducing the number of kilometres travelled by a shift from road vehicles to other forms of transport (modal shift), improved freight transport logistics, compact cities and a higher price per kilometre travelled.
2. VEHICLE: modifying vehicles and adjusting speeds to make driving more energy efficient. The options are fuel-efficient engines, lightweight and smart vehicles, low-emission driving speeds, and electric and fuel cell vehicles.
3. ENERGY: using alternative energy carriers that cause fewer emissions per unit of energy consumed by the vehicle as alternatives to petrol and diesel. Options are biofuels and low-emission electricity and hydrogen.
4. FILTER: filtering or cleaning vehicle exhaust gases to prevent them entering the environment (end-of-pipe). Options are particulate filters, catalytic converters and exhaust gas recirculation.

A fifth strategy can be added: Infrastructure adjustment: free or dedicated lanes for freight transport, freight corridors. Figure 7 shows what the CO_2 reduction could be for trucks (Moorman & Kansen, 2011).

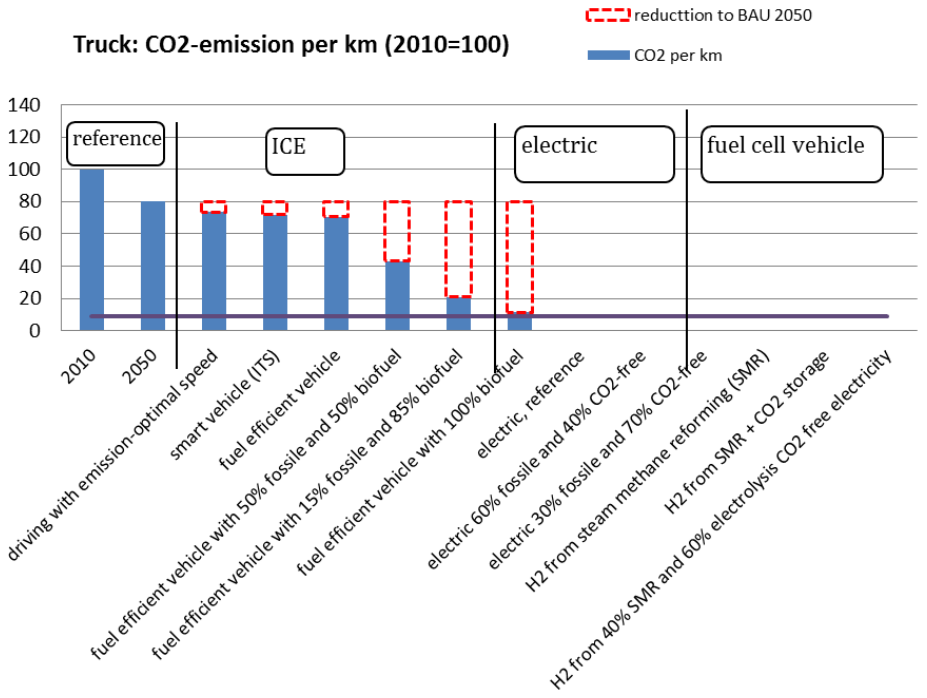

Fig. 7. CO_2 emission per km for trucks in 2050 with different technologies (Source: Moorman & Kansen, 2011)

Electric and fuel cell technologies are not at present very interesting for trucks but both technologies can be used for vans. Figure 8 shows options to reduce CO_2 (based on cars but is also applicable for vans).

Zondag (in press) investigated a ban on trucks in combination with electric city logistics. Full electric propulsion is only feasible on light trucks. Electric city logistics leads to more trips with light trucks and less heavy

trucks. The number of trips with vans and light trucks will increase by a factor three. The total vehicle mileage will increase.

Electric trucks are not common in Japan. Toyota, Hino (Japanese truck maker) and Yamato have developed an electronic truck with one tone loading capacity for delivery purposes, and announced a field study to start in March 2013. The truck has a refrigerator for temperature-controlled parcels, and then can get only 20 or 30 kilometers on a single charge. Bicycles and carts are used for the last-mile delivery in downtown areas in large cities, because there are not sufficient parking spaces on-street.

