

Technology and change in postal services – impacts on consumers

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Executive Summary

Introduction

The aim of this study is to provide an overview of the current technological developments in the postal market and assess the potential future impact of various technologies and innovations on the market, and on British consumers in particular. It also considers the issues that might arise for consumer protection authorities and possible actions to take.

The study was conducted by WIK-Consult and ITA Consulting on behalf of Citizens Advice between September and November 2015, using a mix of desk research, expert interviews and own analysis. Our findings are based on extensive research and literature review, validated during interviews with 15 delivery companies, stakeholders, and experts based on a questionnaire.

Background

Digitalisation has changed the role of the postal sector as mail volumes decline and parcel volumes grow. In the UK mail market, volumes have steadily declined for years, although this drop has slowed somewhat in recent years, while revenues have risen slightly, mostly due to price increases. Royal Mail remains the dominant operator, especially as the only end-to-end competitor has stopped delivery operations. In contrast, parcel volumes increased in 2014-15 by 7 per cent¹ as e-commerce generates additional volumes for delivery. There is intense competition between ten larger operators and many small local and regional firms.

Technology drivers in the postal sector

For the purposes of this report, the terms 'technology' and 'innovation' are used broadly to cover devices and products but also their applications and uses. Different basic technologies are an enabler of innovation rather than an innovation in the postal sector in itself. Prime examples of innovative technologies which are already used in today's postal industry are RFID chips (radio-frequency identification chips), sensors, PDAs (personal digital assistants) and also mobile internet and GPS (global positioning system). Cloud computing, big data, the Internet of Things, robotics, drones and 3D printing are among the most prominent technological innovations that will in future play more significant roles in the postal sector.

Driven by competition and customer demand, postal and parcel operators use advanced technology for different purposes, above all to improve operational efficiency and to offer new products and services. In particular, consumer demand for faster

¹ See Ofcom (2015), Annual monitoring update on the postal market. Financial year 2014-15, 27 November 2015, p. 3.

handling of orders and more convenient delivery is driving change in the sector and technological innovations are enabling e-retailers and postal operators to respond to those requirements.

For example, automated sorting and centralisation of letter and parcel operations are important developments, especially sequencing of letter deliveries to street level, as well as automated scanning. These have both been facilitated by postcode granulation. In the parcels business, last-mile deliveries have been improved with technologies such as PDAs for signature scanning which also have added additional security for consumers.

E-commerce is a key driver for postal services

The internet has transformed society in many ways. About 90 per cent of the British population is now online. People in the more densely populated parts of the country benefit from high-speed broadband networks but there are still gaps in rural areas, such as parts of Scotland and Wales. In parallel, mobile access to the internet is growing fast, especially via Wi-Fi in cities. As a result, internet usage is rising across all age groups, although younger people remain ahead of older citizens in terms of overall time spent online.

High internet penetration has driven the rapid growth of e-commerce in the UK, which is Europe's largest market. The UK has constant double-digit e-commerce growth rates and further strong growth is expected in the years ahead. Britons shop online for all kinds of goods, with groceries as one of the latest trends. Increasing competition in the e-commerce market provides positive incentives for all market players, retailers as well as parcel carriers and lends an additional impetus to the development of new online-shopping and delivery solutions.

Home delivery is clearly the most preferred option for consumers and delivery companies are using technology to introduce new added-value services. But many alternatives also exist and are being expanded to increase customer convenience. The most popular alternative delivery form is 'click and collect', where consumers pick up their online orders at 'parcel shops' or, to a lesser extent, from self-service parcel lockers.

On the supply side, e-commerce is now an established sales channel for British retailers, representing about 20 per cent of revenues.² Most online retailers are multi-channel retailers originating in the high street, although there are many 'pure play' online-only retailers, led by Amazon and eBay.

² See Eurostat (2014), Share of enterprises' turnover on e-commerce, see: <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tin00110&language=en>.

Overall, e-commerce using digital networks has put British consumers in a better position in relation to commerce in the physical world. However, not all consumers will be able to benefit to the same extent. The positive impact of innovations on consumers will only be effective if certain preconditions are fulfilled, ie network access, device ownership and knowledge. As anticipated, the research results show technical requirements such as broadband access are not available in the same quality in remote areas as in urban areas and the necessary equipment like smartphones/tablets or desktop computers are less affordable for low income groups. The use of new innovations requires digital literacy, which is presumably more widespread the younger age group.

Overall demand for postal services

As mentioned above, demand for postal services has been transformed in recent years. Mail volumes peaked in 2004 after a long growth period and have declined since then, albeit somewhat more slowly in the last few years. Consumer demand for transactional mail has dropped substantially due to e-substitution, while direct mail (advertising) volumes have tended to rise and fall in response to general economic trends. Publishing mail volumes have fallen as more communications and media go online, while social mail (ie greeting cards and letters) has also declined significantly.

Parcel volumes in the UK are growing as consumers buy more and more online, generating more orders for delivery. This business to consumer (B2C) volume growth is slightly held back by the digitalisation of some physical goods such as books and music CDs. B2C volumes make up more than half the market compared to business to business (B2B) deliveries which are increasing more slowly, roughly in line with GDP growth.

Innovative technologies enable more efficient postal operations and better services for consumers

As a general trend, technology has helped the parcel delivery chain to become receiver-centralised. Consumers, who act as receivers, are not only better informed about the status of their delivery via tracking, they now also have the option to change the delivery process by redirecting a parcel to a different delivery point, or postpone delivery if they are not at home.

The increasing popularity of these delivery methods means carriers have to turn to a more individual approach instead of a standardised supply chain for delivery of each and every parcel. Consequently, this requires carriers to modernise their processes and to substantially invest in their IT infrastructures as a means of raising their operations' efficiency.

The position of postal operators is under increasing pressure. Global e-retailers might be turning the carrier's core offering, last-mile delivery, into a commodity which lacks added value and is subject to intense competition. By contrast, technology is impacting positively in different parts of the postal sector, mostly in sorting and delivery operations, helping to improve the overall consumer experience. Different kinds of technologies are enabling postal and parcel carriers to make their operations more efficient and create value added services in delivery. This is particularly valid in the parcels business where rising volumes are increasing the need for greater sorting capacity and faster handling processes as well as quality differentiation.

Barcodes speed up parcel sorting as they can be automatically scanned. More carriers are introducing data-rich 2D codes which contain additional information such as routing instructions which enable tracking. These barcodes also enable new value added mail services as the 2D code can carry additional information, such as personalised special offers or discounts that can be redeemed at a local shop.

Other technological advances that speed up sorting include sensors, cameras and area scanners, along with fingerprint technology based on parcel images and software recognition. Radio-frequency identification is a powerful technology that enables even faster remote processing and is used for some express and special logistics products. However, it currently remains too expensive for parcel services that are used by consumers.

Robots have already found their way into parcel sorting operations although at present they are still in a testing phase by companies such as Amazon and DHL. However, with the rapid development of robotics, robots will likely take over more tasks in future.

Self-service parcel lockers offer 24/7 access times and make deliveries more efficient for carriers through avoiding failed delivery attempts. Parcel lockers are being gradually

rolled out in Britain by InPost and Amazon but remain relatively few in number compared to the extensive 'low-tech' parcel shop networks operated by various carriers. Home 'parcel boxes' do not yet play a role in the UK. Futuristic concepts such as self-driving vehicles and flying delivery drones remain some way off at present, despite well-publicised tests.

3D printing is an innovative technology that is growing but at present remains a niche business mostly for business purposes such as industrial production or for creative consumers as tests show (Royal Mail, Myminifactory). To a certain extent, this creates additional items to be shipped. The relevance of consumer deliveries is quite limited at present due to high costs, limited choice of production materials and complex operations.

In contrast, shared (crowdsourced) delivery is a fast-growing phenomenon that is spreading from the USA and into the UK. Technology firms operating through apps and websites sign up consumers to work flexibly as self-employed delivery couriers using their own car or bicycle, with payment usually by the hour or per delivery. Crowdsourced delivery relies on having a large number of couriers available at any time, and is so far mostly used for urgent or same-day deliveries within cities.

It should be noted that many of the potential delivery solutions mentioned above are characterised by a major disparity between urban and rural areas. Most solutions are designed for highly-populated areas, such as click and collect stores, parcel lockers or same-day deliveries. This leaves consumers in thinly-populated rural and remote regions at a disadvantage and/or facing surcharges for some types of delivery services. Consolidated parcel delivery is seen as a potential solution.

There are other technology-based innovations in the postal sector. For example, web-based re-sellers operate portals enabling consumers and SMEs to compare prices and services, and offer prices lower than official rates by consolidating volumes to secure discounts from parcel carriers. This increases market transparency. Meanwhile, in response to public and customer pressure, some operators are making their operations more sustainable and reducing emissions by introducing environmentally-friendly vehicles - although high prices still prevent large-scale rollouts.

The relationship between the innovations highlighted above and their effect on consumers might not be directly a causal one and may contain considerable complexity. However, the results of our research provide some insight into the impact of these innovations on consumers of postal services. To clarify the diffusion and adoption of an innovation in detail, other determining factors such as consumer needs, cost and price trends as well as the overall technological, regulatory and economic development need to be taken into consideration. With this in mind, technological inventions are a necessary but not sufficient condition alone for market changes, but are an important enabler for innovation in the postal sector.

1. Automation in letter and parcel sorting

- *Sector:* Automation in letter and parcel sorting leads to better operational efficiency and cost savings.
- *Consumers:* Automation in letter and parcel sorting adds to improved delivery quality, enables new products and services and cost savings for postal operators that might be passed on to consumers.

2. Extended track and trace for parcels and value-added mail services

- *Sector:* New data-rich 2D barcoding will become a new standard that allows better tracking and tracing. Postal operators can develop new value-added mail services that contain additional information for consumers, such as discounts. Business senders may use value-added letter services to reach new customers. As response rates to digital marketing are low, physical mailings become more attractive even if costs per letter are higher. This will drive demand for direct mail and value-added letter services in contrast to other physical mail streams. New technologies like RFID and parcel fingerprinting will remain niche applications as they are more costly than barcodes on paper.
- *Consumers:* Consumers will benefit from improved delivery quality and new products and services which are based on extended track and trace, namely predictable delivery and redirected delivery.

3. Predictable delivery and redirected delivery

- *Sector:* Predictable delivery/real-time delivery redirections might become a new standard within the next three years. Competitive advantages for best-in-class companies stimulate innovations in this field. However, high investments in parcel carrier IT infrastructure are needed and it seems likely that these services will come with an additional charge for consumers.
- *Consumers:* Consumers value additional convenience in parcel delivery and their demand for predictable services will increase to avoid failed deliveries. Consumers benefit from improved delivery quality, yet this can require providing more personal data. This could give rise to increased privacy concerns and mean consumers are 'always online' leading to additional potential data security issues.

4. Same-day delivery

- *Sector:* Same-day delivery will probably become a normal service option within three years based on variable pricing. A condition for cost effective same-day delivery is the need for decentralised inventory and regional warehouses.
- *Consumers:* Same-day delivery is an attractive option for urgent wants and needs but the willingness and ability of low income consumer groups to pay

premium prices remains unclear. Same-day is likely to stay a niche as there seems to be a stronger demand for 'reliable' deliveries than for 'fast' deliveries. For cost reasons, same-day delivery will not be on offer in remote regions in future and low-income consumer groups will be potentially excluded from the service because of extra charges.

5. Variety of PUDO (pick-up and drop-off) solutions

- *Sector:* Parcel carriers offer a wider choice of alternative 'click and collect' options such as parcel shops and lockers. This is a win-win situation as it allows carriers to realise significant delivery cost savings. New market entrants and more solutions are likely as click and collect options from third parties outside the postal sector emerge.
- *Consumers:* Consumers benefit from the variety, convenience and choice that PUDO solutions can offer. There are potential exclusions or disadvantages for some consumer groups because many of the solutions will not be rolled out nationwide or, if they are, could imply extra charges.

6. Growth and competition in the parcel market

- *Sector:* Strong competition will intensify because of new entrants and due to e-retailers like Amazon offering their own delivery service. This puts more pressure on carrier margins. Growth and competition in the parcel market is also a driver for new and enhanced services and can lead to competitive pricing. One of the main new developments is the extension of competition in retail to expand the supply chain.
- *Consumers:* Consumers are able to profit from parcel delivery services that are innovative and offer new options that can better reflect their needs. Cost savings based on more efficiency create potential for price reductions for consumers.

7. Shipping platforms (re-sellers) for private consumers

- *Sector:* Shipping platforms increase the number of service options for (online) B2C senders. They generate extra volumes but at the same time increase pricing pressures for those carriers who cooperate with the re-seller and platform operator.
- *Consumers:* Consumers are offered lower prices and more service transparency on shipment platforms. They profit from discount prices which are otherwise only on offer for business customers with sufficient volume. Most shipping platforms focus on small online sellers rather than occasional private senders.

8. Sharing economy (crowdsourced deliveries)

- *Sector:* Crowdsourced deliveries are a new business option for technology-based market entrants. Low-cost flexible business models based on web applications allow these delivery companies to organise delivery in a local area or even nationally. However, legal issues like liability for damaged goods or tax and insurance issues remain unsolved at this stage. The long-term business prospects of the sharing economy in delivery is as uncertain as in other business areas.
- *Consumers:*
 - As part-time delivery workers, consumers are able to generate additional income. Crowdsourced delivery is useful for occasional workers who prefer flexible working times. Legal uncertainties such as employee status and insurance issues have to be solved on a national level.
 - As receivers, solutions based on sharing economy stimulate potential new consumer demand, especially in the field of one-hour or same-day delivery. For point-to-point same-day delivery, crowdsourced options allow lower delivery prices. There are potential exclusions or disadvantages that could be expected for some consumer groups, so far these options are only evolving in inner city areas.

9. Sustainability

- *Sector:* Today, postal operators make investments in costly 'green' vehicles on a comparably small-scale. Environmental measures to reduce energy usage in buildings, lighting and other outlets are part of many strategies to reduce emissions. The external pressure for stronger measures is rising, and have been expressed in requirements for congestion charges and emission reductions. The environmental policies in place also influence the expansion of CO₂-neutral delivery options.
- *Consumers:* Many consumers feel the need to act in an environmentally-conscious manner and public pressure for more environmentally-friendly deliveries is rising. New delivery concepts could reduce inner city congestion and influence consumers' living conditions in a positive way.

10. Consolidated rural/remote area parcel deliveries

- *Sector:* There are indications of strong potential for single carriers to deliver all parcels in rural or remote areas, such as the Scottish Highlands and Islands, in order to reduce high final-mile costs. However, this requires industry-wide collaboration and above all, IT integration. Competitive and brand issues prevent further collaboration in some cases.

- *Consumers:* Consolidated parcel deliveries to rural and remote areas ensure continued or even better delivery services. This strategy allows stable or even lower prices for consumers in rural areas by reducing delivery costs. This offers a clear scope to give up delivery surcharges for remote areas.

11. E-substitution

- *Sector:* E-substitution, ie increased digitalisation, will further reduce overall physical letter volumes but might also imply growth potential for direct mail due to better response rates. The need for social and legal requirements for continued traditional letter services remains. Financial pressures will rise if e-substitution reaches a critical mass eroding revenues covering shared costs. New mail products and services like individually barcoded letters are developed to meet demand of senders.
- *Consumers:* Consumers will intensify digital usage but at the same time security concerns could rise. Potential digital exclusion and disadvantages for some consumer groups arise, mainly for consumers with less confidence using the internet which could include groups of elderly consumers, consumers with low income who cannot afford digital devices and access to online services, or those living in areas with low bandwidth. Higher physical mail prices might come up for consumers if letter volume decreases sharply because of e-substitution.

12. Automated (self-driving) vehicles

- *Sector:* Automated, or self-driving vehicles, are currently still in a testing phase. Our findings show a potential future use for long-haul transportation. On the one hand, cost savings are to be expected, and would be achieved through staff reductions, but on the other hand high upfront investments are required. There seems to be little final-mile potential for this innovation due to delivery handover requirements and regulatory and safety issues.
- *Consumers:* Consumers benefit from improved road safety if self-driving vehicles fulfil high standards. We do not expect any impact on last-mile delivery at the moment.

13. Robots in postal logistics

- *Sector:* Robots are increasingly used in parcel sorting and warehouse operations, for example in loading/unloading procedures where they ease the workload for workers. Significant technological improvements are expected in the next few years. Long-term standardisation on a multinational scale is a precondition for successful implementation. Although robots imply cost savings potential high upfront investments prevent smaller parcel operators from pursuing research and development of solutions.

- *Consumers:* Any short-term direct impacts from the use of robots in postal logistics do not seem likely. Long-term potential benefits could occur if cost reductions from their operational use are passed to consumers in the form of price reductions.

14. Delivery by drones

- *Sector:* Parcel delivery by drones is in an experimental phase at present. Many technical issues have to be solved before drones can be implemented as a standard delivery method. We see long-term potential as a niche service, such as urgent deliveries to remote areas, but large-scale usage seems unlikely because of safety regulations, high operational costs (drones have to be steered by trained personnel) and limited carrying capacity.
- *Consumers:* Consumers in rural and remote areas might benefit potentially in the long-term, especially in the field of urgent or deliveries, such as medical supplies. A possible argument against standardised drone delivery routes are unclear delivery handover arrangements.

15. 3D printing

- *Sector:* This niche technology is expected to remain mostly for industrial production due to high costs and limited product choice. The production and selling of 3D objects will have a slight positive volume effect on shipments. There is a theoretical potential to relocate mass production/production of specialised objects to local sites, thus reducing parcel volumes, but major technological improvements and cost reductions would be required within the coming years.
- *Consumers:* Today, 3D printing is a niche alternative for tech-savvy consumers to 'create' their own goods. From our findings we conclude that there is minimal overall impact on consumers as postal services users for the coming years.

Overall impacts on consumers

Overall, the impact of technology on consumers of postal services has clearly been positive to date and will remain so in the years ahead. Technology, primarily through the spread of the internet and mobile devices, has empowered consumers and transformed them from passive to active participants in the postal services market. With the rise of e-commerce, carriers have changed their focus from senders, the business customers, to receivers, the consumers receiving the goods. Carriers have used technology to make their postal operations more efficient and to improve or introduce innovative new products and services. Other new technologies are being tested and many of them will result in further improvements for consumers of postal services.

Generally lower costs expressed through lower prices are good news for consumers, and particularly lower income consumers.

The main general benefits for consumers from technology in the postal sector include:

- better and faster delivery services
- more convenience and choice
- new revenues in parcels as part of revenue pool
- attractive prices, established through competition

There are also new opportunities for vulnerable consumers from the growth of e-commerce because doorstep delivery of all kinds of goods has become standard at no extra charge.

Inevitably, there are various concerns related to the increasing use of technology in postal services - although these mostly result from the absence of technology-based services rather than the technology itself. These include:

- All consumers will have to disclose more personal information in future, potentially putting sensitive data at risk.
- Consumers with low income, limited digital skills and/or no internet access will be excluded from e-commerce benefits found through wider availability of goods, lower prices and convenient delivery services. They are thus at risk to be more impacted by higher mail prices or reduced service quality.
- Consumers in remote areas will have severely limited delivery options and can face a lack of choice, high surcharges or no alternative delivery options.
- Elderly consumers or people with disabilities will rely on delivery to the door and benefit little from 'click and collect' alternatives.

Conclusions and recommendations

This report therefore concludes that technology plays an overall positive role for postal services and acts as an enabler and a driver for better services for consumers. The benefits to date outweigh the risks and concerns. Looking ahead, technology will become more and more important for postal services, and further positive benefits for consumers are expected.

1 Introduction

This study provides an overview of recent developments in the postal market and research on technology trends which will impact postal consumers. It summarises technological developments in the postal and delivery sector in the UK, and includes examples from other European countries where appropriate. It assesses how technologies will change the postal market and the strategic location of the postal sector. The main objective is to evaluate how future technological development will impact consumers of postal services in the short and long run. To achieve this purpose, the study develops scenarios of future technology development. The scenarios describe the most relevant technological developments as well as conditions for their emergence such as legal conditions or acceptance of certain technologies by consumers and businesses.

2 Approach and methodology

The study is based on the following methodological steps:

- research and literature review
- interviews based on questionnaire
- Impact Assessment and analysis of final impacts on consumers using scenarios

Careful desk research and an extensive literature review aimed at getting a suitable understanding of the topics concerning the research question has been undertaken. We collected and analysed results from reports and academic studies and investigated relevant postal and logistics magazines and websites as well as information and communications technology journals and websites.

In addition to presenting and critically assessing the status quo, our assessment reaches beyond latest technological trends and focuses on the impact of technology on consumers of postal services in the future. This is achieved through impact assessment and analysing final impacts on British consumers. We assess the influence of technology within a short-term (less than three years) and a long-term (five years and beyond) perspective. We use the technique of scenario writing to describe future developments. In selected scenarios we combine our fact finding and define likely related social changes. The scenarios include the most plausible developments but also consider unexpectedly important situations, likely problems and disruptions.

Our impact assessment is complemented by 15 expert interviews based on questionnaires with sector experts (see Figure 1). We spoke to delivery companies, stakeholders, and experts: DaytodayEbay / Online Seller UK, DMA (Direct Marketing Association), Fraunhofer Institute for Integrated Circuits /Chair for Supply Chain Management, University of Bamberg, Hermes UK, IMRG (Interactive Media in Retail

Group), Retail Institute University of Cologne (IfH Institut fuer Handelsforschung), ILS - Institute of Shipping Economics and Logistics, Menzies Distribution / AJG Parcels, Myminifactory, Nimber, Royal Mail, T-Systems Multimedia Solutions - Data Science and Visualization, Rural Services Network, Uber and Yodel.

Figure 1: Interview partners for this study



Source: WIK-Consult.

This study was conducted by WIK-Consult and ITA Consulting as its subcontractor. We undertook research between September and November 2015.

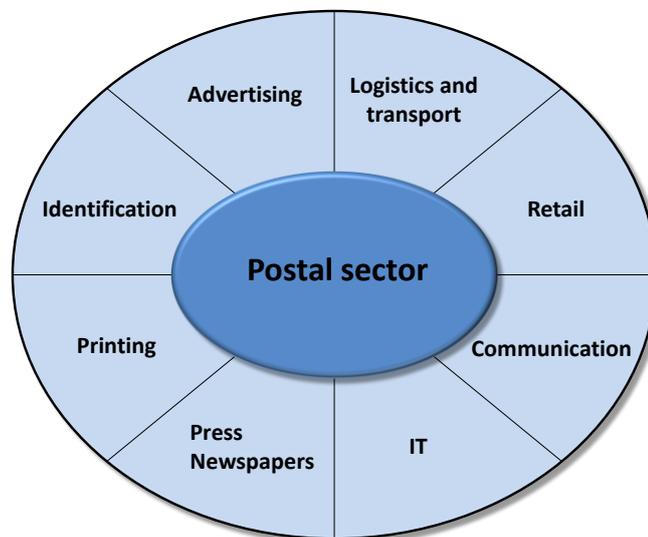
At this point, we wish to express our sincere thanks to all interview partners for their information and ideas. The views and opinions in the study are those of the authors and do not necessarily reflect the position of the expert interview partners or Citizens Advice.

3 The strategic location of the postal sector

3.1 Postal services and related markets

Postal services have been vital to the needs of many industries. From banks and insurances to utilities and public authorities, every business, public or private user in the past relied on postal services for exchanging information, documents, cheques, bills, statements, or simply letters.