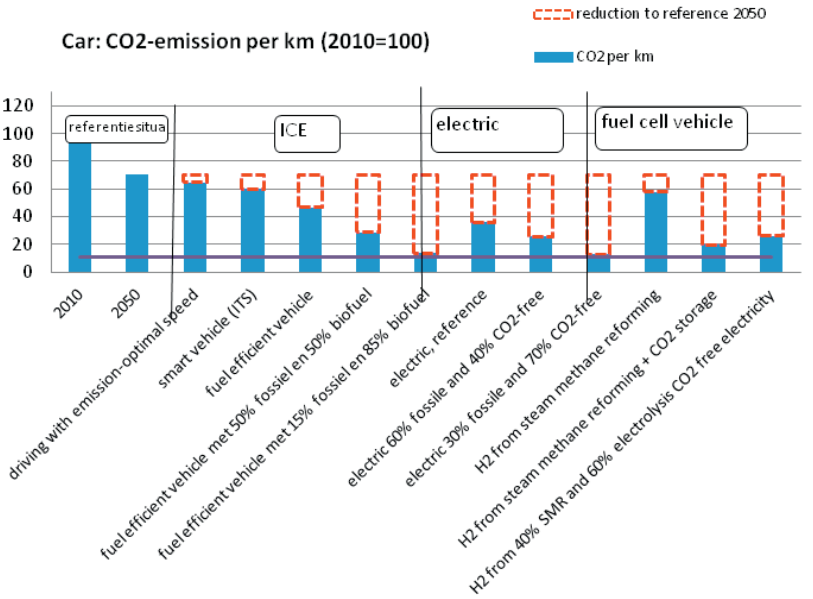

Fig. 8. CO_2 emissions per km for cars (and vans) in 2050 with different technologies (Source: Moorman & Kansen, 2011)

7. Conclusions

This review has highlighted that the last few years have been a period of dramatic change in e-commerce and home delivery. The growth in the home delivery channels and the increasingly comprehensive range of services offered by retailers (such as click & collect) all lead to changes in the pattern of urban freight flows and vehicle movements in cities. The changes are complicated are influenced by wider factors such as demographic changes and the adoption of new consumer technologies.

The impact of the changes remains uncertain. Fragmentation in the retail channel could give rise to increases in vehicle movements in cities as retailers are forced to offer ever higher levels of service to more demanding consumers. On the other hand the increased level of service may lead consumers to change their travel behavior and to make fewer car journeys as their needs are met by sophisticated home delivery systems (or other suitable alternatives). The new services are also likely to be at the forefront of the adoption of new vehicle technologies since the home delivery operation is very visible to consumers and takes place in sensitive areas within cities (i.e. residential zones). Many companies are considering the adoption of alternative fuel vehicles for the home delivery operation and while some of this is based on motives such as corporate social responsibility it also seems clear that marketing factors are relevant.

The changes discussed here pose major challenges for urban planning. New retail developments may look very different to those of the past 10-20 years and give rise to very different freight flows and travel patterns. Not only traffic movements are affected however. In addition there is the need to consider the consolidation points that will

be needed in the new distribution channels. It is important to consider the changes in a comprehensive way taking into account travel behavior as well as urban logistics. Only by taking this holistic view is it possible to identify and evaluate the potential impacts of the increased use of home delivery on the sustainability of cities.

References

BESTUFS (2001). *Best Practice Handbook Year 2. E-commerce and urban freight distribution (home shopping)*. Germany: PTV.

Boyer. K. K., Prud'homme, A. M. & Chung, W. (2009). The last-mile challenge: evaluating the effects of customer density and delivery window patterns. *Journal of Business Logistics, 30, (n°1 2009),* 185-201.

Braimaister, L. G. (2002). Mogelijke gevolgen van e-commerce voor de verkeersveiligheid in Nederland. SWOV, Leidschendam.