Figure 2: Strategic location of postal services



Source: WIK-Consult.

However, with the continuing growth of digital alternatives for communication the communicative role of postal services is diminishing alongside other evolving markets closely related to the postal sector. This implies manifold challenges for the traditional postal value chain. In order to adapt to these new conditions, postal operators have to re-define postal communication services and develop value-added services combining benefits from the digital and paper-based world. At the same time, there are still consumers without internet access in the UK population (11.4 per cent in 2015 or 5.9 million people³). These consumers are in need of postal services in order to participate in social and economic life.

³ Office for National Statistics, Internet user 2015, p. 3. For more information on geographical coverage compare also chapter 5.1.

While postal communications decline, the significance of postal services for retailers, online and mobile commerce surges. The consumer as a receiver has become the central point of the parcel value chain.⁴

Due to this customer-focused approach, the receiver can choose from various delivery options. Postal services have to manage the complex logistics this approach requires while keeping costs under control and meeting customer expectations. In order to keep up with increasing expectations concerning speed of delivery, reliability, and convenience, postal operators have to adapt their logistics and information technology (IT) processes. While postal processes have been quite static in the past, with items being collected, sorted, transported, and delivered to the receiver, carriers now need to invest in information technology to offer services for individual treatment of single parcels according to the delivery preferences of receivers. Today, receivers of online-ordered goods want to be able to redirect or postpone delivery. From the consumers' point of view this adds additional convenience, while for the e-retailer this means more satisfied customers. Parcel carriers also save efforts and costs because they avoid repeated delivery. Postal operators and retailers have to work closely together to integrate different delivery options, such as click and collect, parcel lockers and predicted delivery time services, into their order and logistics processes.

Postal advertisements can help businesses to boost online sales. Response rates of paper-based advertisements still exceed those of digital and online advertisements. Businesses mix addressed direct marketing with digital media to improve awareness and responses from customers.⁵ Postal operators react to these needs and offer innovative marketing products which can reach all customers regardless of their place of residence or access to information technology – an important advantage of postal services compared to internet-based customer approaches. This makes postal services also important for delivering newspapers and other press items. For newspaper readers, postal delivery ensures access to up to date reporting while it enables publishers to sell products on a nationwide basis.

Postal operators offer business senders not only transport services, but also fulfilment options. Before a postal item can be delivered, it has to be printed, put into an envelope, stamped and carried to a postal office branch. Business senders can pass on this extensive and costly process to postal operators, while at the same time simplifying their processes and saving costs.

As Royal Mail delivers to every address in the UK its Postal Address File provides a huge and up to date database of addresses and customer identities. This helps businesses in need of updating their own customer databases or identifying customers.

⁴ Cp. OIG (2015), Rethinking the parcel delivery value chain: a recap of the international roundtable, July 27, 2015.

⁵ DMA (2015), Data-Driven Marketers Diversify Across Channels, DMA news release, New York, NY, April 2, 2015.

Identification of customers is essential for making online transactions easier and to improve data accuracy to the benefits of both businesses and consumers. Addressing and identification services are important for businesses when they want to send bills, information or online-ordered goods to customers, improve their customer service or approach customers in a more targeted way. The use of postcode data also plays a major role in other services such as insurance marketing and advertising.

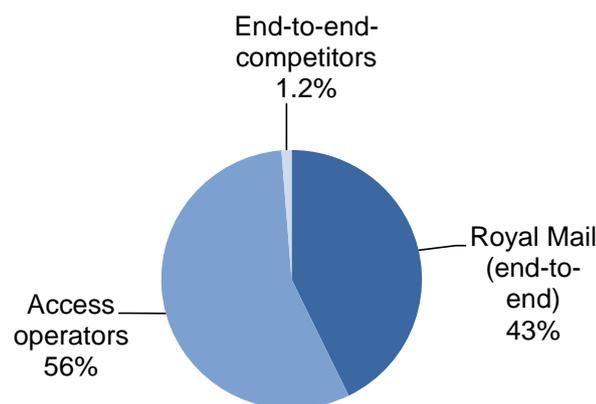
3.2 Overview of the UK core postal sector

UK letter market

Royal Mail is still the dominant postal operator in the UK letter post market, delivering approximately 99 per cent of total letter volumes. In 2014, end-to-end-competitors of Royal Mail carried only 158.5 million letters entirely through their own networks. They represent only a small part of the total letters market (1.2 per cent market share), but show incredible growth rates (volumes tripled in 2013 and again in 2014).⁶

While end-to-end competition plays a minor role, downstream access (DSA) competition⁷ is the predominant form of competition in the UK. In 2014, Royal Mail delivered only 43 per cent of the mail volume end-to-end. Access operators already collect 56 per cent of the mail volume from customers, sort it and hand it over to Royal Mail for final delivery.⁸

Figure 3: Market shares of UK letter volumes



Source: WIK-Consult calculation based on Ofcom (2015), The Communications Market 2015 – Post, p. 391.

⁶ See Ofcom (2015), The Communications Market 2015 – Post, p. 390.

⁷ Royal Mail is required to provide customers and other postal operators with access to its inward mail centers for second class letters and large letters. This enables other operators to offer letter postal services to larger business customers without setting up a delivery network.

⁸ See Ofcom (2015), The Communications Market 2015 – Post, p. 391.

There are a number of access operators in the UK such as UK Mail, Citipost DSA, ONEPOST, and Northern Mail. Royal Mail's main end-to-end-competitor was Whistl (formerly TNT Post UK), which closed its end-to-end-delivery operations in June 2015.⁹ The withdrawal of Whistl from end-to-end delivery has left Royal Mail without any competition on a significant scale for the delivery of letters (see Case study 1).

Case study 1: Major competitor Whistl ends home delivery service

- Whistl was a subsidiary of PostNL, the Dutch incumbent postal operator.
- April 2012: Whistl began delivering letters to homes in West London.
- Until 2014: Whistl extended its delivery services to Central, South West and North West London, Manchester, and Liverpool.
- June 2015: Whistl closed down its end-to-end operations after its investment partner, LDC, announced that it would not fund its further roll-out.
- July 2015: PostNL announced its exit from Whistl via a management buyout
- Now: Whistl focuses on downstream access operations and is now Royal Mail's largest DSA customer.

Sources: Whistl website, CEP-Research.

UK parcel market

Parcel operators delivered around 1.8 billion parcel items in the UK in 2014. In recent years, the increase in e-commerce has driven substantial growth in the number of parcels sent in the UK. Since 2010, the UK parcel market has grown by approximately 3.5 per cent per year.¹⁰ A report by Apex Insight stated the total value of the UK parcel market at £8 billion.¹¹

The UK parcel market can be categorised by delivery speed and certainty of delivery into three broad categories:¹²

- Deferred services are the least time-sensitive type of parcel delivery. Deferred parcels have a promised day of delivery (usually just the next day) or a time period for expected delivery, but no guarantee for delivery time.
- Express services comprise the guaranteed delivery of parcels with a certain day of delivery (such as next-day or two-day) or defined time of delivery (eg before 9am, 10am or before noon). Express parcels are barcoded and tracked and include a compensation payment if the parcel does not arrive on time.
- Courier services typically concentrate on very time-sensitive deliveries, often with a same-day requirement or a delivery at a specific time, and on small items of value

⁹ See BBC News (2015), Whistl ends home delivery service, putting 1,800 jobs at risk, <http://www.bbc.com/news/uk-england-33089423>.

¹⁰ Calculation of WIK-Consult based on PwC (2013), The outlook for UK mail volumes to 2023, p. 10.

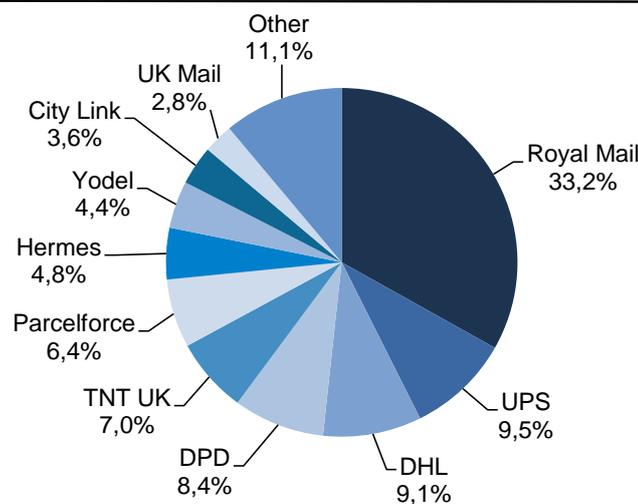
¹¹ See Apex Insight (2014), UK Parcels: Market Insight 2014.

¹² This categorisation is commonly used in competition law cases. For an overview of categorisation used in competition law cases see Bender/Dieke/Junk (2015), Zur Marktabgrenzung bei Kurier-, Paket- und Expressdiensten, WIK Diskussionsbeitrag Nr. 402, Bad Honnef, November 2015.

or importance weighing less than 2 kg. Courier items are usually transported directly on the shortest and fastest route from sender to end-recipient and require that a courier accompany the item at all stages of its journey.

The UK parcel market is highly competitive. There are more than ten significant parcel companies with a market share of more than 1 per cent. Further, there are many small local operators, such as taxis, motorcycle couriers, and bike couriers, who operate in locally defined areas.

Figure 4: UK parcel and express market shares (by revenues)



Source: Postal & Logistics Consulting Worldwide (2015), Review of the impact of competition in the postal market on consumers, p. 33.

The biggest parcel operator in the UK is Royal Mail. Other important parcel operators include international integrators, UPS and FedEx (both based in the US) as well as Dutch-based TNT Express, subsidiaries of large European postal incumbents (such as German-owned DHL, French-owned DPD, and the UK's Parcelforce), delivery companies originally founded by large mail order companies with a focus on B2C delivery, such as Yodel (formerly Home Delivery Network HDN, the logistics division of Shop Direct Group) and Hermes (formerly Parcelnet, founded by the German mail order company Otto Group). Smaller independent parcel and express operators such as UK Mail, DX UK, APC Overnight and Tuffnells Parcels Express also operate in the UK.¹³

¹³ See Postal and Logistics Consulting Worldwide (2015), Review of the impact of competition in the postal market on consumers, p. 23-35.

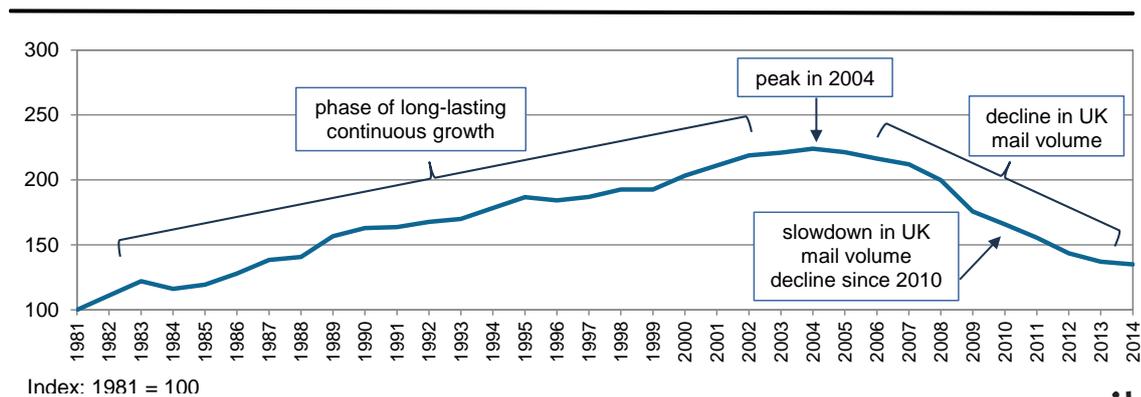
4 Demand for postal services and use of technology in operations

4.1 Demand for letters

In 2014, postal operators in the UK handled approximately 12.7 billion letters. In line with the European trend, UK letter post volumes have declined for years, especially since the overall economic recession following the financial crash in 2007.

Since 2004, total mail volumes in the UK have declined (see Figure 5), mainly driven by electronic substitution of paper communication and changes in the citizens' communication behaviour. Since 2010, the decline in UK mail volume slowed. Ofcom explained this mainly by better economic conditions in the UK.¹⁴ In 2014, postal operators in the UK delivered around 12.7 billion addressed letters.¹⁵

Figure 5: Development of UK letter volumes (1981-2014, indexed)



Index: 1981 = 100

Source: WIK-Consult based on UPU statistics and Ofcom (2015), The Communications Market 2015 – Post, p. 391.

In contrast, letter revenues have slightly increased to £4.3 billion in 2014, mainly due to price increases by Royal Mail.¹⁶ For 2015, Ofcom reported a mail volume decline by only 1.1 per cent for the financial year 2014-15.¹⁷ The slower decline is attributed by Ofcom to the improved economic development in the UK. Sector experts also expect that addressed advertisements have stabilised, in contrast to ongoing e-substitution of transactional mail, such as bills and bank statements. In its '*Outlook for UK mail volumes to 2023*' PwC also expects a slowdown in letter volume declines as a result of growing GDP and because they believe that a baseline of non-online users or less willing online users has already been reached.¹⁸ Value-added mail services though

¹⁴ See Ofcom (2015), The Communications Market 2015 – Post, p. 390.

¹⁵ See Ofcom (2015), The Communications Market 2015 – Post, p. 391.

¹⁶ See Ofcom (2015), The Communications Market 2015 – Post, p. 389-391.

¹⁷ See Ofcom (2015), Annual monitoring update on the postal market. Financial year 2014-15, 27 November 2015, p. 2.

¹⁸ See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 10.

which are sometimes discussed as the future of physical mail have obviously failed to slow down volume decline, as data on volume development in the UK and other European countries show. This can be illustrated by two examples. First, better targeted direct mail products provide an added value to senders by improved selection of receivers who are potential buyers of a product – and rejecting addresses which are less likely to react to the advertisement. Better targeted mailings though reduce the number of mail items sent. A second example is invoices that can be combined with customer-tailored advertisements which can be individualised according to the services or goods a customer already has purchased. These ‘transpromotional’ letter services (combining the words ‘transaction’ and ‘promotion’) have been enabled by big data analysis and digital printing services but have not stopped businesses from embracing electronic billing services.¹⁹

In comparison, mail volumes are continuing to decline sharply in other European markets, although at significantly different rates and for diverse reasons. In Germany, for example, the decline has been relatively slow while in neighbouring Denmark volumes have plummeted due to a governmental push for electronic communications.

Generally, the four UK mail segments transactional mail,²⁰ direct mail,²¹ publishing mail²² and social mail²³ have developed differently in the last 10 years in response to the growth of internet communications (see Figure 14). The segments have been affected differently by the various drivers for postal services (see chapter 5). According to PwC, the UK mail volumes have declined in average between 3.9 per cent (social mail) and 9.5 per cent (publishing mail). Particularly some mail segments are more affected than others, because their development depends on different factors.²⁴

19 For an overview on substitution of transactional mail to digital services, compare Hildebrand (2015), E-invoicing as the principal driver of change in B2X letter market definitions, in: Crew, M. and Brennan, T. (2015), Postal and delivery innovation in the digital economy.

20 For example, bank statements, utility bills, government communications, payments/cheques, other bills/invoices, receipts, insurance and legal documents, and orders for goods and services.

21 Unaddressed direct mail (for example, advertising leaflets) and addressed direct mail containing advertising material and catalogues.

22 For example magazines, journals and newsletters.

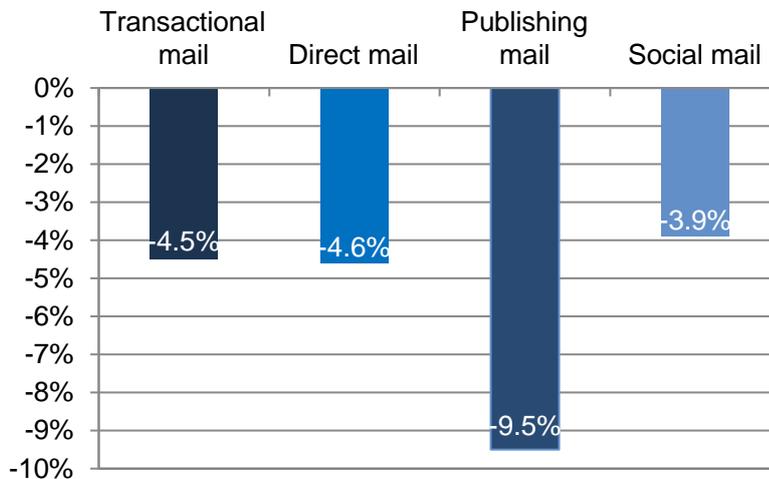
23 For example, greetings cards, Christmas and birthday cards, social correspondence and postcards.

24 See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 18.

Case study 2: Mail volume development in Denmark and Germany	
Denmark	Germany
<p>Development (last 10 years):</p> <ul style="list-style-type: none"> ➤ Danish letter market / Post Danmark lost more than half of its letter volume fastest decline in mail volume in Europe ➤ mainly loss in priority/transaction mail <p>Main drivers:</p> <ul style="list-style-type: none"> ➤ electronic communication system e-boks has started in 2001 and grown rapidly ➤ e-boks has been strongly pushed by the Danish government: each citizen must have a digital mailbox as of 2014 and since 2015 it is mandatory for citizens to use digital solutions in all their written communication with the public authorities ➤ today, e-boks is used by around ¾ of the Danish population 	<p>Development (last ten years):</p> <ul style="list-style-type: none"> ➤ German letter market lost only 7 per cent of its letter volume ➤ Deutsche Post lost around 17 per cent of its volume (competitors market share: >10 per cent) ➤ one of the slowest declines in mail volume in Europe <p>Main drivers:</p> <ul style="list-style-type: none"> ➤ low level of mail items per capita, particularly of direct mail items ➤ Low priority of digitalization for the German government ➤ low level of acceptance of electronic communication so far

Source: WIK-Consult Research.

Figure 6: Development of different UK mail segments (CAGR: 2005-2012)



Source: PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 18.

Generally, the key drivers for letter post demand are economic development, digitalisation, changes in communication behaviour, cost savings and efficiency measures of mailers and prices of postal services. The development of transactional mail is mainly affected by changes in communication behaviour. Consumer preferences for communication channels have changed in the past, resulting in increasing demand for telecommunication and internet-based services but declining demand for letters. Thus, bulk mailers look for more cost efficient ways to distribute their messages by different measures such as reducing the mailing frequency of invoices and statements,

sending invoices, notifications or statements by electronic alternatives such as email, or establishing self-service websites. Other factors such as pricing of postal services and economic development are less relevant for transactional mail where demand is less responsive to price movements or trends in relation to economic growth.

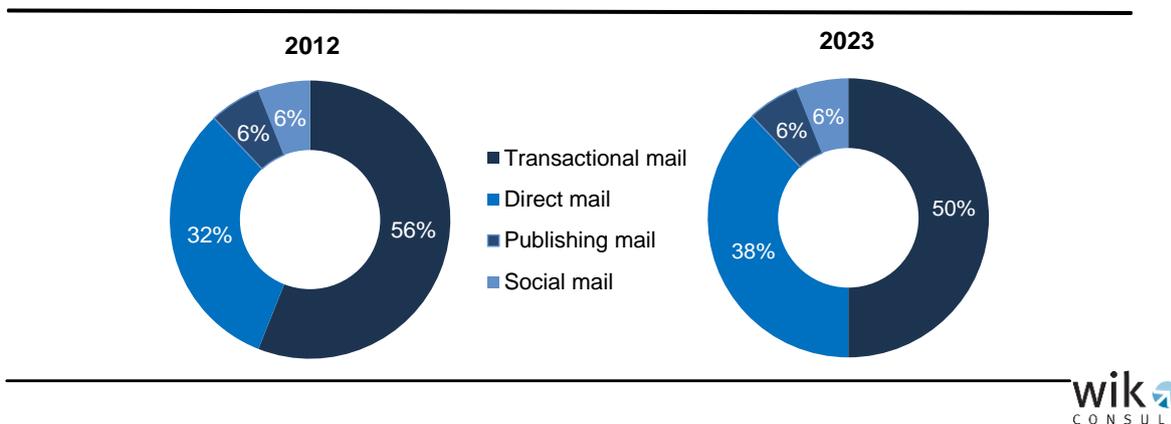
Direct mail letters, both addressed and unaddressed, are highly dependent on economic development and are very price-sensitive. The financial crisis 2008/2009 revealed that particularly advertisers are looking for more cost efficient ways to place their messages. They have improved efficiency of addressed direct mailings by better analysing existing customer data and creating more customer-targeted advertisements. Furthermore, direct mail competes against other advertising channels such as inserts in magazines, newspapers, packets and parcels, outdoor advertising and promotion through television and the internet. Advertisers decide how to distribute their budget to competing advertising media. If these budgets do not grow, as happened in recent years, while the number of advertising options increases, then the budget available for each of the competing options becomes smaller. However, the amount of advertisement sent by mail has increased, not only due to the overall positive economic development. New technologies such as tracking of letters generates added value for bulk senders, and in particular for marketers who want to orchestrate and improve efficiency of multiple marketing channels.

In particular, demand for publishing mail has dropped in recent years. With emerging online media an additional channel has been created to publish news and information. This new online media channel competes with the paper-based publishing of newspapers and magazines. Postal operators have only limited influence on the development of subscriptions of publications. If readers decide to switch to online dailies and magazines, subscriptions of paper-based dailies and magazines will decline which in turn implies less volume to deliver for postal operators.

Social mail is the mail segment that is least affected by the decline in UK mail volumes as most social mail has already migrated to digital communication. The communication behaviour of British consumers has substantially changed during the last two decades. Data and voice services are available via fixed lines or mobile phones. The internet is omnipresent and increasingly serves as communication platform.

New technologies have put consumers in control. For urgent communication, text messages and social networks like Facebook and WhatsApp are more important than letter services. However, greeting and Christmas cards – which make up a large proportion of social mail - remain an important element in individuals' communication behaviour and are much less subject to substitution than other mail segments. In addition, consumers still rely on physical mail for sending important documents, such as those which need to be signed. Consumers therefore have a choice between different communication channels according to their preferences and communication needs.

Figure 7: Development of different UK mail segments (CAGR: 2005-2012)



Source: PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 18.

According to PwC, the volume decline of direct mail, publications and social mail is already flattening. However, transaction mail volumes will decline steadily as other channels become increasingly popular.²⁵ This will have an impact on the future composition of the UK mail bag.

4.2 Technology in letter operations

In mail, optimisation through technology has to a large extent served to counter declining volumes and revenues. In order to ensure profitability, improving operational efficiency through restructuring and automation has been a necessary measure already undertaken by many European postal operators.²⁶ Apart from sorting and linehaul operations, technology plays a significant role in the last mile, the most costly step of the delivery process.²⁷

Automation of sorting

In light of changing demand for postal services and therefore falling mail volumes, many postal operators across Europe need to improve their operational efficiency. Volume declines and competition put margins under pressure, urging private or privatised operators to react in order to cope with expectations from investors. In order to improve operational efficiency and automate sorting of large quantities of mail items, many European postal operators have already centralised their sorting process: where they previously had a larger number of facilities, postal operators have moved towards an infrastructure with significantly less but larger facilities, where not humans but state-of-the-art sorting machines do most of the sorting work.

²⁵ See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 20.