Browne, M. (2001). Transport and Local Distribution. A paper at the 'E-commerce and urban transport Joint OECD/ECMT Seminar'. Paris 5 & 6 June. Available at: http://www.oecd.org/sti/transport/roadtransportresearch/2536564.pdf

Crainic, T. G., Errico, F., Rei, W. and Ricciardi, N. (2011). Integrating C2E and C2C traffic into city logistics planning. *Procedia - Social and Behavioral Sciences, 39,* 47-60.

CRR (2012). Online retailing: Britain and Europe 2012. CRR research commissioned by Kelkoo, summary available from: http://www.retailresearch.org/onlineretailing.php.

Cushman & Wakefield (2013). *Global perspective on retail: online retailing.* London: Cushman & Wakefield.

Durand, B. & Gonzalez-Feliu, J. (2011). Urban logistics and E-grocery: Have proximity delivery services a positive impact on shopping trips? *Procedia - Social and Behavioral Sciences, 39*, 510-520.

European Commission (2011). White Paper. Roadmap to a single European transport area – Towards a competitive and resource efficient transport system. Brussels: EC.

European Commission, Directorate-General for Health and Consumers (2012). *Consumers conditions scoreboard.* Luxembourg, Office for Official Publications of the European Union.

IMRG (2012). UK valuing home delivery review 2012. IMRG.

Javelin Group (2011). *How many stores will we really need? UK non-food retailing in 2020.* London: Javelin Group.

KiM (in press) Intershopping and the impacts on mobility, paper at ETC 2013. KiM: Den Haag.

METI (Japanese Ministry of Economy, Trade and Industry) (2012). Market research on E-commerce, Press Release.

MIC (Japanese Ministry of Internal Affairs and Communication) (2011). The research on effect of the ICT. Infrastructure Development to the National Lifestyle and Social Environment

Moorman, S. and Kansen, M. (2011). Naar duurzaam wegverkeer in 2050. Een verkenning van mogelijke opties, Den Haag: KiM.

Nemoto, T., Visser, J. & Yoshimoto, R. (2001). Impacts of information and communication technology on urban logistics system. *Working paper series No. 65,* Hitotsubashi University, Tokyo.

ONS (Office for National Statistics) (2013). Retail Sales, March 2013, ONS. Available from: http://www.ons.gov.uk/ons/dcp171778_307078.pdf.

OPTA (2011). de Nederlandse postmarkt in 2010.

SUGAR (2011). *City Logistics Best Practices: A Handbook for Authorities*.

Teo, J. S. E., Taniguchi, E. & Qureshi, A. G. (2011). Evaluating city logistics measure in E-commerce with multi-agent systems. *Procedia - Social and Behavioral Sciences, 39,* 349-359.

TNO (2010). Online winkelen in Nederland, Noodzaak tot slimmere logistiek. TNO, Delft.

Verdict (2010). UK home delivery and fulfillment 2010. Verdict.

Visser, J., Nemoto, T. & Boerkamps, J. (2001). E-commerce and city logistics. In E. Taniguchi & R. Thompson (Eds.), *City Logistics II, Kyoto* (pp. 35-66). Kyoto: Institute of Systems Science Research.

Visser, J. & K. Hassall (2005). The future of city logistics: estimating the demand for home delivery in urban areas. In E. Taniguchi & R. G. Thompson (Eds.), *Proceedings of The Fourth International Conference on City Logistics, 12-14 July 2005*, Langkawi, Malaysia.

Weltevreden, J. (2007). *Winkelen in het internettijdperk.* Rotterdam: NAi Uitgevers.

Weltevreden J. W. J. & Rotem-Mindali, O. (2009). Mobility effects of b2c and c2c e-commerce in the Netherlands: A quantitative assessment. *Journal of Transport Geography, 17 (2),* 83-92.

Zondag (in press). Elektrisch rijden in 2050: gevolgen voor de leefomgeving, Den Haag: PBL.