²⁶ WIK (2013), Review of Postal Operator Efficiency. Study for Ofcom. Bad Honnef, 19 November 2013.

²⁷ WIK (2013), Main Developments in the Postal Sector (2010-2013). Study for the European Commission, Directorate General for Internal Market and Services, August 2013.

The largest challenges for sorting machines are that they have to accurately identify the destination address. Postcode granularity facilitates sorting to street level but implementation of more granular postcodes goes along with substantial investments and regulatory issues as the introduction of the new Irish postcode system in 2014 shows. Many other postal operators manage to walk sequence letters without individual postcodes for addresses. Sorting machines have to be able to handle not only regularly shaped letters with fixed sizes but also flats, magazines and catalogues (sometimes wrapped in plastic), as well as small parcels.

Today's sorting technology for mail includes advanced optical character recognition (OCR). This allows sorting machines to read machine as well as hand writing in order to understand addresses. For instance, the sorting technology currently used by Deutsche Post, manufactured by Siemens, can read 90 per cent of hand-written addresses.²⁸

Irregularly shaped mail presents a major difficulty for sorting technology. And as traditional letter volumes are expected to decline and the share of direct mail including catalogues as well as small parcels is forecast to increase, the share of items which are more challenging to sort will increase as well. Therefore, postal operators are upgrading their sorting equipment to be able to handle all these different items. But still, not all mail can be sorted automatically and all postal operators still have to resort to manual sorting to a certain degree. For example, Royal Mail is sorting letters and bulk mail automatically in mail centres to a certain degree while the presorted mail is sorted to the round of the postman or postwoman in the local delivery office.

Apart from sorting mail items for delivery regions or tours, modern sorters can also already sort the objects in the order in which they will later be delivered. This is called sequence sorting and it allows postal operators to be even more efficient by minimising sorting by humans and making the preparation of their delivery rounds considerably easier and faster for postmen and postwomen.

Last mile of letter delivery

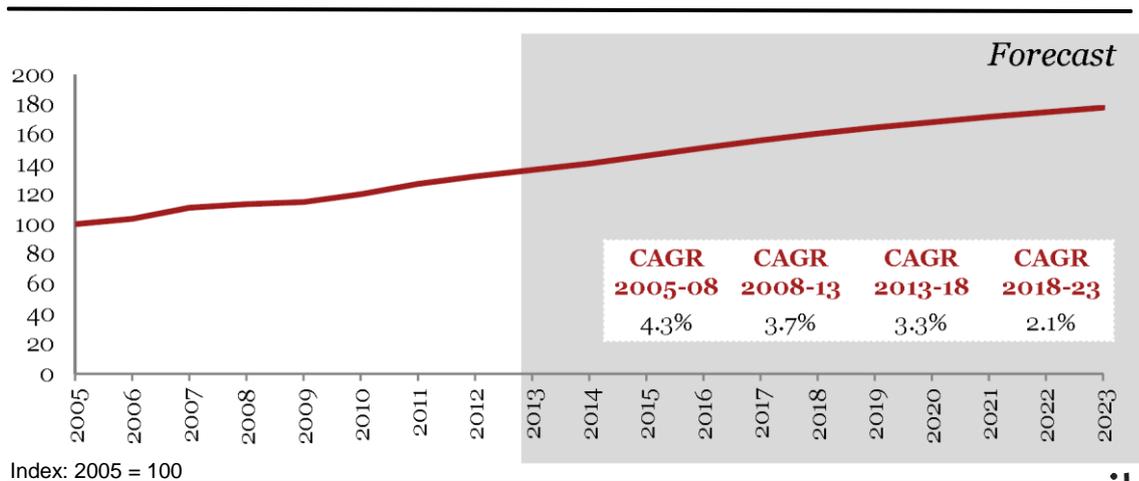
Apart from sequencing, the last mile for letter deliveries is relatively unaffected by technological modernisation compared to parcel deliveries. But technology has come into letter deliveries in the form of PDAs, which allow postmen to digitally capture the recipient's signature for signed letters and parcels, among other features. Although found to a lesser extent than in parcel delivery, route optimisation software plays a role in reducing the number of tours. Eco-friendly delivery vehicles are increasingly important as postal operators look for ways to reduce emissions.

²⁸ Press release Siemens Postal, Parcel & Airport Logistics, July 17 2015.

4.3 Demand for parcels

In recent years, the number of parcels sent in the UK has grown substantially, driven by changing consumer needs and preferences and the increase in e-commerce. According to PwC, UK parcel volumes rose on average by around 4 per cent p.a. between 2005 and 2013.²⁹

Figure 8: Development of UK parcel volumes, historical and projected (2005-2023, indexed)



Index: 2005 = 100

Source: PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 10.

Parcel volumes have benefitted from growth in online shopping. E-commerce leads to a structural shift in the UK parcel market:

1. consumers are increasingly buying eg clothing, footwear, health and beauty products and electrical goods online, thus increasing rapidly the number of parcels;
2. partial digital substitution of music, books, computer games and films that are significantly reducing the number of small parcels.³⁰

The delivery of parcels in the UK can be categorised into the following three segments:³¹

- B2C (business-to-consumer): items sent by businesses to consumers and items returned to businesses by consumers;

²⁹ See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 7.

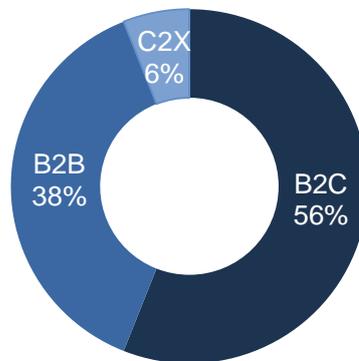
³⁰ See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 48, and Royal Mail (2015), Response to Ofcom’s July 2015 Discussion paper: Review of the regulation of Royal Mail, Appendix: Parcels market developments, p. 1.

³¹ See Postal & Logistics Consulting Worldwide (2015), Review of the impact of competition in the postal market on consumers, p. 23.

- B2B (business-to-business): items sent between different businesses; and
- C2X (consumer-to-consumer/business): items sent by consumers to other consumers or to businesses. It often includes items from eBay traders and micro-businesses that do not have enough volume to qualify for a business account.

These parcel segments can overlap; therefore the definition cannot be exact. For example, some people run businesses from their homes, while some employers allow their staff to receive personal parcels at their workplace.

Figure 9: The UK parcel segments (2012)

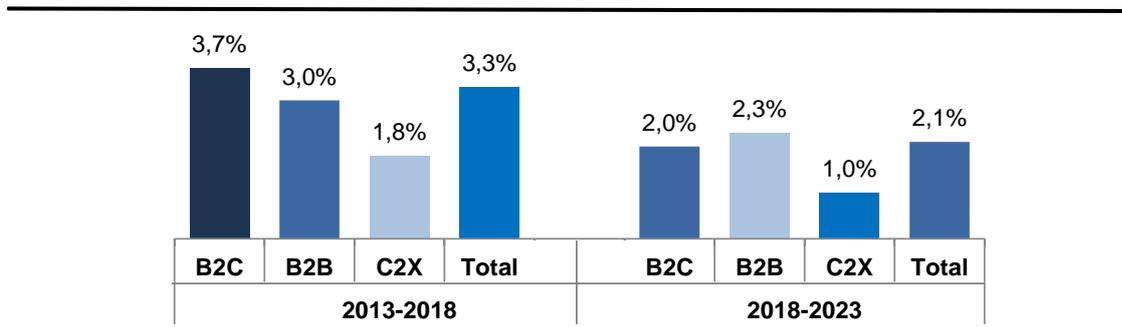


Source: Royal Mail (2013), Prospectus, p. 52.

The three parcel segments behave in different ways. While the growth of B2C parcel volumes in the UK is mainly driven by the trend in online shopping, the B2B segment is less exposed to the risks of digital substitution but follows general economic growth in the UK, generally measured against and compared with growth in GDP.³² The growth of the C2X segment is mainly driven by online trade (especially items sent by small eBay traders).

³² See Postal & Logistics Consulting Worldwide (2015), Review of the impact of competition in the postal market on consumers, p. 26.

Figure 10: Projected volume growth by UK parcel segment (2013-23)



Source: PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 47.

For the near future, PwC expects the overall UK parcel volumes to continue to increase – albeit more slowly than we have seen historically – by 3.3 per cent p.a. between 2013-18. Growth in the total market is driven mainly by B2C parcel volumes. The strong growth in the B2C segment is expected to continue due to sustained high growth rates in e-commerce.

Market experts predict a slowdown in the rate of growth of the total parcel market in the later years (only 2.1 per cent per annum between 2018-23) due to continued partial digital substitution.³³ In particular, fulfilment of music and DVDs, video games and books will remain under pressure until 2023 due to intensifying digital substitution. In comparison, Europe’s largest parcel market, Germany, has seen broadly similar trends in recent years, with strong B2C growth but low B2B growth.

Case study 3: Parcel volume development in Germany

- **Market size:** 2.8 bn parcel items and 16.6 bn € in 2014
- **Main parcel operators (market share >1%):** Deutsche Post DHL, DPD, FedEx, GLS, Hermes, TNT Express, trans-o-flex and UPS
- **Development of the German parcel market:**
 - Volumes: ~65% since 2000 (3.6% p.a.)
 - Revenues: more than 66% since 2000 (3.7% p.a.)
- **The German parcel segments:**
 - B2C segment increased its share (45% in 2009) significantly mainly due to E-Commerce
 - B2B volumes increased in line with general economic growth, but lag behind B2C (B2B: 47% in 2009)
 - C2X volumes increased, but the share remained quite stable
- **Future expectations:** Total volume growth of 4% - 4.5% in 2015

Source: BIEK (2015), KEP-Studie 2015 – Analyse des Marktes in Deutschland, p. 8, 16, and 18; and WIK (2014), Postmarkterhebung 2014, p. 13.

³³ See PwC Strategy & Economics (2013), The outlook for UK mail volumes to 2023, p. 7, 10 and 47.

4.4 Technology in parcel operations

In consumer parcel delivery, developments are more dynamic than in letters as the market is very competitive and growing fast, driven by e-commerce. Operational efficiency plays a large role when it comes to the use of technology but demand for new and improved services is also a key driver for parcel operators to modernise and upgrade their technology including IT.

Automation of sorting

As with letter sorting, a prerequisite for efficient automation is the centralisation of sorting processes by organising the infrastructure in such a way that high volumes of parcels are sorted in a small number of facilities. The linehaul routes between centralised sorting centres and distribution centres are usually optimised through special software which ensures that the right vehicle types and numbers are used to transport parcels to their destinations.

Typically, letters and parcels are sorted separately for reasons of efficiency. Besides there are so-called multi-sorters available which can sort all mail items from letters and flats to small and large parcels. Multi-sorters can be interesting for postal operators who lack sufficient volume to justify separate systems. However, for large volumes, consolidated through a centralised sorting infrastructure, specialised parcel sorting machines are more efficient.

Parcel sorting and conveyor machines can determine the weight and the dimensions of parcels – up to a certain maximum - and can scan parcel labels in order to determine the destination of the respective parcel. In general, sorting and conveyor technology has not changed drastically in recent years but there have been noticeable improvements in scanning and IT.³⁴

As in letter sorting, the automation of parcel sorting has its limits as irregularly shaped parcels or parcels which are too large and cannot fit into sorting systems have to be processed either manually or via specialised equipment. Furthermore, humans are involved in feeding the parcels into the sorting system and loading sorted parcels back into delivery vans and also play a significant role in video coding, which is needed when OCR fails to understand addresses on parcel labels, for instance.

Last Mile of parcel delivery

On the last mile, carriers have invested mostly in their IT, which is a prerequisite for flexible route optimisation and recipient-centred services including interaction. This includes software as well as mobile devices or PDAs for the delivery staff.

³⁴ WIK (2013), Review of Postal Operator Efficiency. Study for Ofcom. Bad Honnef, 19 November 2013.

Vehicles with alternative propulsion are becoming more common as carriers try to improve their ecological footprint – also as a result of consumer demand. Parcel lockers are increasingly used for deliveries as they reduce last mile costs for carriers and can increase convenience for consumers.

5 Drivers for innovation in postal services

The use of postal networks has changed in line with altering consumer and business needs. These changes are to a great extent triggered by consumers' access to and use of online services (as a precondition for participation in e-commerce) and also by new trends in e-commerce supply and new shipment solutions.

5.1 Consumer access to and use of online services

The growth of ICT (information and communications technology) has added a different dimension to the postal sector. The information technology available today is being leveraged in customer acquisitions, driving automation and process efficiency as well as delivering new comfort to customers.

New communication applications such as over-the-top services (ie voice/video over internet protocol, instant messaging, etc.) and affordable mobile devices like smartphones and tablets are substituting need and preference for letters across some consumer groups. While the traditional local business continues to play an important role in the UK, the use of postal services through online services via the internet is gaining increasing momentum. According to the Office for National Statistics, the number of internet non-users in UK has been constantly falling over the last five years.³⁵ The large majority of the population have increasing access to internet-based services and applications but on the downside, about one out of ten consumers still have no internet access. This is one of the lowest shares of internet non-users in Europe.³⁶

While the number of UK consumers who use the internet is increasing, the UK Government identifies that in order for citizens to benefit from what the internet can offer, they need to be digitally included. This requires three factors to be met³⁷:

- Digital skills - being able to use computers and the internet.
- Connectivity - access to the internet. People need the right infrastructure but that is only the start.
- Accessibility - services should be designed to meet all users' needs, including those dependent on assistive technology to access digital services.

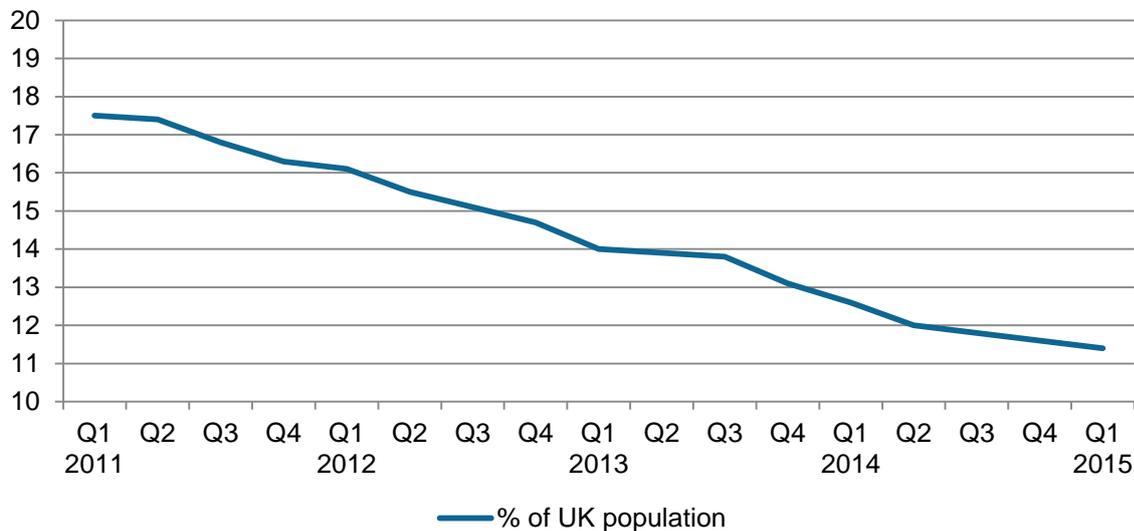
³⁵ Office for National Statistics (2015): Internet Users 2015, p. 3.

³⁶ See Eurostat data for 2014, Individuals who have never used the internet.

³⁷ UK Government Digital Inclusion Strategy (2014)

<https://www.gov.uk/government/publications/government-digital-inclusion-strategy/government-digital-inclusion-strategy>

Figure 11: Internet non-users in the UK



Source: Office for National Statistics, Internet user 2015, p. 3.

Modern broadband internet access can be provided by so-called next generation access (NGA) technologies. There are fixed network technologies such as DSL (ADSL, SDSL), cable and hybrid fibre (DOCSIS, FTTC, G.Fast) and fibre optic (FTTH, FTTP, FTTB). Moreover, there are fixed wireless access technologies (WiFi, WiMAX) as well as mobile access networks (3G, 4G, 5G) and satellite technology. Existing differences between these technologies as regards reliability, coverage, speed and take-up are a matter of time as these internet access technologies continue to evolve, leading the way to the digital society.

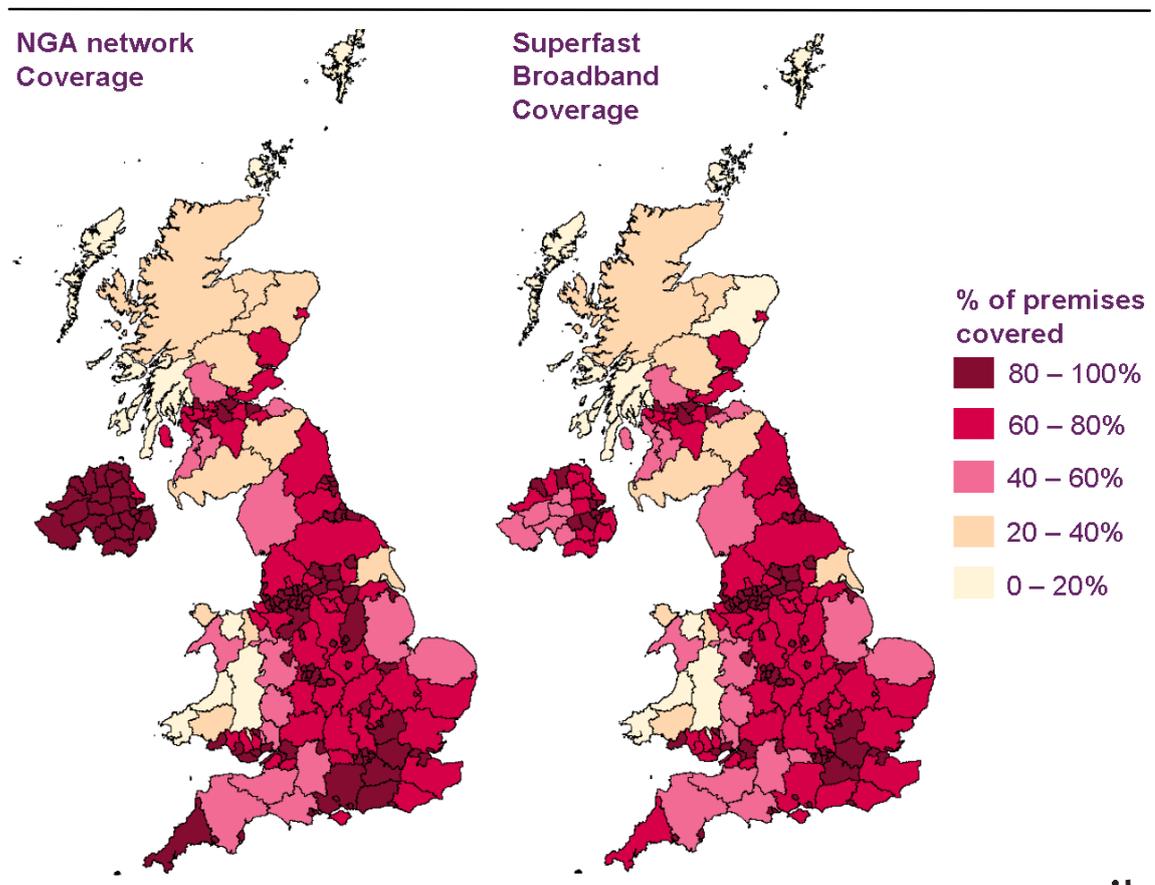
The map below clearly indicates a good coverage of modern broadband technology in the more densely populated areas of the UK broadband coverage is especially low in Scotland (islands, Argyll and Bute and Aberdeenshire) and Conwy, Denbighshire, Powys, Carmarthenshire, Ceredigion, and Pembrokeshire in Wales as well as in parts in the East of England. While the regions with a high percentage of premises covered correspond to the urban areas predominantly in the southern half of the UK, the rural areas in the northern regions indicate the opposite. Broadband Delivery UK (BDUK)³⁸ is investing over £1 billion improving broadband and mobile infrastructure to provide - amongst others - basic broadband (2Mbps) for the UK population of 63.7 million³⁹ by 2016 and superfast broadband to 95 per cent of premises by 2017.⁴⁰

³⁸ <https://www.gov.uk/guidance/broadband-delivery-uk#history>

³⁹ <http://ecommercenews.eu/ecommerce-per-country/ecommerce-the-united-kingdom/>

⁴⁰ SQW Analysis (2014): UK Broadband Impact Study 2014.

Figure 12: NGA networks and superfast broadband premises coverage



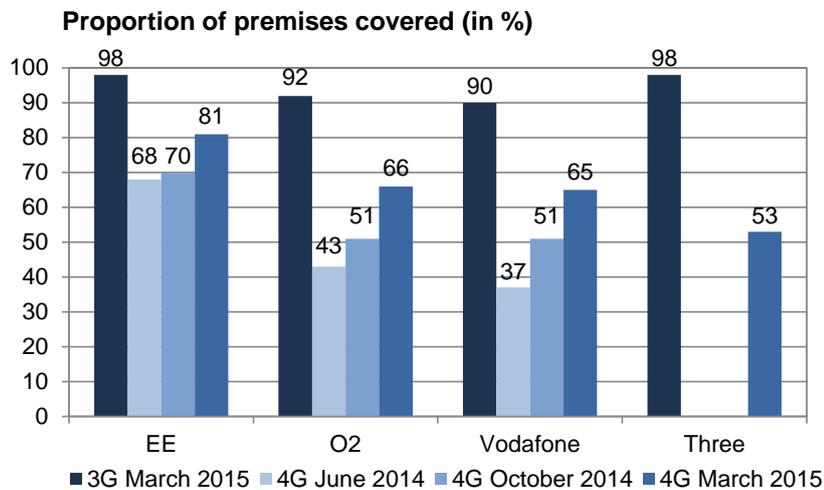
Notes: Superfast broadband is defined as a speed level above 30 Mbit/s.⁴¹
Source: Ofcom, Infrastructure Report 2014, p. 22.

A key enabler for a number of innovative technological applications is mobile internet. Mobile internet access has improved considerably with faster connections and better coverage. In 2015, 3G was available in 98 per cent of the UK and 4G networks are being continuously expanded.⁴² Both free and paid wifi is also becoming more and more standard in UK cities, which also has a positive effect on take up of mobile internet usage.

⁴¹ Ofcom (2014): Infrastructure Report 2014, p. 20.

⁴² 4G provides data more quickly and on broader bandwidths than previous standards and allows a better quality of surfing the web, video streaming, downloads or app updates.

Figure 13: Estimated 3G and 4G premises coverage by operator

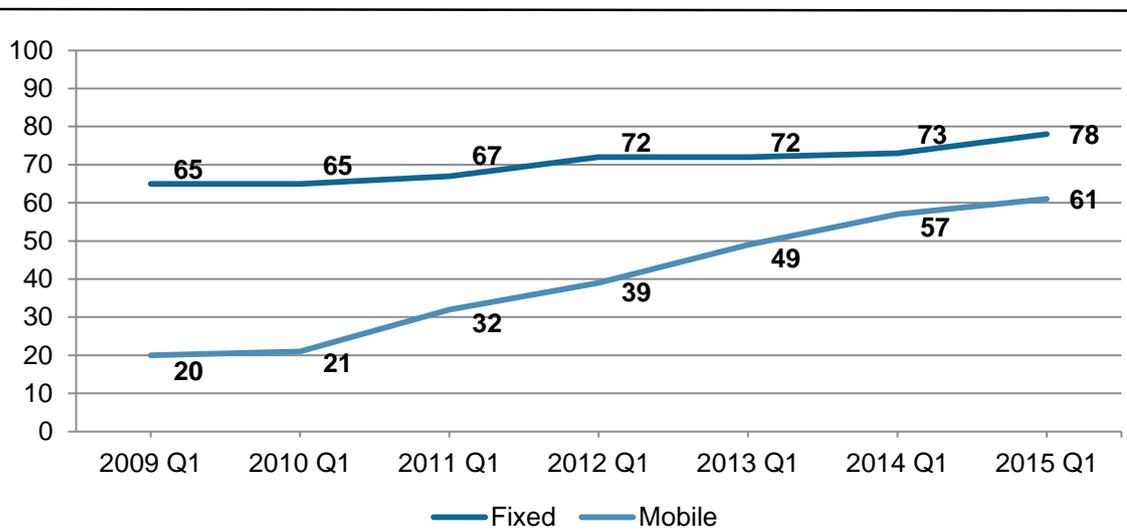


Source: Ofcom, Infrastructure Report 2014.

Internet users most frequently access the internet over fixed access networks (as illustrated by Figure 14). There is a strong increase in the mobile take-up rate of households from 21 per cent in 2010 up to 61 per cent in 2015.⁴³ This trend is mainly associated with devices such as smartphones and tablets becoming more popular. However, mobile access in residences and apartments is realised by wifi based on fixed line connections. This is mainly due to higher tariff structures for mobile access. Therefore, it seems unlikely that mobile access will overtake fixed line access in the near future.

⁴³ Ofcom (2015): Communications Market Report 2015, p. 28.

Figure 14: UK take-up of fixed and mobile by proportion of households in %



Source: Ofcom, Technology Tracker 2015, Q1. Base: All adults aged 16+ with n = 3756.

Internet usage quality of experience largely depends on speed. Since 2009, the current universal service broadband speed for every household is at least 2 Mbit/s. However, this may now be insufficient as 2Mbit/s is the minimum bandwidth for watching a video via an internet device. In their Infrastructure report 2014 Ofcom points out that household bandwidth requirements increase both by the number of users and by their multi-tasking behaviour. Typical data use at peak-times may well add up to 12.5 Mbit/s for a four person household and the need for more bandwidth might well rise in future when more and more internet-enabled devices are becoming a part of the average household.

As Table 1 shows, average download speeds have increased for the entire UK from 12.7 Mbit/s in 2012 to 23.4 Mbit/s in 2014.⁴⁴ Thus, access to and use of online services is more and more comfortable allowing for all kind of services, contents and applications provided over the internet. However, this must not hide the fact that basic broadband (2Mbps) for the UK population of 63.7 million will be available by 2016 at the earliest and superfast broadband coverage with a speed level above 30 Mbit/s is especially low in rural and remote areas as we have shown before (see Figure 12).

⁴⁴ Ofcom (2014): Infrastructure Report 2014, p. 38.

Table 1: UK Average broadband speeds in Mbit/s

	2012	2013	2014
UK	12.7	17.6	23.4
England	12.9	18.0	23.9
Scotland	12.1	15.8	21.1
Wales	14.4	20.4	24.8

Source: Ofcom, Infrastructure Report 2014, p. 38.

When it comes to internet usage patterns Table 2 shows that there are increasing figures in fixed and mobile take-up rates, monthly active users and advertising expenditures as well as disproportionately increasing advertising revenues. Since 2013, the time spent with web browsing via notebook or desktop has shown a decreasing trend because of a constant increase in smartphone and tablet usage.

Table 2: UK internet usage patterns

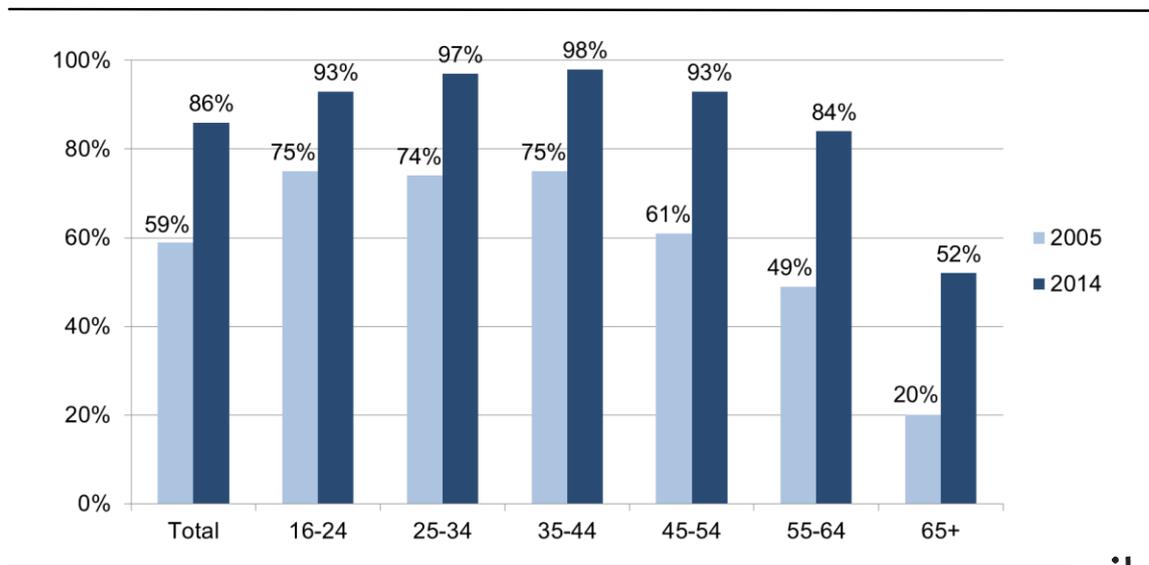
	2011	2012	2013	2014
Internet fixed take-up in %	77	79	80	82
Internet mobile take-up in %	32	39	49	57
Monthly active users via notebook / PC in Mio.	42.2	43.6	44.6	45.1
Time spent web browsing via notebook / PC in hours	31.5	34.7	34.2	29.8
Digital advertising expenditure in Bio. £	4.8	5.4	6.3	7.2
Mobile advertising revenue in Mio. £	203	529	1021	1625

Source: Ofcom, Communications Market Report 2015, p. 327.

The key insight from the demographic structure in the UK is that internet use is increasing across all age groups: in the past ten years, the share of adults who go online has increased considerably. The most noticeable development can be seen in the age group of those aged above 65. While only 20 per cent of adults in this group used the internet in 2005, the figure more than doubled to 52 per cent of those 65 and older in 2014.⁴⁵

⁴⁵ See Ofcom (2015), Adults' media use and attitudes, Report 2015, p. 27.

Figure 15: Internet use by age in the UK (2005, 2014)



Source: Ofcom (2015), Adults' media use and attitudes, Report 2015, p. 27.

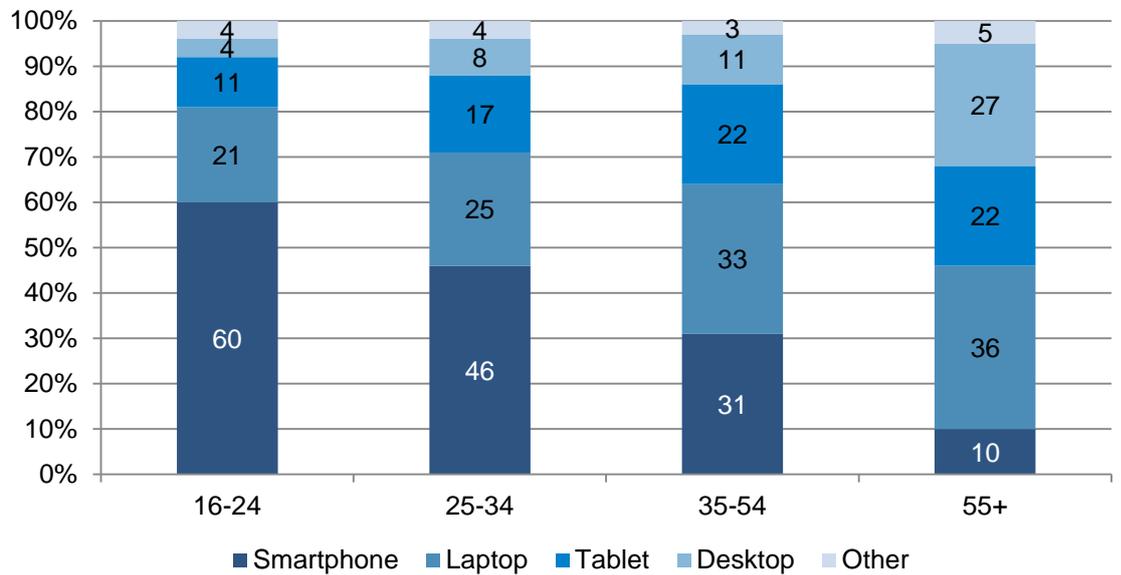
But still, the general pattern of use by age has remained very consistent over the years. Younger people use the internet the most, and the older age groups use the internet the least. While younger age groups have a similar pattern regarding preferred devices for internet access, older consumers preferences differ from that (see Figure 15). The geographic location of consumers also plays a role: in rural areas, the share of non-users is higher than in urban areas.⁴⁶

For younger people the smartphone is in the first place, followed by laptops, tablets and desktops in last place (see Figure 16).⁴⁷ For older consumers the laptop remains the top device for accessing the internet, but as tablets are easy to use and comparatively cheaper compared to laptops they might become the preferred overall device to access the internet in all age groups.

⁴⁶ See ONS (2015), Internet users, 22 May 2015, p. 8.

⁴⁷ Ofcom (2015): Communications Market Report 2015, p. 347.

Figure 16: UK internet users' most important device for internet access by age group



Source: Ofcom, Communications Market Report 2015, p. 347. Base: n=3095 UK.

Hours of internet use has more than doubled in UK from 9.9 hours online per week in 2005 up to 20.5 hours online per week in 2014⁴⁸. Out of home use is more commonplace today and other activities such as e-commerce continue to grow as well as usage of internet applications by mobile phone.

Table 3: Usage of internet applications – Online on any device

Application	E-Mail	Messaging	Banking	E-commerce	Video	News	Games
% of user	79	58	42	26	39	42	22

Source: Ofcom, Adults Media Use and Attitude Report 2015, p.25.

Table 4: Usage of internet applications – Mobile phone

Application	E-Mail	Messaging	Photos	Calls	Media	Games
% of user	52	90	54	94	53	29

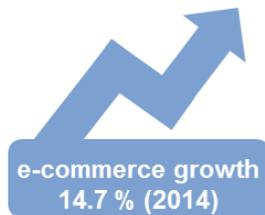
Source: Ofcom, Adults Media Use and Attitude Report 2015, p.25.

⁴⁸ Ofcom (2015): Adults Media Use and Attitude Report 2015, p.25.

5.2 E-Commerce trends

Overview of e-commerce in the UK

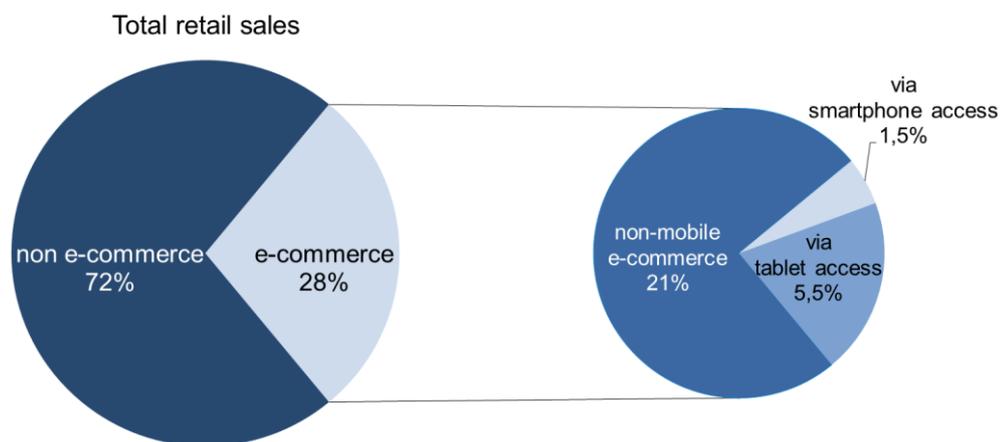
The UK is the largest e-commerce market in Europe, with B2C revenues of £90.7 billion in 2013.⁴⁹ Germany and France are lagging far behind, with roughly half of UK e-commerce revenues (£50.5bn in Germany and £40.3bn in France).⁵⁰ The UK market has double-digit growth rates, and e-commerce associations as well as sector-related experts expect this to continue. In 2015 (as per September), the UK market has grown 18.9 per cent year-on-year (according to IMRG).



Experts define the UK as a “home ordering country” and assume that the traditionally high proportion of mail order selling has paved the way for a quicker adoption of e-commerce compared to other countries. In addition, internet use, the precondition for e-commerce, rose comparatively quickly in English-speaking countries like the US and UK.

UK e-commerce sales amount to 28 per cent of total retail sales (see Figure 17). As UK consumers increasingly use smartphones and tablets to access the Internet, mobile commerce has become increasingly popular during the last few years. It has soared from 1 per cent of e-commerce in 2010 to 25.7 per cent in 2013.

Figure 17: Total retail sales and share of e-commerce in UK



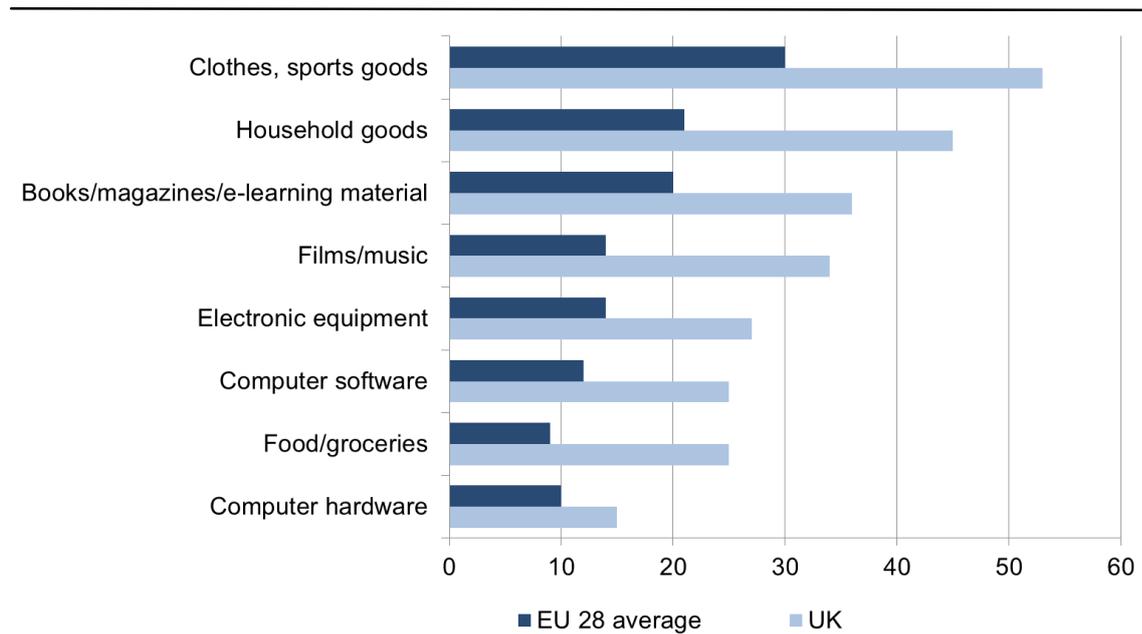
Source: Based on data from IMRG, UK passport 2014.

⁴⁹ IMRG (2014), UK Passport 2014, Cross-Border Trading Report.

⁵⁰ E-commerce Europe (2015), European B2C E-commerce Report 2015.

Internet purchasing by UK consumers has increased strongly since 2008 and is now higher than in any other EU country.⁵¹ UK consumers shop online across all product groups and do this to a larger extent than shoppers on average in the EU (Figure 18). For almost all categories, consumers in the UK buy more online than in all other EU countries.⁵² More than half of British consumers buy fashion online, followed closely by household goods (45 per cent of individuals).

Figure 18: UK and EU compared: popular product groups in e-commerce (percentage of individuals bought... in last 12 months)



Source: Based on Eurostat data, 2014.

Trends in last mile delivery

As e-commerce continues to grow, parcel carriers and retailers are further developing and refining delivery options for B2C parcels. Home delivery is the most preferred⁵³ and convenient option for consumers but also the one which causes the most delivery frictions if receivers are not at home during the day. Alternatives to home delivery therefore aim to reduce failed delivery attempts and customer frustration – as well as costs for parcel carriers.

⁵¹ Eurostat data for 2014, online purchase in the last 12 months.

⁵² Based on Eurostat data for 2014, online purchases made by individuals during the last 12 months.

⁵³ According to IMRG, the majority of consumers prefers home delivery. See IMRG (2015), UK Click & Collect Review 2015 Extract.

As a general trend, the parcel delivery chain has become receiver-centralised.⁵⁴ Receivers are not only better informed about the status of their delivery via tracking, they also have the option to change the delivery process by redirecting a parcel to a different delivery point, or postpone delivery if they are not at home. As a consequence, carriers now have to turn to a more individual approach instead of a standardised supply chain for delivery of each and every parcel. Behind the scenes, this solution requires the carriers to re-think their processes and substantially invest in IT.

From the receiver's point of view, information about delivery and interaction with the carrier is crucial for a convenient delivery. Receivers increasingly expect to be informed about eg the expected delivery day, the expected delivery time slot, delivery delay, or a failed delivery. IMRG's study *UK Consumer Home Delivery Review* showed that the share of consumers wanting to receive updates on delivery status has increased across all parts of the delivery process.⁵⁵ In particular, the younger generation expects a more tailored service, and is even prepared to pay more for goods if delivery options are more convenient.⁵⁶

Click and collect and other pick-up solutions

Among the numerous alternatives to home delivery, click and collect is the most popular solution in the UK.⁵⁷ It provides an opportunity for consumers who are not at home during working hours when parcels will be delivered to pick up their parcel personally. However, to create a convenient click and collect solution for customers it is essential to provide a dense network of click and collect delivery points. Receivers will accept travelling to a pick up and drop off point if the store is on their regular route, or if they can associate the trip with other activities like shopping, going to the gym, etc. Planet Retail expects '*that the number of UK shoppers using click and collect is poised to more than double by 2017*⁵⁸. This may even cause conflicts between customers wanting to collect their parcel and normal shoppers. Shoppers might be discouraged by long queues of parcel customers and leave the shop without buying. Experts assume that click and collect solutions are well-established but might not be pushed by high street retailers as much as it was recently. They have found the additional amount spent by consumers visiting the retail locations remains below expectations.

⁵⁴ See OIG (2015), Rethinking the parcel delivery value chain. A recap of the international round table.

⁵⁵ IMRG (2015), UK Consumer Home Delivery Review 2015, Executive Extract.

⁵⁶ See Metapack (2015), Delivering Consumer Choice: 2015 State of eCommerce Delivery.

⁵⁷ See IMRG (2015), UK Click & Collect Review 2015 Extract.

⁵⁸ Planet Retail (2014), <http://www1.planetretail.net/news-and-events/press-release/76-online-shoppers-use-click-collect-2017>.



Photo: InPost

Parcel lockers are not very popular compared to other countries. In Germany, for example, where DHL has rolled out 2,750 parcel lockers across the country, the solution is widely known and accepted.⁵⁹ This success of DHL parcel lockers though has evolved slowly. DHL started its lockers in 2002 in only a few pilot cities in Germany and gradually rolled out the service. Postal customers value the 24/7 accessibility of lockers and the fast picking-up of their parcels without the need to queue in a store.

In the UK, parcel lockers are run by InPost (1,100 lockers) and Amazon (about 300 locker locations). It is a relatively new solution and not yet fully adopted by UK consumers. However, as parcel lockers offer 24/7 accessibility and need less time to operate than using a click and collect solution, experts interviewed for this study expect that the service will become more popular.

Apart from retailers' own stores, other pick-up solutions are offered by third parties like parcel operators or dedicated delivery solutions provider. The Post Office provides the largest network named 'Local Collect' with more than 10,500 pick-up points, although in most cases with restricted by post office hours. 'Local Collect' is a pick-up and drop-off (PUDO) solution run by Royal Mail who is bound by an exclusive agreement with Post Office Ltd. to use their branches as retail locations. Other networks of parcel operators consist of fewer stores but are accessible also in the evenings or at weekends.

Table 5: Examples of PUDO networks in UK

Company	Number of pick-up points	Located in
CollectPlus	5,800	Convenience stores, supermarkets, petrol stations, newsagents
Doddle	44	Train stations
Hermes	4,500	Supermarkets, petrol stations, newsagents
PostOffice	11,500	The Post Office ⁶⁰
Amazon	13,000	Local shops

Sources: Company websites.

⁵⁹ See Metapack (2015), Delivering Consumer Choice: 2015 State of eCommerce Delivery.

⁶⁰ This includes outlets for Royal Mail's "Local Collect" offered by 10,500 Post Offices. 4,200 branches offer extended opening hours in the evening and on weekends.

Case study 4: CollectPlus



CollectPlus is jointly owned by parcel carrier Yodel and retail payment provider Pay Point. It has a network of more than 5,800 pick-up-and-drop-off stores throughout the UK (see figure on the left), mostly located in urban areas. At CollectPlus stores, consumers can receive their online orders, send parcels, or return unwanted items. Delivery to CollectPlus stores is available on more than 260 e-retailer websites. In 2015, Amazon ended its partnership with CollectPlus (no pick-ups but drop-offs of returns remain possible).

Source: CollectPlus website.

Same-day delivery

More and more online retailers now offer same-day delivery options, although in some cases restricted to certain products or areas. As regards underlying logistics, same-day services can only be provided if the items ordered are relatively near to the receiver. That is why same-day services are mostly available in densely populated areas like London or Birmingham.⁶¹ Amazon, having launched its Prime Same Day service in November 2015, offers the service for a restricted selection of its product range.⁶²

Although the idea of a same-day service sounds appealing, experts interviewed for this study believe that same-day will remain a niche service. The reasons given are twofold: on the one hand, logistics are complicated, while on the other hand, consumers have different preferences for delivery and same-day delivery might not even be the most convenient solution – eg if a consumer knows that he will spend the evening out.

⁶¹ Amazon's same-day services is available to customers in London and parts of Hertfordshire and Berkshire. House of Fraser offers the services in London and Birmingham.

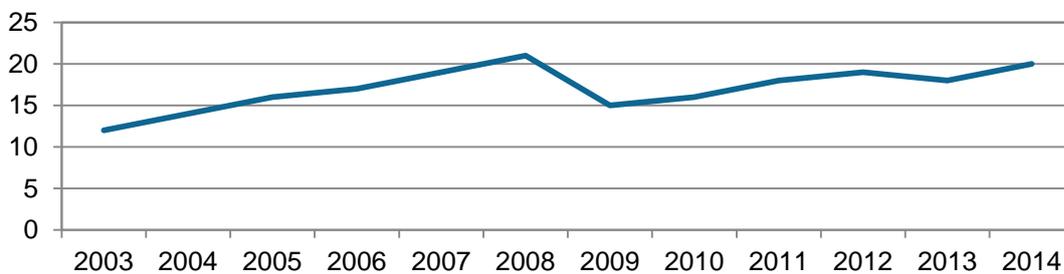
⁶² Available for about one million items. See Amazon website, https://www.amazon.co.uk/s/ref=nb_sb_noss_2?url=search-alias%3Daps&field-keywords=prime+same+day.

5.3 Growing demand for e-commerce

The business models in e-commerce, major e-retailers, online marketplaces, search engines and price comparison tools are all connected to the growing consumer demand for e-commerce.

E-commerce has become an important source of revenue for businesses in the UK, accounting for around 20 per cent of UK enterprises' turnover today (see Figure 19). Compared with other European countries, e-commerce in the UK is already the most advanced in sales terms.⁶³

Figure 19: Share of enterprises' turnover on e-commerce (2003-2014, in %)



Source: Eurostat (2014), Share of enterprises' turnover on e-commerce, see: <http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&plugin=1&pcode=tin00110&language=en>.

Across Europe, e-commerce is driving the growth in consumer spending. While in-store sales are predicted to drop, online sales are expected to increase significantly, driving total retail revenues. The weighted average order value for parcel deliveries in 2014 and for all destinations stands at £39.76 which is a slight decrease compared to previous years when the average order value was well above £40.⁶⁴

Major e-retailers in the UK

Most e-retailers originate from the traditional retail sector. They now operate an online shop alongside their local retail store. Many companies have already developed a multi-channel strategy. Their customers can switch between their shopping channels (local, online, mobile) offered by these e-retailers as they wish (multi-channel operators).⁶⁵ There are also some of pure e-retailers that operate only operate using digital platforms.

⁶³ Office for National Statistics (2015), <http://www.ons.gov.uk/ons/rel/rdit2/e-commerce-and-internet-use/eu-comparisons/sty-e-commerce-in-the-uk-and-the-european-union.html>

⁶⁴ IMRG MetaPack (2015), IMRG MetaPack UK Delivery Index Report, p. 17, see: <http://www.metapack.com/wp-content/uploads/2015/02/MetaPack-January-2015-Delivery-Index-December-2014.pdf>. See also IMRG MetaPack (2012), IMRG MetaPack UK Delivery Index Report July 2012, p. 10 for comparison. In June 2012, the average order value was £46.85.

⁶⁵ However, some e-retailers apply high surcharges for rural and remote consumers or do not deliver to remote areas at all. Switching between channels is thus not possible for these consumers.

According to IMRG, the biggest players in the UK’s online retail market are Amazon, Argos, Apple, and Tesco. The ranking of e-retailers is based on visitors of online shops tracked.⁶⁶ Table 6 shows the top 10 e-retailers in the UK ranked by using desktops / laptops, smartphones and tablets.

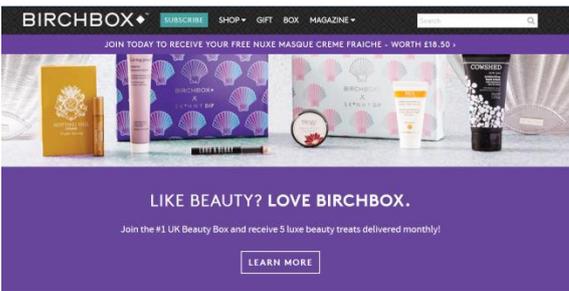
Table 6: The top 10 e-retailers in the UK

ranked by...	Desktops and Laptops	Smartphone	Tablet
1	Amazon UK	Amazon UK	Amazon UK
2	Argos	Apple	Apple
3	Apple	Tesco	Tesco
4	Tesco	Argos	Argos
5	AVG	Asda	Asda
6	Netflix	Boots	Netflix
7	Marks & Spencer	thetrainline.com	Disneyland Paris
8	Asda	Netflix	Boots
9	Currys	Very	Asos
10	Next	Ticketmaster	Marks & Spencer

Source: IMRG (2015), The top 50 online retailers in the UK February 2015, see: <http://www.imrg.org/the-top-50-online-retailers-in-the-uk-february-2015>.

In addition to pure online sellers, providers of subscription models have become widespread in recent years in the UK (see Case study 5).

Case study 5: Subscription commerce



Subscription boxes are available with every imaginable content, from vegan snacks to cosmetics, crafting kits, or jewellery.

Subscribers receive a parcel for a fixed price on a regular basis, mostly once per month.

Apart from the value of the parcel contents, the element of surprise seems to play an important role as the parcel contents vary each time.

Source: Birchbox website.

⁶⁶ IMRG (2015), The top 50 online retailers in the UK February 2015, see: <http://www.imrg.org/the-top-50-online-retailers-in-the-uk-february-2015>. The IMRG top 50 e-retailer ranking tracks visitors based on comScore’s MMX online audience measurement technology of those selling goods and services within the IMRG Capgemini Index Classification. Marketplaces, such as eBay and price comparison / aggregator websites are excluded.

Online marketplaces

Online marketplaces are a way for retailers to gather and attract greater numbers of potential customers. The marketplace operators provide the technical infrastructure and process the transactions. Within a framework of rules set by the platform provider, consumers are also able to act as traders under their own terms and conditions of sale and can order or return goods. 95 per cent of UK retailers now sell via online marketplaces.

Today, Amazon and eBay still dominate the world of online marketplaces: some 86 per cent of retailers sell on Amazon and 68 per cent on eBay.⁶⁷ Table 7 shows a selection of other online marketplaces that are active in the UK.

Table 7: Selection of online marketplaces active in the UK

Marketplace	Description
alibaba.com	<ul style="list-style-type: none"> the world's largest online business-to-business trading platform for small businesses based in Hangzhou, China, but online shops worldwide
ebid.net	<ul style="list-style-type: none"> online auction website for nearly everything (like eBay) based in London with online shops in 23 countries worldwide
eCrater.com	<ul style="list-style-type: none"> a free marketplace that offers customizable online stores to retailers based in California, with online shops in the UK and Australia
folksy.com	<ul style="list-style-type: none"> online marketplace that enables small retailers to offer hand crafted gifts and handmade or commercial supplies based in Sheffield, UK
fruugo.co.uk	<ul style="list-style-type: none"> worldwide marketplace bringing many retailers from many countries all together in one site (specialised on cross-border e-commerce) based in the UK, active in Europe,
iOffer.com/gb	<ul style="list-style-type: none"> offers fashion, accessories, beauty and health products but also books and electronics, household goods, toys and games headquarter in San Francisco, with online shops around the world
Pixmania.co.uk	<ul style="list-style-type: none"> Online shop specialized on consumer electronics, based in France In addition to the products offered directly by Pixmania, the shop also enables professional traders to offer their own products
Play.com / Rakuten	<ul style="list-style-type: none"> online marketplace that provide products and services for consumers and businesses, with a focus on e-commerce, finance, and digital content headquarter in Tokyo, but expanding worldwide and currently operates throughout Asia, Europe, the Americas and Oceania

Source: WIK Consult research.

Cross-border e-commerce

Cross-border purchasing is popular amongst UK consumers, with over 50 per cent confirming that they had previously ordered from non-UK web sites.⁶⁸ In the past six

⁶⁷ Internet Retailing (2014), 95% of UK retailers now sell via online marketplaces: study, Article from 15. August 2015, see: <http://internetretailing.net/2014/08/95-of-uk-retailers-now-sell-via-online-marketplaces/>

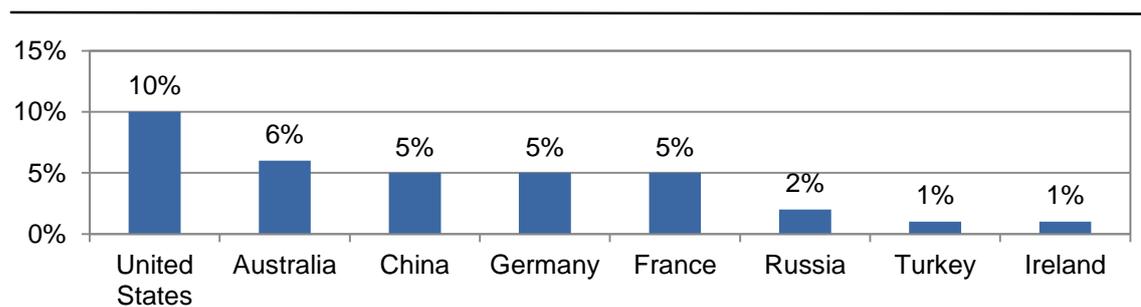
⁶⁸ IMRG (2014), UK Passport 2014: Cross-Border Trading Report, Your guide to international e-trading, p. 20.

months, 45 per cent of consumers have purchased goods online from overseas. Especially digital natives of the 18 to 26 range leading the field (62 per cent) and want to be able to buy products from anywhere in the world.⁶⁹

Price difference is only one key driver of cross-border e-commerce. The use of efficient search tools not only enable consumers to find the same goods cheaper worldwide but makes it also easy to search for specific or uniquely manufactured products. This means that even small dealers have a particular opportunity to benefit if they manage to present themselves online with specialised supplies. Large e-retailers and fulfilment providers with international scope, on the other hand, use warehouses in more than one country to gain efficiencies of scale and performance. To send and receive goods in time is enabled by the underlying IT infrastructure and guarantees well-organised enterprise resource planning also beyond national borders.⁷⁰

The following figure indicates the leading UK outbound cross-border e-commerce sales:

Figure 20: Share of UK outbound cross-border e-commerce sales (2013, in %)



Source: IMRG (2014), UK Passport 2014: Cross-Border Trading Report, Your guide to international e-trading, p. 20.

Over the last years there has also been an increased rate of expansion by UK-based online retailers in overseas countries and increased demand for products originating in the UK. Cross-border e-commerce is expected to continue to grow strongly, particularly with regard to exports to Europe and Asia.

Further, e-retailers need a shipping partner who will transport and deliver their parcels outside the UK. The main parcel operators used for the delivery of outgoing cross-border parcels in the UK are DHL, GLS, TNT Express and UPS.⁷¹

⁶⁹ Metapack (2015), Delivering Consumer Choice: 2015 State of eCommerce Delivery, p. 7.

⁷⁰ See for more information on cross-border e-commerce WIK-Consult (2014): Design and development of initiatives to support the growth of e-commerce via better functioning parcel delivery systems in Europe. Study for the European Commission DG Internal Market and Services. Bad Honnef, p. 25 ff.

⁷¹ Royal Mail plc (2013), Prospectus, p. 53.

6 Technological innovations: Technology push and demand pull in the postal sector

In this study the term ‘technological innovation’ is used with a wide scope to include not only basic technological devices and products, but also applications and combinations including software, such as cloud computing, big data or the Internet of Things (see Case study 6, Case study 7 and Case study 8).

With the above in mind, we follow the definition used by the OECD:⁷²

“Technological innovations comprise new products and processes and significant technological changes of products and processes. An innovation has been implemented if it has been introduced on the market (product innovation).”

‘Innovation’ is to be distinguished from mere technological improvement but this line can be blurry. ‘Technological innovation’ is used in a broad sense here but differentiating innovative basic technology and innovative applications in complex technology is important as what kind of devices are available and what ways of using and combining them are very different, although obviously applications depend on basic technology.

The postal sector has come to rely heavily on advanced technology in daily operations, in sorting as well as in delivery. Which strategy triggers technological change here might be described as some kind of interaction between a “demand pull” and “technology push” (see Figure 21). It can be argued that innovation in the postal sector originates from a variety of sources and that adoption follows a variety of patterns influenced by the consumer demand for better and faster services⁷³ and the postal operators’ demand for efficient operations in a competitive market environment, while the availability and cost of technology are key enablers.⁷⁴

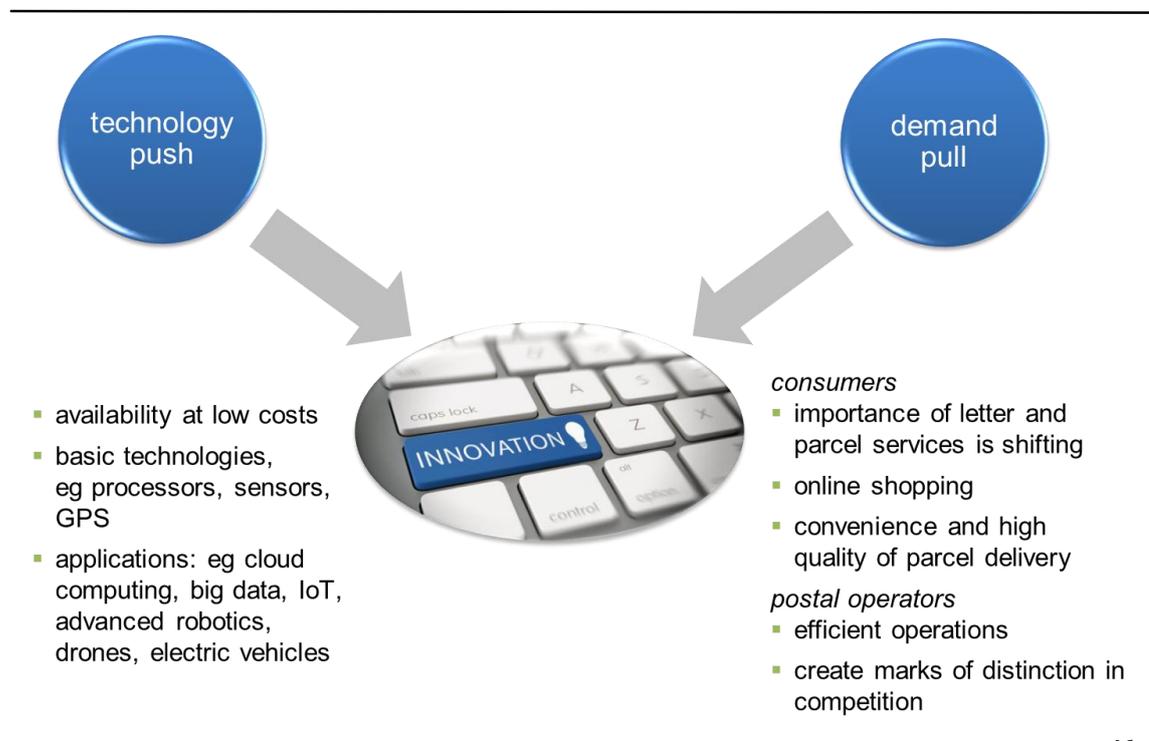
While a certain basic technology may have been available for a longer period of time, what can pave the way for a broad adoption of certain innovative applications is its price, as in the case of cheap IT and sensors. Without them, innovations like the Internet of Things would still be possible for postal operators, but very costly. This example is to illustrate that a successfully implemented technological innovation does not always require innovations in materials science or anything else basic but is sometimes an innovative application enabled by low materials costs. This, in turn, can be a result of more efficient production and higher demand, which lowers the price of the basic technology below a threshold so that it becomes economically viable to use it for a certain application (“technology push”).

⁷² OECD (ed.) (2015), Glossary of statistical terms. <https://stats.oecd.org/glossary/detail.asp?ID=2688>.

⁷³ International Post Corporation (ed.) (2105), Innovation in the postal industry: trends and insights. <https://www.ipc.be/en/newsroom/in-the-spotlight/innovation/innovation-trends>.

⁷⁴ Regulations and policies might also influence prospects for the adoption of innovations, for example environmental policies can have an effect on the use of electric vehicles.

Figure 21: Technology push and demand pull in the postal market



Source: WIK-Consult research.

Typically, technological innovations are not developed by the postal industry but come from or are driven by other industries which can invest higher sums in research and development – for instance the military, automotive or high-tech industries. These technologies then become available for other industries and applications. The cost of innovative technology determines whether it can actually be used in low-margin consumer deliveries. Whether or not technological innovation makes financial sense to implement depends on how big the effect of a certain technology is on operational efficiency. If service quality and speed are concerned, then the expected competitive advantage and, occasionally, consumers' willingness to pay extra should also be considered.

Connected to the issue of the price of new technology is market penetration of devices - such as is the case of smartphones a high market penetration is a necessary condition for a range of state-of-the-art recipient services in parcel delivery. This relies on consumers having almost non-stop mobile internet connection via a smartphone, but also for cloud-sourced working models in delivery. The high usage of mobile devices in cities, for example, makes certain applications economically interesting and it can create a driver for an innovative application.

In consumer parcel deliveries, competition has increased greatly in many European markets. Privatised postal operators and private competitors are engaging in a service race while prices and margins are at low levels.⁷⁵ Competition is one of the major demand drivers on the supply side (“demand pull”) for using technology to achieve a higher operational efficiency. This is generally realised through automation and centralisation, as well as improvements in sorting and delivery. Meanwhile, in letter deliveries, increasing the operational efficiency is key to compensate declining mail volumes and revenues.

Consumer demand is another important “pull” factor when it comes to technology in the postal sector. Consumers want faster and more convenient services with more precise delivery windows and rerouting options. These services require considerable investments in technology including sorting, automation and IT. While any advantages of competitors in service level or speed in parcel deliveries made possible by technology, puts pressure on other carriers to catch up.

To further highlight these issues, several case studies of technological innovations and their relevance to the UK postal market are outlined in this study.

⁷⁵ eDelivery (ed.) (2105), A cautious welcome for Royal Mail sell-off: eDelivery readers` thoughts.
<http://edelivery.net/2015/06/a-cautious-welcome-for-royal-mail-sell-off-edelivery-readers-thoughts/>.

Case study 6: Cloud computing

One key technological innovation in recent years is cloud computing. Made possible through improved mobile and landline connections, cloud technology allows users to flexibly access their data from wherever they choose and also use a range of on-demand services including software-as-a-service applications which do not need to be installed locally but can simply be used via a web browser. Memory, computational power and installed programmes have thus become independent of the device used to access them and are available on demand from diverse cloud service providers. Cloud computing, for example, is a precondition for sharing economy services like shared delivery and also allows the set-up of shipment platforms without server infrastructure.

Source: CEP-Research.

Case study 7: Big data

Big data technology provides the means to analyse vast amounts of data, such as in e-retailing and shipment. It is a prerequisite for all kinds of prediction services, namely planning of market basket analysis, analysis of warehouse stock, logistics for route optimisation, real-time-tracking, and fleet optimisation etc. In addition to memory technology to store the data and internet connections for data transfer to wherever it is analysed, big data technology requires computational power in order to automatically process the available information quickly. Big data technology or whether its application makes sense necessarily depends on what data is available – and the availability of large amounts of data is significantly boosted by inexpensive sensor technology and communicating mobile devices, which also make up the Internet of Things.

Source: CEP-Research.

Case study 8: Internet of Things (IoT)

Communicating and interconnected moving physical objects which can also autonomously coordinate processes make up the Internet of Things, which “is set to enable large numbers of previously unconnected devices to communicate and share data with one another” ⁷⁶. The Internet of Things is mainly based on IPv6 standard, ie the next generation of the internet protocol that is still in various stages of deployment worldwide. Previously unconnected items communicate and share data with one another because each can be identified by their own IPv6 address. Sensors and mobile internet (or other forms of wireless communication) obviously are the main enablers for this technology, which has the potential to improve a wide range of processes from warehousing and inventory stock monitoring in retail to farming and traffic control. The Internet of Things makes smart self-steering vehicles and smart environments such as smart cities possible.⁷⁷ According to Ofcom, in the UK there are currently about 40 million devices connected within the Internet of Things. This figure will grow more than eightfold by 2022, when it will consist of 360 million devices and more than a billion daily data transactions.⁷⁸

Source: WIK-Consult research, CEP-Research, Ofcom.

⁷⁶ Ofcom (2015), Promoting investment and innovation in the Internet of Things, January 2015, p. 1.

⁷⁷ Forbes (ed.) (2015), How Big Data And The Internet Of Things Create Smarter Cities. <http://www.forbes.com/sites/bernardmarr/2015/05/19/how-big-data-and-the-internet-of-things-create-smarter-cities/>.

⁷⁸ Ofcom (2014), Promoting investment and innovation in the Internet of Things. Summary of responses and next steps, p. 2.

7 Developments of technology on the supply side

Growing e-commerce demand and letter volume declines place postal operators under stronger competitive pressure to reduce costs. Increased automation and continuous improvements in services will give enterprises competitive advantage through advancements productivity. Technology therefore plays an increasingly large role in letter and parcel delivery operations and it can be expected that its importance will grow even further in the future. There is strong pressure from consumers and e-retailers on postal operators to improve efficiency and increase service quality alongside the availability of more advanced technologies. This section highlights the areas where the effects of technology on consumer deliveries are strongest.

The following sections partly revolve around case studies which illustrate significant developments by means of examples. The main players appearing in these case studies are often Royal Mail, DPD and Hermes. Royal Mail has the best network in terms of geographical coverage but has started modernisation measures relatively late. DPD UK, on the other hand, can be seen as the main innovator in the UK in terms of recipient services. Hermes UK is a pure B2C parcel operator who has seen very high volume growth rates.

7.1 More efficient operations in sorting and delivery

As previously outlined, parcel sorting is one field where carriers continuously invest in new technology. The need for more sorting capacity is rising quickly as B2C volumes grow and strong competition and high price pressure make efficient operations a necessity.

7.1.1 Barcoding

In order to improve parcel handling in sorting facilities, parcel operators typically use barcodes. Barcodes optimised for easy machine reading allow all relevant information on the shipment to be scanned and interpreted in the easiest and fastest way possible. This is to speed up operations and avoid the necessity to scan written addresses, which is much more difficult to realise technically and also more prone to error.

While these barcodes have been mostly just one-dimensional in the past, many carriers now switch to two-dimensional codes which can include more information on the same space, such as address information and routing instructions. The additional information capacity can also be used for more redundancy of information which helps to make the code more robust so that it can still be read even if it is partly damaged.

While barcoding is not a new development for most parcel carriers, Royal Mail has only just upgraded its network for barcoding in October 2015 and now requires all parcels

and large letters to include a two-dimensional barcode.⁷⁹ One of the benefits apart from improvements in handling will be the availability of tracking information to senders and recipients. This feature will be implemented in early 2016. Royal Mail offers also a 2D barcode option called Mailmark for letters.⁸⁰

Letters with bearing a Mailmark barcode are tracked in Royal Mail's mail centres and delivery offices, providing information on the predicted date of delivery, the number of items already delivered, the share of undelivered letters due to errors and the nature of the error - such as non-machinability or address errors. Senders and producers of mailings receive detailed day-to-day information by means of a web-based reporting dashboard. Performance information enables senders to increase efficiency of call centre staffing and to ensure stores are ready for customer responses. The Mailmark barcode can also be created to be used to carry additional information on special offers or discounts which are granted upon scanning the barcode in the store – further enhancing knowledge on customer reactions to the mailing.

Example of 2D barcode



Source:
qr-code-generator.com.

Although there is a general trend towards 2D barcodes, 1D nevertheless still has its place in situations when barcodes have to be scanned from a larger distance or when the scanned object is moving. 1D scanners are generally more suitable for these tasks. Therefore, many parcel operators use 1D barcodes and laser scanner in their facilities in addition to the 2D codes on the labels. The costs for 2D imagers have fallen over the last years, also as a result of the consumerisation of IT. Simple laser scanners are typically the cheapest barcode scanners available, along with

linear imagers. Costs are not necessarily a driver for the shift towards 2D barcodes and thus 2D-capable scanners – it is more the higher flexibility offered by imagers that make them a more suitable solution for many. However, consumer and data protection authorities might raise concerns with regards to the protection of personal data and privacy. It seems essential that data protection issues are taken into account at the earliest possible stage and are embedded into the architecture of the envisaged tools. A high degree of user acceptance could be achieved if personal data is protected and, as intended, only used for targeted advertisement beneficial to the consumers such as discounts, special offers and not sold to third parties without prior consent.

⁷⁹ Royal Mail (ed.), What parcel services will now contain a 2D barcode?; <http://www.royalmail.com/business/help/preparing-your-mail/getting-barcode-ready-frequently-asked-questions>.

⁸⁰ See Royal Mail's website on Mailmark <http://www.royalmail.com/mailmark>.

7.1.2 Sensors and machine vision

Processors and memory have been improved significantly in recent years through innovative research and engineering. Moore's law states that transistor density on computer chips doubles every two years – and still appears to hold.⁸¹ Meanwhile, processors have also become more energy-efficient, which is highly significant for mobile technology. Similarly, memory technology has improved drastically. Computers are getting smaller and more powerful at a very fast pace and this has made fast and light-weight mobile devices as we know them today possible.

Thanks to innovative technologies, a trend towards parallel use of different technologies is becoming apparent throughout the digitised world. A good example of the parallel use of technology in different industries is the use of sensor technology originally developed for consumer applications.⁸² Sensor technologies are becoming less expensive, so industries that might have missed out or would rather not invest in elaborate research and development can now participate in the cutting edge of an inexpensive technology. Similarly to computer chips and memory, sensors have also become much more widespread as a result of smartphone penetration. The effect of mass production of sensors is that, in general, sensor technology has become considerably cheaper and can now be used in a variety of applications which were not economically viable before.

For instance, Microsoft's Kinect gaming console has introduced optical 3D sensor technology at a very low price.⁸³ For such advanced low-cost sensors, there is a multitude of applications in postal sorting, especially when it comes to irregularly shaped items. The use of sensor technology can also enable consumers to easily determine their shipments' dimensions.

Technologies that already have a strong impact on sorting are obviously sensors and pattern recognition software, where improvements can enhance machine vision for reading parcel labels and improve handling in sorting facilities.

In addition to weighing mail items by means of weight sensors and registering their dimensions through optical scanners, sorting machines have to be able to read addresses at very high speeds to ensure fast handling of parcels and thus timely delivery to consumers. For instance, laser scanners and linear imagers capture one-dimensional barcodes and are used to scan parcel dimensions. Cameras or area imagers can be used for the same purposes as well as scanning two-dimensional barcodes, hand written letters and complete images of labels or whole parcels which

⁸¹ Intel (ed.) (2015), 50 Years of Moore's Law. <http://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html>. But Intel has recently stated that the pace is slowing down a bit so that transistor density now doubles every 2.5 years. <http://uk.businessinsider.com/intel-ceo-brian-krzanich-suggests-moores-law-is-over-2015-7?r=US&IR=T>.

⁸² Fraunhofer Institute for Factory Operation and Automation, DHL Customer Solutions & Innovation (2013), Low-cost sensor technology. December 2013.

⁸³ A web search reveals list prices starting from £120 for Xbox One Kinect Sensors.

can be used for video coding or fingerprinting. As prices for high-quality cameras fall and improved pattern recognition software improves, their possible applications in scanning become wider. The general trend in sorting is moving away from laser scanners to cameras.

Sorting facilities have to process rapidly increasing numbers of parcels, which is why handling and scanning speed is critical to ensure timely deliveries. The software that enables the sorting equipment has to accurately and quickly interpret the data fed into it from laser scanners or cameras. This is especially challenging when cameras are used as the software has to extract patterns and features from irrelevant visual information.

Furthermore, sensors are used in sorting facilities to ensure safety, for instance when using telescopic belt conveyors for unloading parcels from a container. These sensors are used to guarantee that parcels are fed into the sorting system with the correct spatial orientation and distance to one another. This is important to ensure the sorting machines operate well.

Figure 22: Hermes Warrington hub sorting system



Source: Hermes UK.

7.1.3 Label learning and fingerprinting

Connected to the field of machine vision are label learning software and parcel fingerprinting technology. Label learning software enables sorters to go beyond predefined sets of labels that can be recognised and also learn to include new label formats. This is achieved by manually assigning sender, recipient and barcode fields to

the different areas of the label with the help of the specialised software so that the sorting system can recognise this label in future and read it automatically.⁸⁴

Fingerprinting is also a relatively new technology in parcel sorting. It captures unique visual features of parcels by means of cameras and uses extracted feature vectors to identify the parcel along the sorting process. Essentially, this works in the same way as software designed to recognise other visual patterns such as fingerprint recognition – hence the name. Fingerprinting can eliminate the need to use the label for identification so that it can potentially replace barcoding in future.⁸⁵ This can be an advantage especially when a high proportion of parcels with unknown or unreadable labels has to be sorted.

7.1.4 Optical character recognition and video coding

Optical character recognition (OCR) software plays a large role in how efficient especially hand-written labels can be handled. Advanced OCR software works with neuronal networks that serve to give the software learning capabilities – improving its accuracy. Furthermore, modern OCR software can interpret a wide range of languages including Chinese or Russian. But nevertheless, OCR is still inferior to human capabilities so a relatively large proportion of address labels still have to be read by human staff. For instance, PostNord reported an OCR read rate of 55 per cent after upgrading its systems in 2012. Human assistance in label reading typically takes the form of video coding, which involves specialists looking at captured images of the parcel label and manually typing in the address. This process can also be outsourced thanks to high-speed internet connections. One example for this practice is PostNL, who has been outsourcing its video coding to the Philippines and Vietnam since 2011. According to the postal operator, the process of sending the image to the video coders and receiving the coded address takes merely 18 seconds.⁸⁶ This coding solution uses cameras to produce an image of the address the machine cannot read. This image is sent through a high-speed data connection to several processing sites in Eastern Asia where the data-entry staff type in the correct address. After the data is transferred back to PostNL, the sorting machine can continue automated sorting.

⁸⁴ Siemens Postal, Parcel & Airport Logistics, Press release 30 September 2015

⁸⁵ Siemens (ed.), Recognition and more; <http://www.logistics-airports-solutions.siemens.com/las/global/en/pp/sorting/rec/pages/rec.aspx>.

⁸⁶ PostNL (ed.) (2011); PostNL's video-coding solution now also available to parcel companies; http://shore.postnl.nl/en/news/postnls_video-coding_solution_now_also_available_to_parcel_companies.

7.1.5 RFID

Radio frequency identification (RFID) is another significant technological innovation which is already improving postal logistics processes. RFID transponders can potentially replace barcodes for identifying parcels while also eliminating the need to scan parcels since RFID works over a distance via radio waves.

RFID already plays a role in more high-margin logistics segments such as healthcare logistics, where they improve tracking and monitoring, but they are more costly than barcodes printed on paper.⁸⁷ Postal operators and e-retailers would need to make high investments in their entire fulfilment centre and warehouse infrastructure to implement readers with integrated antennas that send out radio signals.

RFID already plays a large role in several industries and in basic applications such as ID cards. The technology might have potential to replace barcodes in logistics applications in the future. The distinct advantages of RFID over barcodes are that information can be read from a distance of up to several metres (depending on the exact RFID technology used) by an RFID reader. Visual contact which is necessary for barcode reading is not required for RFID tags. In contrast to barcodes which require sequential reading, RFID tags can be read out in bulks. This can potentially result in significant speed advantages in sorting applications.

There are several varieties of RFID chips which differ in the frequency band used for communication. The most common varieties are LF (low frequency), HF (high frequency) and UHF (ultra-high frequency), where LF is oldest and cheapest and UHF is comparatively expensive. Microwave RFID chips are comparatively new and have the longest range but also the highest price. Furthermore, there are passive RFID tags which have to be powered by a scanner, while semi-passive and active RFID tags include a battery to power sensors or memory and the latter also to actively communicate with other RFID chips. Finally, active RFID chips can also include a scanning functionality so that they can power nearby passive RFID chips and communicate with them. Increased use of active RFID chips in transport would be a step towards a more powerful Internet of Things and smart logistics where shipments can take a more active role in the process.

⁸⁷ DHL (ed.) (2015), COOL SOLUTION – DHL SMARTSENSOR.
http://www.dhl.com/en/about_us/logistics_insights/dhl_trend_research/smartsensor.html. Experts emphasise that RFID tags are more costly compared to barcodes (c.£0,07 per tag) and that the investment in reading facilities in fulfilment centres can add up to at least £3,600 per gateway. Each fulfilment centre consists on several gateways depending on the postal operator.

DHL SmartSensor



Source: DHL.

RFID tags are already used in some logistics applications such as on reusable containers or pallets or for high-value shipments. In the latter case, advanced active RFID chips coupled with sensors can transmit information on the parcels temperature, or location, for instance. One example for such a use of RFID technology is DHL's SmartSensor for healthcare shipments where monitoring temperature is often critical.

Although the core technology exists for several decades now, RFID has not found its way onto consumer parcel labels yet. One major barrier is the cost of RFID chips. Although RFID prices have decreased considerably of late, the technology is still costly for industries with high volumes and low margins. But ultra-high frequency (UHF) chips are available at well below \$0.10, down from \$0.50 some 6-7 years ago.⁸⁸ It is likely that advanced RFID tag prices will drop to a level where they can be used on parcel labels in future – although this will also largely depend on the costs of adapting the infrastructure and IT as well as on how large the cost benefits are,

Although the core technology exists for several decades now, RFID has not found its way onto consumer parcel labels yet. One major barrier is the cost of RFID chips. Although RFID prices

FedEx's SenseAware technology or DHL's SmartSensor GSM, on the other hand, do not use RFID but rather use the equivalent of a cell phone to transmit sensor data. This has the advantage that the sensor tag does not require a scanner to read out the data. The information can be actively transmitted at more stages of the shipment's journey and its position can also be tracked seamlessly. Therefore, this method could be considered as a step beyond RFID - but the price is also significantly higher: at the launch of the service in 2009, FedEx' SenseAware service cost \$120 per month.⁸⁹

7.1.6 Robotics

Robots benefit from improvements in sensor technology as well as in artificial intelligence and pattern recognition. There is significant overlap with previously mentioned fields as robots can be part of the Internet of Things and carry out tasks within smart environments and they can also be combined with cloud computing.

While robots can drive forward automation in letter and parcel sorting and thus possibly replace human workers, they also serve to make work physically less demanding for

⁸⁸ CBR (ed.) (2015), Setting up (smart) shop: UK leads to retail revolution; <http://www.cbronline.com/news/internet-of-things/consumer/setting-up-smart-shop-uk-leads-iot-retail-revolution-4716104>.

Alibaba supplier research

⁸⁹ American Shipper (ed.) (2012), FedEx expands SenseAware deployment; http://www.americanshipper.com/Main/News/FedEx_expands_SenseAware_deployment_48343.aspx.

humans by taking over repetitive tasks or heavy lifting. This makes robotics an important discipline for an aging society.⁹⁰

Robots have already found their way into parcel sorting operations. With the rapid development of robotics, they will likely take over more tasks in future. As parcel sorting operations requires human staff to perform a range of highly repetitive tasks which can involve heavy lifting, robots can help significantly improve working conditions. For instance, DHL has been working on an automated parcel robot which can unload containers and is exploring the possibilities of the technology. According to DHL, the robot does not work as fast as humans yet⁹¹ but expects that it will become faster than humans in the future.

Figure 23: DHL Parcel robot



Source: DHL.

In other applications robots are already present in warehouse operations. Since 2014, Amazon has been using Kiva robots in its warehouses to move orders by picking up shelves and driving them to their destination, guided by markers on the floor.⁹² The company has created its own robotics division, Amazon Robotics, in order to work on possible applications of robotics in logistics. At the moment, though, the picking work

⁹⁰ Kiyoshi Matsumoto, Masaru Ishikawa, Masayuki Inaba, and Isao Shimoyama (ed.), Assistive Robotic Technologies for an Aging Society. http://www.irt.i.u-tokyo.ac.jp/en/outline/about_irt_e.pdf. "Japan's Tech Solution for Its Aging Population", Wall Street Daily, 11 Jul 2015, <http://www.wallstreetdaily.com/2015/07/11/japan-healthcare-robots/>. For a UK example see the pilot project CHIRON (Care at Home using Intelligent Robotic Omni-functional Nodes), funded with over £3.15m by Innovate UK, <http://www.designability.org.uk/researchproject/chiron-care-at-home-using-intelligent-robotic-omni-functional-nodes/>.

⁹¹ DHL Discover logistic (ed.), The comeback of the robots; <https://www.dhl-discoverlogistics.com/cms/en/course/technologies/reinforcement/reinforcement.jsp>.

⁹² MIT Technology Review (ed.) (2015), Inside Amazon's Warehouse, Human-Robot Symbiosis; <http://www.technologyreview.com/news/538601/inside-amazons-warehouse-human-robot-symbiosis/>.

still has to be done by human workers. DHL has recently introduced a similar solution from Toyota for automated transport of items in its warehouses in Japan.⁹³

Another significant application of robotics which can improve parcel operations is robotics-assisted movement. This is exemplified in Panasonic's recent development of a mechanised exo-suit with electronic motors which support the carrier and facilitate higher lifting capabilities, which would improve working conditions.⁹⁴ For the future, the company plans to develop exo-suits with larger proportions and thus higher lifting power. Japanese parcel operator Yamato has recently announced that it will test the device.

Furthermore, with falling sensor and IT prices and the consumerisation of robotics, robot prices have been falling considerably over the last years while their productivity increases. This trend is set to continue, as prices of hardware and software for robotics are expected to decrease by more than 20 per cent over the next 10 years while the performance of robots is projected to increase 5 per cent per year.⁹⁵

Naturally, the usage of robots in most fields is strongly determined by economic considerations. As the price/productivity ratio of robots improves and as wages rise, it can be expected that using robots will become viable in more industries and for more tasks. BCG expects increasing wages while robot operating costs will continue to fall in the U.S. automotive, electrical equipment and furniture industries.⁹⁶ Although wages are comparatively low in parcel sorting, it can be expected that robots will play a larger role in the near future as their price decreases and their performance increases.

⁹³ DHL (ed.) (2015), DHL is first to introduce an automated guided vehicle in warehouse for logistics industry in Japan; http://www.dhl.co.jp/en/press/releases/releases_2015/local/092915.html.

⁹⁴ BloombergBusiness (ed.) (2015), This Company Is Building the Mechanized Suit From Aliens; <http://www.bloomberg.com/news/articles/2015-08-18/mitsui-channels-james-cameron-s-aliens-with-mechanized-suit>.

⁹⁵ Bcg.perspectives (ed.) (2015), The Robotics Revolution: The Next Great Leap in Manufacturing; <https://www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robotics-revolution-next-great-leap-manufacturing/>.

⁹⁶ Boston Consulting Group; <https://www.bcgperspectives.com/content/articles/lean-manufacturing-innovation-robots-redefine-competitiveness>

Case study 9: Parcel sorting case studies: Royal Mail, DPD and Hermes

While automated sorting of parcels is the norm for many parcel operators, Royal Mail has only just begun to automate its parcel sorting operations in 2014/2015⁹⁷, despite already having automated letter sorting to a significant degree. In order to modernise its operations, the postal operator has announced that it is investing £20 million in a new parcel sorting system which is to be installed in 20 UK sorting centres.⁹⁸ But with such a late investment in what is generally considered a basic requirement of efficient parcel operations, Royal Mail is considerably lagging behind parcel competitors.

DPD, for instance, started a £175 million investment programme in late 2012 to upgrade its network and sorting. This includes a new £100 million national parcel hub and 18 new or enlarged depots. The new parcel hub, which opened in summer 2015, includes a 3,000m automated sorter which will increase DPD UK's parcel capacity from 800,000 per day to 1.4 million.⁹⁹ In mid-2015, DPD launched another £150 million network investment programme which includes the construction of 10 new depots, bringing its total investments since 2010 up to £400 million.

Hermes UK has similarly upgraded its automatic sorting capacity to be able to cope with rising volumes. In September 2015, the company has increased the sorting capacity of its Warrington hub to 1 million parcels per day through a £10 million investment and plans further upgrades as volumes are predicted to continue growing strongly. In 2014, Hermes already invested £14 million in the construction of the site. According to the company, the latest upgrade of its Warrington hub has allowed it to push back cut-off times for next-day deliveries so that later orders by consumers can still be delivered on the following day, which is a significant benefit for retail clients. In preparation for the 2015 peak season, Hermes also opened 125 sub depots. Its capacity expansions play a critical role in being able to cope with generally growing volumes over longer periods but are also important for being able to manage sudden spikes in activity. The scalability (up and also down) of its infrastructure according to demand is thus essential for Hermes to operate efficiently.

In terms of capacity expansion, Royal Mail has not made similarly large upgrades recently and has even reported over-capacity to be one reason for the increasing price pressure it sees in the UK parcel market.¹⁰⁰ One reason why Royal Mail has not upgraded its capacity to a similar degree as its parcel competitors is perhaps its lower volume growth in the domestic parcel segment. According to DPDgroup UK, the company's turnover rose by 26 per cent in 2014, which strongly suggests a high volume growth.¹⁰¹ Hermes UK's parcel volumes grew 42 per cent in the last three years.¹⁰² Meanwhile, Royal Mail saw only 3 per cent volume growth for its UKPIL Royal Mail core network in its 2014/15 annual report. Its Parcelforce Worldwide volumes, however, rose 12 per cent, but these make up merely 7.2 per cent of Royal Mail's UKPIL parcel volumes.

Source: WIK-Consult research.

⁹⁷ Royal Mail plc Full Year 2014 – 15 Results , Management presentation and Q&A transcript, 21 May 2015
<http://www.royalmailgroup.com/sites/default/files/Royal%20Mail%20plc%20Full%20Year%202014-15%20Results%20Transcript.pdf>.

⁹⁸ Datalogic (ed.) (2015), Datalogic selected by Royal Mail to implement new Parcel Sorting Systems in UK mail centres; <http://www.datalogic.com/eng/media-center/news/datalogic-selected-by-royal-mail-to-implement-new-parcel-sorting-systems-in-uk-mail-centres-nd-4093.html>.

⁹⁹ Post Expo 2015 press release, 30 September 2015

¹⁰⁰ Logistic Manager (ed.) (2015), Royal mail to automate parcel sortation at key mail centres; <http://www.logisticsmanager.com/2015/05/royal-mail-to-roll-out-automated-parcel-sortation/>.

¹⁰¹ "DPD UK records double-digit growth in revenues and profits in 2014", CEP-Research, 5 Nov. 2015; <https://www.cep-research.com/news/dpd-uk-records-double-digit-growth-in-revenues-and-profits-in-2014>.

¹⁰² Hermes (ed.), Future Proofing our growth so we can support yours; <https://www.hermes-europe.co.uk/future.html>.

7.1.7 Personal digital assistants and route optimisation

In 2013, Royal Mail rolled out personal digital assistants (PDAs) for its delivery staff so that, by the end of the year, every postman was equipped with a mobile device.¹⁰³ This year, Royal Mail has ordered 76,000 new handhelds for its delivery staff as part of a £130 million investment in technology, although benefits are mostly expected for parcel deliveries.¹⁰⁴

France's La Poste, on the other hand, started equipping its postal delivery staff with smartphone handhelds in 2013 with plans to complete the rollout in 2015. The 'Facteo' devices feature standard smartphone functionalities, also for private use, in addition to delivery round functions as well as access to Group news and internal information.¹⁰⁵ Through the new handheld, La Poste's staff are able to offer better doorstep services for signature capture, authorisations and returns.

Furthermore, Deutsche Post started implementing route optimisation for letter deliveries in 1999 and has reduced the number of its delivery routes from 80,000 in 2000 to 51,500 in 2013.¹⁰⁶

Case study 10: Last mile parcel case studies: Royal Mail, DPD and Hermes

In terms of IT, Royal Mail has recently upgraded its PDAs, as mentioned in the above section on letter deliveries. Much more than letter delivery, PDAs improve parcel deliveries as the delivery personnel can collect the recipient's signature as a digital image, which can potentially also be accessed by the sender to confirm delivery. Also, the Zebra Technologies TC75 used by Royal Mail improves tracking as it enables couriers to scan barcoded parcels and will improve recipient interaction as postmen and women are informed if a parcel should be delivered to a safe location on the recipient's premises. Overall, Royal Mail wants to spend £130 million over the next five years on its handheld equipment.¹⁰⁷

DPD has recently upgraded to a new hand scanner model which also features a camera for taking photos of neighbour deliveries or calling cards. Furthermore, the Saturn CN70 device has a faster mobile connection than the previously used model so that communication with DPD's IT and operational management is improved. Ad hoc collection requests can be transferred directly to the device and it enables drivers to prioritise their deliveries.

¹⁰³ Royal Mail (ed.) (2013), PDAs: access for all; <https://www.myroyalmail.com/news/national/2013/06/pdas-access-all>.

¹⁰⁴ "Royal Mail to deploy 76,000 hand-held devices as part of £130m investment", CEP-Research, 11 June 2015; <https://www.cep-research.com/news/royal-mail-to-deploy-76000-hand-held-devices-as-part-of-130m-investment>.

¹⁰⁵ Le Groupe la Poste (ed.) (2015), Facteo pour tous les facteurs en 2015; <http://legroupe.laposte.fr/actualite/facteo-pour-tous-les-facteurs-en-2015>.

¹⁰⁶ WIK (2013), Review of Postal Operator Efficiency, Study for Ofcom, November 2013.

¹⁰⁷ "Metamorphosis of UK Parcels Market", Post & Parcel, 22 June 2015; <http://postandparcel.info/65831/in-depth/metamorphosis-of-uk-parcels-market/>.

The mobile computer also constantly sends GPS signals to make DPD's 'Follow My Parcel' service possible. This innovative service allows recipients to track their deliveries on a map in real time. Also, precise collection point coordinates are captured for future use by means of GPS and scan data and the Saturn device automatically navigates the driver to the next stop. And the device's GPS tracking capabilities are used by the respective depot management to monitor the driver's activity.

Furthermore, DPD uses historical data as well as data on its drivers' current workload to calculate optimised routes and predict delivery times. The 'DPD Predict' service, launched in the UK in 2010, informs recipients on concrete time windows for their deliveries. The service includes diverse rerouting options for recipients and DPD's IT system informs drivers via their mobile devices if a parcel is rescheduled for another day while the route is adjusted accordingly.

Hermes UK has also invested in its mobile technology to ensure that all its drivers were equipped with Intermec CN3 handhelds in 2009, where previously parcel reception still had to be registered on paper.¹⁰⁸ In 2012, Hermes then rolled out 600 upgraded Belgravium Atlanta 5000 devices for improved data capture. The new devices were acquired at a time when Hermes upgraded its barcoding system in order to be able to provide end-to-end tracking services.¹⁰⁹

Following DPD, Hermes started to roll out its delivery time window service – called 'Hermes ETA' in the UK – in September 2015. This follows an earlier launch of a similar service in Germany in late 2014. According to the company, the customer initially receives a four-hour delivery time window which is then reduced to a two-hour slot and finally reduced to one hour. The service will be expanded to include recipient notifications one hour before the scheduled delivery. Also, the company plans to launch rerouting services, branded 'Diversion', in 2016 which will be similar to the rerouting services offered by DPD¹¹⁰. Finally, its real-time tracking app 'Parcel Manager' has played a key role in reducing failed delivery attempts and thus increasing its first-time delivery rate, according to Hermes.

While its standard parcel services are lagging behind its competitors' offerings in terms of notification and interaction, Royal Mail has also launched advanced recipient services for its Parcelforce Worldwide division which offers express services. The 'Parcelforce Select' service, launched in January 2015, allows recipients to reroute their parcels while they are in transit. Parcelforce is also expanding its recipient notifications to include one-hour delivery time windows.¹¹¹

Source: WIK-Consult.

¹⁰⁸ "Hermes link up with Blackbay", Post & Parcel, 5 Jul. 2009;

<http://postandparcel.info/26329/news/hermes-link-up-with-blackbay/>.

¹⁰⁹ "Hermes UK introduces over 600 sophisticated hand-held terminals", CEP-Research, 12 Jan. 2012; <https://www.cep-research.com/news/hermes-uk-introduces-over-600-sophisticated-hand-held-terminals>.

¹¹⁰ "Metamorphosis of UK Parcels Market", Post & Parcel, 22 June 2015;

<http://postandparcel.info/65831/in-depth/metamorphosis-of-uk-parcels-market/>.

¹¹¹ Royal Mail Group (ed.) (2015), Parcelforce Select is launched to provide greater delivery choice and control; <http://www.royalmailgroup.com/parcelforce-select-launched-provide-greater-delivery-choice-and-control>.

7.1.8 Parcel lockers

Parcel lockers enable consumers to be more flexible in picking up their parcels as lockers can typically be accessed 24 hours per day. For parcel carriers, using parcel lockers for deliveries has the advantage that multiple parcels can be dropped off at a single stop, which is much more efficient than the typical case of delivering one parcel per stop. Parcel lockers also allow carriers to avoid the issue of missed deliveries.

As parcel lockers are essentially secure boxes, the main technological challenge is to make the system both safe against theft and conveniently accessible for both recipients and delivery staff, possibly even from different parcel operators.

In the UK, Polish InPost has strongly expanded its network of parcel lockers and aims to reach 2,000 parcel terminals by the end of 2015.¹¹² The lockers can be accessed by scanning a barcode which opens a compartment so that parcels can be dropped off or picked up. Amazon is also increasingly using parcel locker technology in the UK and had 300 parcel terminals in the country in late 2014¹¹³ after launching in the USA and the UK in 2011.

7.1.9 Parcel boxes

Private parcel boxes for single homes or apartment complexes do not play a large role in the UK yet. However, they represent a major innovation in Germany, where Deutsche Post DHL Group (DPDHL) launched its parcel box in mid-2014¹¹⁴ and denies its competitors access to the last mile solution. DPDHL's competitors in consumer delivery are working on their own 'open access' solution, due to be launched in mid-2016.¹¹⁵ According to a Hermes survey, 39 per cent of UK consumers find parcel boxes appealing, the most liked last mile innovation included in the survey.¹¹⁶

112 "InPost agrees delivery partnership with Britain's P4D", CEP-Research 23 Jul. 2014; <https://www.cep-research.com/news/inpost-agrees-delivery-partnership-with-britains-p4d>.

113 "Amazon launches parcel lockers at UK airport as strikes hit German business", CEP-Research, 22. Sept. 2014; <https://www.cep-research.com/news/amazon-launches-parcel-lockers-at-uk-airport-as-strikes-hit-german-business>.

114 Deutsche Post DHL Group (ed.) (2014), DHL Paketkasten bundesweit verfuegbar; http://www.dpdhl.com/de/presse/pressemitteilungen/2014/dhl_paketkasten_bundesweit_verfuegbar.html.

115 „Wohin mit unseren Paketen“, Wirtschaftswoche, 6 Oct. 2015; <http://www.wiwo.de/unternehmen/dienstleister/hermes-dpd-und-gls-stellen-paketbox-vor-wohin-mit-unsere-paketen/12412740.html>.

116 "British and German online shoppers want more innovative home delivery services", CEP-Research, 13 Oct. 2015; <https://www.cep-research.com/news/british-and-german-online-shoppers-want-more-innovative-home-delivery-services>.

Figure 24: DHL parcel box



Source: DHL.

Similarly to parcel lockers, one main technological challenge is to enable couriers to access the parcel box while guaranteeing that the contents are secure. This is especially challenging if the box is accessible by multiple carriers with different IT systems. DHL, for instance, has designed the system to work with RFID-based smart keys. One distinct advantage of parcel boxes for recipients and carriers is that the problem of missed deliveries is eliminated, providing perhaps a more secure alternative to standard 'safe place' deliveries. But for apartment buildings, safe place deliveries are often not an option so parcel boxes could be more attractive in this scenario. DHL in Germany, for instance, launched a trial parcel box model of delivery for apartment buildings in early 2015.¹¹⁷

¹¹⁷ Deutsche Post DHL Group (ed.) (2015), DHL Paketkaesten jetzt auch in Mehrfamilienhaeusern der Deutschen Annington; http://www.dpdhl.com/de/presse/pressemitteilungen/2015/dhl_paketkasten_jetzt_auch_in_mehrfamilie_nhaeusern.html.

Case study 11: Delivery to the trunk of Volvo, Audi and VW cars

Several European car manufacturers cooperate with parcel carriers to test delivery to the trunk of a car. Swedish firm Volvo has been the first to test this new delivery method based on an telematic services solution, while Audi (in cooperation with DHL in Germany) and Porsche/VW (with Austrian Post) followed with their own solutions during 2015. The customer chooses the car as point of delivery during checkout in an online shop. The parcel carrier will then GPS-track its exact location, open the trunk with an electronic key and deposit the parcel.

In order to guarantee security of the car and parcels delivered, the key is valid for single use only. In addition, car manufacturers offer monitoring solutions to the customer. For example, Volvo customers can track who has opened the trunk and when via their smartphones.

Source: <http://bit.ly/1OguDwH>

https://www.post.at/footer_ueber_uns_presse.php/presse/details/id/1186371

<http://edition.cnn.com/2014/10/01/business/volvo-roam-klas-bendrik/>

7.1.10 Automated vehicles

Vehicles with self-driving features are a reality in the UK, yet they still require a driver to steer the car manually. Superclass cars and a number of trucks already employ features like parking assist systems, autonomous emergency braking and lane keeping assistance. Several car manufacturers are piloting fully automated vehicles which should be able to make a journey without human interaction, and deal with all traffic incidents on the way (see Case study 12).¹¹⁸

Vehicles with high or full automation levels should have numerous benefits.¹¹⁹ In addition to enabling access to car transport even to those unable or unwilling to drive, they eliminate human failure and promote road safety. Self-driving vehicles can save energy by having a better overview of traffic and surrounding landscapes, resulting in more efficient travelling. This aspect will be important for postal services as it has the potential to reduce costs – although currently the costs of self-driving technology by far outweigh potential energy savings.

¹¹⁸ In contrast to fully automated vehicles, cars with high automation level still require a driver to take over for certain operations or under certain circumstances, see Department for Transport (2015), The pathway to driverless cars: A detailed review of regulations for automated vehicle technology.

¹¹⁹ See Department for Transport (2015), The pathway to driverless cars: A detailed review of regulations for automated vehicle technology.

Case study 12: Automated trucks by Mercedes-Benz

Mercedes-Benz has started testing its Future Truck 2025 with a self-driving system called Highway Pilot in 2014. After successfully testing the system on a closed-off road, German and U.S. (Nevada) authorities have permitted tests on public highways. The truck's intelligent driving system consists of radar sensors, a stereo camera and assistance systems such as adaptive cruise control, brake assist and lane keeping assist.

Source: Mercedes-Benz Website.

Self-driving larger vehicles such as the Google car¹²⁰, on the other hand, have not become a major topic for parcel operators as far as delivery trials are concerned since the more complex and variable task on the last mile, the more difficult it is for machines to learn. Last mile delivery typically involves taking the parcel from the vehicle to the recipient or at least to their doorstep. A self-driving delivery van would in theory still need a human courier on board to do this, therefore there would be no cost savings for parcel firms and no advantage in terms of increasing speed of delivery. But, like with flying drones, it is nevertheless possible that ground-based unmanned vehicles can improve parcel operations by exploring possibilities of delivering parcels in conjunction with different types and sizes of drones. Once the technology is considered safe enough and regulations allow these vehicles to drive without human supervision, a combined model where self-driving vehicles serve as mobile depots with recharging stations for smaller and more mobile flying or ground-based drones, there could theoretically be a new viable option for standard B2C deliveries.

7.1.11 Drones

The development of drones has originally been driven by military demand, but drones have also become affordable and suitable for a range of civilian applications. Many parcel carriers have recently been testing drone deliveries and some expect drones to be a truly disruptive technology for the last mile.¹²¹ 'Drone' does not necessarily mean a flying vehicle as they can also be ground-based, ie in the form of a self-driving object on the ground. Furthermore, drones can be remotely controlled by pilots or they can be self-steering. And if they are electrically powered, as is the case with most flying drones currently tested by postal operators and parcel carriers worldwide, developments in electric vehicle technology also affect these types of drones and potentially increase their usability with extended range or cargo capacity.

¹²⁰ Google Self-Driving Car Project (ed.), Where we've been; <https://www.google.com/selfdrivingcar/where/>.

¹²¹ See DVZ (2015), Die wichtigsten Forschungsfelder der Logistik, 26 October 2015.

Drone deliveries have been one of the recent hot topics in the postal industry. In theory, drones have the potential to revolutionise last mile delivery as they would make delivery by human staff unnecessary, making last mile more cost efficient. If a flying unmanned vehicle is used for deliveries, it has the advantage of avoiding street traffic and is able to reach locations without sufficient infrastructure. Flying drones also have the disadvantage of being much less energy efficient than ground-based vehicles and typically only have a very small cargo capacity and limited range.

Several companies have already begun testing deliveries with small flying drones. Amazon did an initial test in 2013 to explore the possibilities of drone deliveries for ultra-fast premium shipments. DPDHL followed soon thereafter and launched a drone delivery trial for medicine to a remote island in the North Sea. The tests lasted for several months. DHL's drone can fly for about 45 minutes with a range of at least 12 km and can carry up to 1.2 kg in a special transport container.¹²²

Many others including Google, Alibaba, GeoPost, Swiss Post and SingPost have since also tested different varieties of flying drones for deliveries so that it can be expected that they will be used for certain logistics applications in future. How far this will be relevant for standard consumer deliveries and whether drones will only be used for fast and more expensive deliveries will remain to be seen and will strongly depend on the types of drones used.

Figure 25: Amazon delivery drone



Source: Amazon.

Small drones which only carry light loads will probably only be useful in certain high-value niches, especially if they have to be operated by human pilots and are not self-steering. Drones would potentially have to return to the depot after each delivery to pick up a new package, making cost-saving delivery routes impossible. The effectiveness of

¹²² DHL (ed.), Die Technik; <http://www.dhl.de/de/paket/kampagne/paketkopter/technik.dhl-titlecontent-only.html>.

drone pilots in terms of parcels delivered per time would approach more that of same-day direct drive couriers than that of a parcel courier, and so would the costs.

While the technology for drone deliveries is already there, an obvious factor which will determine their future use is regulations set by the airspace authorities. In the UK, the Civil Aviation Authority (CAA) requires pilots of small unmanned aircraft to be in direct and unaided visual contact with the remote-controlled vehicles at all times¹²³ and similar regulations apply in other European countries. However, exceptions can be made as in the case of the DHL drone, which flies outside of the visual range of its pilot during the trial – albeit mostly above the North Sea where the authorities likely have much less safety concerns than for similar trials in cities. As the technology is tested further, it is possible that regulations will be softened to allow realistic applications.

A precondition for drone delivery will be exact geo-mapping services even in rural and remote areas to exactly specify the location of delivery. Delivering a parcel only a few metres apart could result in dropping it in the neighbour's garden. Experts do not expect sufficient geo-mapping in UK's highlands and islands for the near future. Therefore, drones are unlikely to succeed in these regions during in the next five years.

But at this stage, existing regulations in the UK and also in other European countries pose a strong barrier to the usability of drones in deliveries. In order to approach the problem of airspace safety, Amazon has suggested creating a separate airspace for flying drones (61 to 122m).¹²⁴ Amazon has also recently stated that it is in discussions with the UK government to begin Amazon Prime drone delivery trials after experiencing problems with over-regulation in the USA.¹²⁵ Amazon has already conducted local drone tests in the UK in 2014.

Meanwhile, the public acceptance of air-based drone deliveries will also determine whether the technology can be used for consumer deliveries. According to a recent survey conducted by the British Airline Pilots' association (BALPA), the UK public wishes to see stricter regulations for private drone use than are currently in place, including the requirement that drone pilots should have as much training as regular pilots.¹²⁶ Meanwhile, 33 per cent of UK online shoppers would accept a delivery by drone, according to a study by eDigitalResearch¹²⁷, although 47 per cent had concerns about packages left by drones and 39 per cent stated that they believe that the

¹²³ Civil Aviation Authority (ed.), Unmanned Aircraft and Aircraft Systems; <https://www.caa.co.uk/default.aspx?catid=1995>.

¹²⁴ BBC (ed.) (2015), Amazon suggests a separate airspace for delivery drones; <http://www.bbc.com/news/business-33698812>.

¹²⁵ "Amazon may trial drones for parcel delivery", Independent, 24 Sept. 2015; <http://www.independent.co.uk/news/business/news/amazon-may-trial-drones-for-parcel-delivery-10137120.html>.

¹²⁶ IBTimes (ed.) (2015), British pilots' association says UK public wants much stricter drone laws in urban areas; <http://www.ibtimes.co.uk/british-pilots-association-says-uk-public-wants-much-stricter-drone-laws-urban-areas-1500766>.

¹²⁷ eDigitalResearch (ed.) (2015), One third of online shoppers open to drone deliveries; <https://www.edigitalresearch.com/one-third-of-online-shoppers-open-to-drone-deliveries-2/>.

technology is not reliable and can't be used with larger parcels. Major Chinese carrier SF Express, on the other hand, has already taken drone deliveries a step further as the country's authorities are much more liberal when it comes to commercial drone use. The company delivered some 500 items per day with small flying drones in early 2015¹²⁸ and has plans to expand this same-day service.

One recent example of a ground-based autonomous vehicle for last-mile deliveries is a small delivery robot developed by UK start-up Starship¹²⁹ which is designed to travel on pavements. According to the company, the vehicle would be used for ultra-fast CO₂-neutral city deliveries at 10 to 15 times lower costs than current with human couriers. A similar ground-based concept is the Transwheel drone design study¹³⁰.

7.2 3D printing services

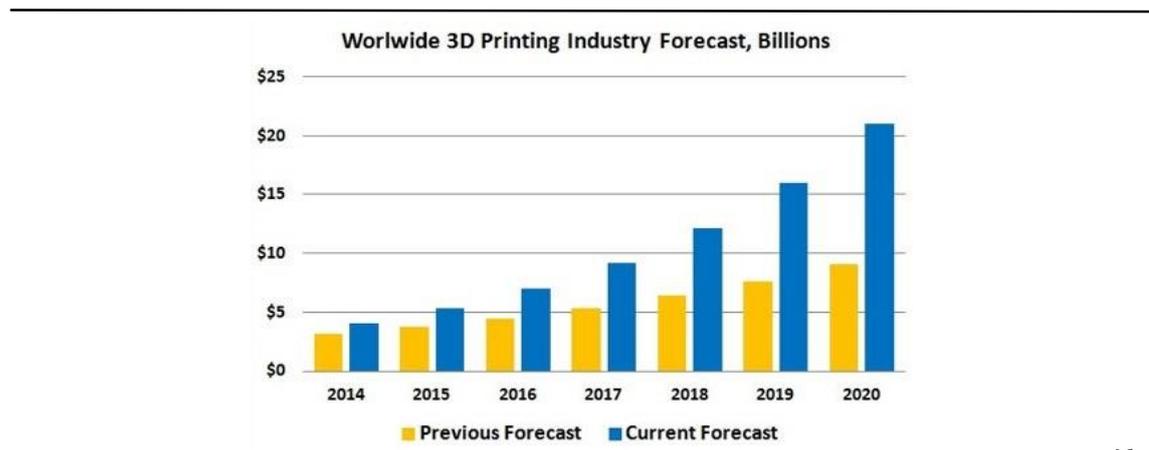
3D printing technology has often been described as a disruptive technology and an enabler of another industrial revolution by decentralising and shifting production to consumers – 3D printing would enable consumers to simply print out items at home.¹³¹ But, at least for now, 3D printing is used more for industrial applications, where decentralised manufacturing of parts has a number of advantages.¹³² It is also widely used today by consumers who create their own action figures or form other objects creatively.

Its future impact on the parcel transport business is not entirely clear. Royal Mail launched a 3D printing service in cooperation with iMakr in late 2014¹³³ while TNT has launched a similar service in Germany¹³⁴ and UPS in the USA¹³⁵. These services are

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- 128** Discover (ed.) (2015), Drone Delivery Services Are Booming In China; http://blogs.discovermagazine.com/drone360/2015/03/27/drone-delivery-china/#.Vjyw_.
- 129** Starship (ed.), Skype co-founders launch a company with a mission to make local delivery free, 2 Nov. 2015; <http://www.starship.xyz/press-release/>.
- 130** BBC (ed.) (2015), Meet Transwheel, self-balancing parcel-delivery drone; <http://www.bbc.com/autos/story/20150824-meet-transwheel-the-self-balancing-autonomous-robotic-parcel-delivery-drone>.
- 131** "3D printing: not yet a new industrial revolution, but its impact will be huge", The Guardian, 11 Dec. 2013, <http://www.theguardian.com/commentisfree/2013/dec/11/3d-printing-not-yet-a-new-industrial-revolution-but-its-impact-will-be-huge>.
Harvard Business Review (ed.) (2015), The 3-D Printing Revolution. <https://hbr.org/2015/05/the-3-d-printing-revolution>.
- 132** A.T. Kearney (ed.) (2015), 3D printing – a manufacturing revolution. <https://www.atkearney.com/documents/10192/5992684/3D+Printing+A+Manufacturing+Revolution.pdf/bf8f5c00-69c4-4909-858a-423e3b94bba3>.
- 133** Royal Mail (ed.), 3D Printing Products; <http://www.royalmail.com/personal/stamps-collectibles-gifts/3d-printing-products>.
- 134** 3D Printing Industry (ed.) (2015), Trinkle 3D Now Delivers Enterprise 3D Printing Solutions with TNT; <http://3dprintingindustry.com/2015/08/18/trinkle-3d-now-delivers-enterprise-3d-printing-solutions-with-tnt/>.
- 135** The UPS Store (ed.) (2014), The UPS Store Expands 3D Printing Across the Nation; <https://www.theupsstore.com/about/pressroom/3d-printing-expands-across-the-nation>.
Engineering (ed.) (2015), CloudDDM's New Strategic End-of-Runway 3D Printing Service; <http://www.engineering.com/3DPrinting/3DPrintingArticles/ArticleID/10488/CloudDDMs-New-Strategic-End-of-Runway-3D-Printing-Service.aspx>.

typically realised through partnerships with 3D printing companies whose products are transported by the parcel carrier. Parcel carriers are attempting to benefit from 3D printing technology, even though it could be a potential threat as it enables local production of parts as an alternative to shipping from distant production countries.

Figure 26: Worldwide 3D printing industry forecast, billions



Source: <http://www.forbes.com/sites/louiscolombus/2015/03/31/2015-roundup-of-3d-printing-market-forecasts-and-estimates/>.

The worldwide 3D printing industry is growing rapidly and growth expectations for the future are very positive (see Figure 26). Whether reality will catch up with forecasts depends on the advances of 3D printing technology (eg as regards printable materials and stability of printed objects). The progress of 3D printing might also be limited by, its direct relevance for consumers which is relatively small. This in turn limits the relevance of 3D printing for consumer deliveries. One reason is that custom 3D-printed products have to be designed via CAD programmes which is technically difficult. In order to make 3D printing more accessible for consumers, providers thus increasingly offer ready-to-print models, easily modifiable templates and simpler 3D editors.

Prices for 3D printers have dropped over the last few years and models which are affordable for consumers have become available. According to industry research, 3D printers costing less than \$1,000 will make up more than 40 per cent of the 1-to-\$2,500 price range by 2019 – a strong increase from currently 25 per cent.¹³⁶ However it is felt by the 3D printing industry that the demand for printers in that price range will come primarily from schools and universities and not consumers.

The materials costs for 3D printing depend very much on the type of material used. Cheaper non-industrial printers typically use polymers, which can cost between £10 and £50 per kg, depending on quality and colour. But other materials such as metals or

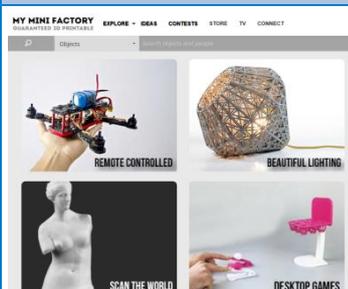
¹³⁶ Gartner (ed.) (2015), Gartner Says Worldwide Shipments of 3D Printers to Reach More Than 490,000 in 2016; <http://www.gartner.com/newsroom/id/3139118>.

ceramic are more expensive and printers for non-polymer materials are also far more costly so that they are normally not used for manufacturing at home. Apart from materials costs, the price of 3D printing services is also to a large degree determined by the amount of space the printed object occupies in the printing machine for the duration of the process. Printing simple small objects can already take up to several hours so that the space required for the manufactured object is blocked during that time.

3D printing is often used in prototyping and product development¹³⁷ or for low volumes of special parts, where flexible local manufacturing can speed up processes considerably in comparison to a time-consuming process of setting up a production line.

One further advantage of 3D printing apart from flexibility is that it can handle complex geometries far better than traditional manufacturing, which can be an additional asset in prototyping or for complex customised items. For mass production of simple consumer items, however, 3D printing is not adequate at this time as it is relatively slow and expensive. It is assumed by experts that the costs will come down eventually not only for plastic materials, which are already offered at low cost, but also for other materials as woods, metals and ceramics.¹³⁸

Case study 13: Platforms for 3D-designs and printing services



Specialised 3D-printing platforms offer services around the setting up 3D-design files and printing services for consumers and businesses. Users can share their design files, post ideas around 3D-printing or purchase printed objects. An UK-based example is My Mini Factory whose platform for 3D-designs complements its retailing business for 3D-printing machines. My Mini Factory has specialised on services for printers converting plastic filament. Others, like 3D-printing giant Materialise (Belgium), offer printing services for a wide variety of materials, from ceramics to steel and titanium.

Source: MyMiniFactory website.

¹³⁷ Gartner (ed.) (2014), Gartner Survey Reveals That High Acquisition and Start-Up Costs Are Delaying Investment in 3D Printers; <http://www.gartner.com/newsroom/id/2940117>.

¹³⁸ For a list of filaments see for example <http://www.imakr.com/en/19-filament?p=3>.

7.3 Shared delivery

Shared or crowd-sourced deliveries involve flexible use of private consumers to deliver parcels. This is realised through internet portals or smartphone applications connected to a central IT system which connects supply and demand. By using the smartphones' GPS capabilities, these systems can also make tracking possible. Companies which offer crowd-sourced deliveries normally have a relatively lean organisation as they are mostly a technological intermediary and do not have to operate a classical delivery network. That also means that the barriers to market entry are relatively low, which explains the relatively high number of start-ups in this market.

Nimber UK, for instance, uses machine learning and big data analysis for its matching algorithms that determine which users get the request to transport an item. The matching process involves past user activity and past routes. It can also involve acquiring the current location of users through geotracking.

Apart from a high internet and smartphone penetration, another prerequisite for shared deliveries to be a reasonably fast delivery model is the number of available couriers in the region. This depends on population density, which is why crowd-sourced deliveries play a larger role in cities and could be more difficult in rural regions, although they could be useful in remote regions if delivery time is less important. Potentially, shared delivery companies could offer delivery services in rural regions where carriers that rely on a network structure either are not present or would be forced to ask a higher price.

Nevertheless, the typical application for shared deliveries is in the ultra-fast same-day segment, where using private consumers or pre-registered bike messengers as couriers can provide a significant cost advantage over using professional drivers. Other advantages of crowd-sourced deliveries can be reduced emissions if consumer couriers deliver parcels on routes they already travel. To which extent this is actually the case and how large the share of full-time 'professional' consumer couriers is, and will be in the future, is unclear.

Crowd-sourced delivery companies can operate in different market segments. The classical model is peer-to-peer (or consumer-to-consumer) delivery, where senders can manually choose who will deliver their items on the basis of the offered price or personal preference. Also, crowd-sourced deliveries can be used for B2C, for example for deliveries of items ordered online which are then carried by private consumers on their way to work. If shared delivery companies manage to provide an appropriate platform, shared delivery can even be used as a cost-efficient means to assist elderly or less mobile consumers with their shopping needs.

While shared deliveries play no significant role in B2C deliveries in the UK at the moment, this could potentially change with any launch of Amazon Flex and Uber Rush in the country. In the USA, both crowd-based delivery services have already been

launched – Uber Rush was launched for peer-to-peer deliveries in 2014 and started offering its service to businesses as well in October 2015¹³⁹ while Amazon Flex was launched in September 2015¹⁴⁰. Since Amazon is quickly introducing its new services in the UK as well - such as its Amazon Prime Now service with ultra-fast deliveries, it can be assumed that a launch of Amazon Flex in the UK is on the company's agenda for the near future.

Finally, the further development of shared deliveries will depend on consumer acceptance of the service. As a study by Endicia of American consumers has shown, 92 per cent said that they are more likely to use traditional delivery services because of familiarity, reliability, security and convenience.¹⁴¹ It is likely that a similar attitude is prevalent in UK consumers. While there is also a lack of experience with shared deliveries in the UK, also because it is not entirely clear if potential disadvantages like security concerns are outweighed by the advantages.

According to a survey by Hermes, only 10 per cent of UK consumers find the idea of a social delivery service appealing.¹⁴² But as discussed above, crowd-sourced deliveries are a diverse field. Consumer surveys on the matter can be deceiving as there can be a confusion over the terminology and activity – peer-to-peer delivery of an item bought on eBay by someone who happens to pass through your town next weekend is a different experience than a one hour city delivery of small packets ordered through a local online-shop delivered by semi-professionals.

Nimber, for instance, perceives no significant consumer concerns in its UK operations but at the moment does not have substantial operations in the classical B2C segment. Nimber finds that its services are often used for transport of large objects like couches or even for animals, or items that are typically excluded from the services of other carriers.

139 Digital Trends (ed.) (2015), Your next pizza might be delivered by Uber's courier service, launching today, <http://www.digitaltrends.com/business/uber-rush-launch/>.

140 Forbes (ed.) (2015), Amazon Launches Flex In Seattle, Will Pay Part-Time Drivers To Deliver Packages; <http://www.forbes.com/sites/abigailtracy/2015/09/29/amazon-launches-flex-in-seattle-will-pay-part-time-drivers-to-deliver-packages/>.

141 Forbes (ed.) (2015), Amazon Launches Flex In Seattle, Will Pay Part-Time Drivers To Deliver Packages; <http://www.forbes.com/sites/abigailtracy/2015/09/29/amazon-launches-flex-in-seattle-will-pay-part-time-drivers-to-deliver-packages/>.

142 "British and German online shoppers want more innovative home delivery services", CEP-Research, 13 Oct. 2015; <https://www.cep-research.com/news/british-and-german-online-shoppers-want-more-innovative-home-delivery-services>.

Case study 14: Uber

Uber Technologies Inc., San Francisco, USA, was started in 2009 to develop and operate services via a mobile app. Uber offers an internet service platform transportation services in 64 countries and had more than 150,000 drivers in the US in 2014, a figure that doubled in 2015.¹⁴³ Drivers are paid weekly by Uber. Commission is reportedly 20 per cent of the fare but new schemes with higher commissions are under preparation.

Uber faces lawsuits in several countries, including the Netherlands, France, Germany and the UK, in connection with established licensed taxi and hire cab businesses. In the UK, the UK High Court ruled that the company's app does not effectively work as a taximeter, so Uber drivers do not have to be licensed.¹⁴⁴

In Germany, Uber is currently only present in Munich and Berlin and the company lost a case against the German taxi association in March 2015. As a result, Uber had to change its business from independent owner drivers to licensed hire car drivers with an additional license for passenger transport. This has led to problems in acquiring a substantial number of new drivers in Germany.

UberRUSH is the delivery section of Uber, and is currently only operational in New York, Chicago, and San Francisco. It seems likely that Uber will expand the service worldwide like its transportation service, but this is yet to be confirmed in an official statement. The company characterises its delivery service as a "demand delivery network" with live tracking features.

The delivery service is organised via software application that is used by the "messenger" (the courier), the e-retailer, and the receiver of the goods. Messengers are registered with Uber and undergo background checks beforehand and ongoing quality checks through a rating system. UberRUSH delivers by bike in New York, van in Chicago and both in San Francisco and will guarantee lost or damaged items up to \$250.¹⁴⁵

The e-retailer registers with UberRUSH and integrates the application into his online store system. The online shopper orders the goods and may choose UberRUSH as a delivery option. The e-retailer gets the order with the delivery request indicating the time needed for delivery by the courier. The e-retailer clicks the new delivery icon to start the process. The messenger who is nearest to the pick-up point of the order will get the delivery request first and has to confirm within 10 seconds if they can complete the delivery. If the messenger does not take the offer, the next available messenger will get the message. A map shows when the messenger will arrive at the shop to pick up the order.

The messenger can be tracked in real time and contacted via mobile phone or text message. The seller can share the tracking link with the customer. UberRUSH notifies the customer when the messenger is arriving. The normal chain of custody process requires that the customer (or a reception attendant) receives the goods unless indicated otherwise by the e-retailer.

The e-retailer is charged \$6 for deliveries within the first mile and \$3 for any added mile and there are slight variations in prices between cities.

Source: Uber website, interview.

¹⁴³ <http://www.businessinsider.com/uber-doubles-its-drivers-in-2015-2015-10?IR=T>

¹⁴⁴ In the UK, only licensed operators, ie black cabs, may run cab services with a taximeter. For judgement see https://www.judiciary.gov.uk/wp-content/uploads/2015/10/tfl_-v_uber-final_approved-2.pdf.

¹⁴⁵ UberRUSH Terms & Conditions as of April 8, 2014.

7.4 Delivery in urban versus rural and remote areas

As consumer delivery services diversify in speed and quality with more convenient options and value-added services, the disparity in terms of services between urban and rural deliveries grows. Many of the abovementioned state-of-the-art technologies and new delivery options are first launched in cities and their expansion to rural areas is not always planned. One of the few examples of the contrary is the DHL drone trial for island deliveries in Germany, but the far larger number of technology-driven developments is reserved for city residents.

Modern last mile delivery developments such as specified delivery time, recipient interaction, same-day delivery and parcel terminals are typically less relevant for people who do not live in larger cities as they are either not available, or only as a reduced version of the full service. This is often a result of the geographical coverage of service providers. For instance, many same-day companies operate locally in larger cities and the geographical coverage of parcel operators can also be limited when compared to Royal Mail. Similarly, shared deliveries play a much smaller role in rural regions and it is highly unlikely that they will be used for B2C in the near future, or at least not for the same types of ultra-fast delivery services. There are not enough potential couriers and the travel distances in rural areas would be too long to realise 1-hour deliveries.

Meanwhile, parcel terminals, as used by Amazon or InPost in the UK as alternative delivery locations, are mostly concentrated in densely populated regions as they are less cost efficient outside cities due to lower volumes. Furthermore, if a parcel terminal is available nearby, recipients living in the country typically have to travel longer distances to get to it. The same holds true for parcel shops as networks are thinner in the country so that alternative delivery locations are generally less convenient in rural regions. One exception could be secure private parcel boxes for receiving and returning parcels, which would help to improve first-time delivery rates and last mile costs in rural regions. It is also where the space to set up such boxes is often available.

The development of delivery time windows is one important example of recent improvements in delivery service quality and are typically bigger windows in rural regions. This is due to the fact that parcel carriers largely base their delivery time window estimates on historical data and send the delivery window to the recipient before the delivery route has been planned. Daily delivery destinations are spread over a much larger area in the case of rural deliveries and different daily routes can make a large difference when it comes to the time when the carrier will pass through a town. On one day, the most efficient route might allow the carrier to drop a parcel off in a town at 9 am while the next day it could be 1 pm. In cities, parcel volumes per area are much higher so there is less variance in delivery routes for B2C carriers, making more precise predictions possible.

But, naturally, for more modern delivery time window services which calculate the estimated delivery time on the fly and constantly inform recipients, this does not apply. Delivery time windows chosen by recipients are also different as they require routes to be planned according to consumer preference. Nevertheless, rural consumers normally have much less choice when it comes to scheduled deliveries due to limited service coverage for premium services. These premium services require dense delivery networks and this requirement remains unmet outside of cities.

Apart from a lack of premium services, there is also still a significant price disparity as retailers forward the carriers' surcharges to consumers. In September 2015, Citizens Advice Scotland reported on developments in deliveries to rural Scotland in its study 'The Postcode Penalty'. While a lower number of retailers surcharged for rural deliveries in 2015 when compared to 2012 (Highlands surcharge down to 44.1 per cent from 49.8 per cent, Islands surcharge down from 62 per cent to 53.1 per cent), the average surcharge applied had risen by 10 per cent (Highlands, adjusted for inflation) and by 15.8 per cent (Islands).

One way to reduce or eliminate cost disadvantages for online shoppers in rural regions is to reduce operating costs for deliveries. This could potentially be achieved by using a shared delivery infrastructure in rural and remote regions as is the case in Scotland where Menzies Distribution offers several options (see Case study 16).

An example of a project where public transport is used for deliveries of goods is the KombiBUS project in a region with a very low population density of merely 40 inhabitants per km² in Northeast Germany. Using the existing bus infrastructure, the transport of goods, post and passengers is combined in order to achieve synergy (see Case study 15).¹⁴⁶ While B2B shipments still dominate, there are plans to extend the service for B2C services to consumers' homes as well.

146 WIK (2014), Design and development of initiatives to support the growth of e-commerce via better functioning parcel delivery systems in Europe. Study for the European Commission DG Internal Market and Services.

Case study 15: KombiBUS (Germany)

KombiBUS combines the transport of goods, post and passengers by using the existing public bus system in a rural area of Brandenburg/Uckermark. The project was initiated and funded by the Federal Ministry of the Interior as part of the rural development project “Services for the Public 2030” (Daseinsvorsorge 2030). Today, a regional transport licensee provides the service without any public funding. The service includes the delivery of goods within the region or to defined delivery hubs (central bus stations with storage facilities). The KombiBUS transports all kinds of goods and luggage including bicycles. All bus stations function as a pick-up and drop-off point but collection of goods for businesses is also offered at any location along the route. Generally, transport orders have to be indicated one day ahead and a last-minute-option is available. KombiBUS also works as a transport partner for mail, express and parcel service providers.

KombiBUS has positively influenced regional development. For example, farmers who supply dairy products, cheeses, and other local farm products use the new transport system to expand their sales area to Berlin.

Source: WIK research and KombiBUS: Effizienter ÖPNV in ländlichen Regionen. Mobilität sichern, Zukunft gestalten [„Combined bus: efficient local public transport in rural areas. Retaining mobility, designing the future”] see <http://kombibus.de>.

Case study 16: Menzies Distribution

Menzies Distribution runs its own delivery network to Scottish Highlands and Islands areas and also major towns in the UK. Menzies’ special feature is its integrated IT solution which allows it to deliver parcels from other carriers like Yodel, Parcelforce, UPS, DPD and others to consumers in Scotland. As the costs of the last mile are especially high in remote areas of Scotland, it is economic for these carriers to share resources, and have their parcels commonly delivered by Menzies. Prices for senders start at £6.25 (excl. VAT).

Tracking of parcels is possible for each of the carriers due to Menzies’ IT solution which works on a single handheld device used by all delivery drivers. Menzies Distribution also collects parcels in remote areas for own delivery or passes them on to other carriers. The company makes 9,000 deliveries and about 800 pick-ups daily. Menzies plans to expand its services and has only recently acquired Inverness-based AJG Parcels and Oban Express, a parcel carrier delivering in western Scotland and the Hebrides.

Source: Menzies Distribution website, <https://www.pressandjournal.co.uk/fp/business/scotland-business/604698/menzies-focuses-hard-reach-areas-north-following-ajg-acquisition/>.

An extension of this model for rural deliveries could potentially be achieved by using peer-to-peer delivery models. For instance, commuters could transport parcels and deliver them to their neighbours when coming back from work. While such a model could potentially reduce delivery costs and lower rural surcharges, this would not necessarily improve service quality and speed, which could even decline as a result. This model would depend on the willingness of parcel operators to accept a shared final mile infrastructure.

Case study 17: Electronic delivery in rural areas by Finnish Post

Between 2010 and 2013, Finnish Post undertook several pilots for electronic delivery in rural areas. The first pilot scheme took place in the rural village of Anttila where 122 households and several small businesses participated.¹⁴⁷ Letters and daily newspapers were scanned or delivered to the participants in digital format. After scanning, the mail was put back into the envelope and delivered to a mail locker at the village shop. Whenever receivers did not collect their letters from the box, they were delivered to their mailbox twice a week. Parcels were delivered to a locker situated at the shop on a daily basis.

The pilot has been repeated on islands in the Southwestern archipelago of Finland.¹⁴⁸ Here, participants received their letters and daily newspapers in digital format early in the morning. This enabled receivers on islands to read their newspaper at the same time as subscribers on the mainland.

The pilot was successful and Finnish Post stated that about 75 per cent of participants wanted to continue electronic delivery of mail items. However, as the scanning of mail and newspapers was very costly, there are no plans to roll-out the service on a broader basis.¹⁴⁹ However, the parcel locker used in the pilot to receive parcels was also rated very positively by participants. Finnish Post has decided to develop the product further and has introduced 'SmartPost' parcel lockers on a broader basis.

Source: Itella Annual Report 2010 and 2013, and Itella (2011), Universal service and electronic delivery in Finland: Conclusions from Itella's field experiment, presentation at the 13th Koenigswinter Seminar on Postal Economics.

Case study 18: Rural delivery services in Sweden

In Sweden, the standard postal service for single houses in rural areas, such as summer homes or single farms, is to collect mail from a mailbox placed at the intersection of the street leading to a house with the main road. Whereas for all households in Sweden, parcels have to be collected from the post office. For elderly persons or those with reduced mobility in rural areas, a publicly funded service for delivery to the boundaries of the premises or even to the main house is available.¹⁵⁰

Consumers wishing to be served by this rural postal service have to satisfy several conditions, such as being older than 80 years for all persons in the household or having a disability. The services covers delivery and collection of all postal items like letters, parcels, registered or express items. A request for buying stamps can be made online at least one day before the purchase.

Source: PostNord, <http://www.postnord.se/sv/privat/ta-emot/post-hem/Sidor/posttjanst-i-glesbygd.aspx>.

¹⁴⁷ See Itella (2010), Annual Report 2010, p. 32 and Itella (2011), Universal service and electronic delivery in Finland: Conclusions from Itella's field experiment, presentation at the 13th Koenigswinter Seminar on Postal Economics.

¹⁴⁸ See Itella (2014), Annual Report 2013, p. 24.

¹⁴⁹ See Stelacon (2015), Postservice i glesbygd - En nordisk jaemfoerelse.

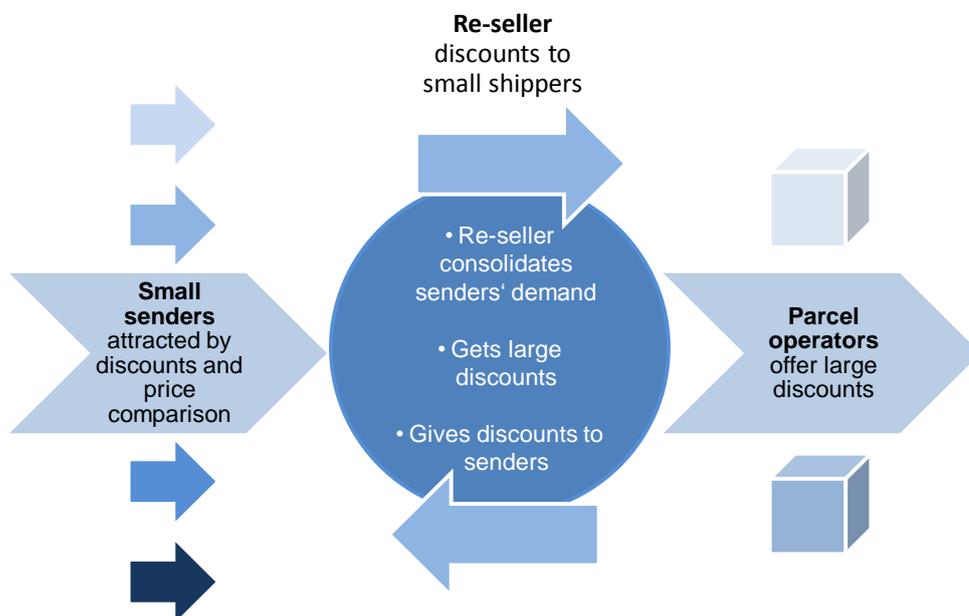
¹⁵⁰ See PostNord, <http://www.postnord.se/sv/privat/ta-emot/post-hem/Sidor/posttjanst-i-glesbygd.aspx>.

7.5 Re-sellers and shipping platforms

Re-sellers or price comparison sites for parcel services have become much more common for UK consumer deliveries in recent years. Price comparison sites operate using a business model that consolidates their customers' demand in order to get higher discounts from parcel carriers. The customers then benefit from these discounts through lower rates than they would normally pay while the re-seller keeps a certain margin to himself. Furthermore, re-sellers often also have price comparison features so that senders can choose the cheapest or otherwise best service for sending a specific item to a certain destination – but there are also pure price comparison websites which do not offer any discounts.

While this is not a technological innovation in the strict sense, it is a significant development in the parcel business which is driven by information technology. The technological challenge for re-sellers is to integrate the parcel carrier's processes in its system so that customers can order shipments directly from the re-seller's website or by means of an application programming interface (API).

Figure 27: Parcel re-sellers' business model, schematic representation



Source: ITA graphic.

Originally, re-sellers mostly operated in the B2B segment because it offers higher margins. However as of late, they have been more active in consumer deliveries, presumably as a result of mostly stagnating B2B volumes and high B2C growth rates. Since margins are very thin in the UK consumer delivery market, re-sellers tend to focus

on those customer groups which have the highest relative margins within the market, which are low-volume senders such as SMEs and consumers.

For the parcel carrier industry, re-sellers can create relatively stable demand and perhaps savings in sales staff costs, but they are also competitors. Especially when it comes to profitable consumer groups which puts further pressure on margins in the UK B2C delivery market.

Re-sellers and price comparison sites strongly increase transparency for senders as prices for different weights and dimensions and different destinations can be compared instantly. This would otherwise be a very time-consuming process – especially for lower-volume shippers such as private senders or SMEs.

Re-sellers generally are not liable in cases of damage or delay – liability remains with the parcel carriers. This is of particular importance when price comparison sites re-sell parcel services to consumers who may not be fully aware of the relation between re-sellers and parcel carriers and ways to seek redress if there is a problem with their delivery.¹⁵¹

Case study 19: Re-sellers for shipping services: Parcel Monkey



Parcel Monkey offers a comparison tool for domestic and international parcel deliveries at discounted rates. Parcel Monkey compares the delivery services and prices of Parcelforce, DHL, DX, DPD, Asendia, CitySprint, Trak Pak and other parcel carriers.

Consumers submit their parcel's dimensions and delivery address and receive a list with the most popular courier services including the service name, the price, its particular features and the latest five customer reviews. The sender pays for the service online and the parcel is collected from their home or work, then delivered.

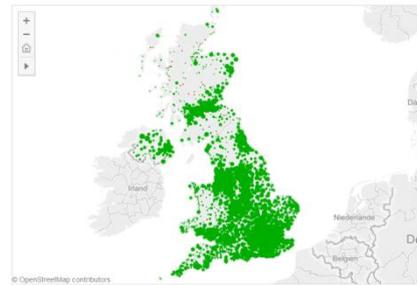
Parcelmonkey is financed by discounts they obtain from parcel operators through grouping together all of their customers' shipments and booking through one account. A part of these savings is passed to the customers via discounted prices.

Source: Parcel Monkey website.

¹⁵¹ See <http://www.moneywise.co.uk/scams-rip-offs/consumer-rights/parcel-monkey-answers-its-critics>.

Case study 20: Re-sellers for shipping services: MetaPack

Carrier Heat Map



MetaPack provides delivery management solutions for e-retailers or other senders and thus facilitates interoperability between senders and carriers.

MetaPack provides a single interface to a wide range of carriers with more than 300 international carriers available. Senders can pick from a delivery option and produce labels for the selected carrier. MetaPack also enables retailers to offer a wider selection of delivery options by allocating the suitable carrier to the nature of the order.

In addition, Metapack increases market transparency on quality of parcel services across the UK. In its carrier heat map, MetaPack displays an indicator measuring how the top 10 UK parcel carriers perform across the UK (see map on the left) for clients. This performance index is made up of information about the speed and quality of delivery available to MetaPack through the carrier's tracking information.

As the heat map is one of Metapacks' core services, the computation of the performance index is confidential.

Source: Metapack website.

7.6 Sustainable operations

While a number of parcel carriers today offer carbon-neutral services, which compensate emissions through investments in environmental projects, many have also invested considerably in their facilities and fleet in order to reduce emissions. This development is driven by consumers' environmental concerns, stricter regulations, image-related initiatives and the desire to save on energy costs.

For instance, Royal Mail aims to reduce the emissions resulting from its UKPIL operations by 20 per cent by 2020/21, compared to 2004/05. As part of this process, energy efficiency is being upgraded in both Royal Mail's buildings and fleet (34 per cent and 65 per cent of its total carbon footprint, respectively).

Typical measures to upgrade the energy efficiency of facilities used in parcel operations are using energy-efficient LED lighting. For instance, Hermes, generated 30 per cent energy savings in its facilities and reduced CO₂ emissions by 25 tonnes per location by switching over to LED lights in several of its depots in 2012.¹⁵²

Meanwhile, as Royal Mail's figures show, fleet emissions make up a large proportion of the total emissions. Therefore, technological improvements in delivery fleets can have a significant impact on overall emission reduction and energy efficiency. Apart from

¹⁵² "Hermes UK cuts down CO₂ emissions through sustainable operations", CEP-Research, 22 Jun. 2012; <https://www.cep-research.com/news/hermes-uk-cuts-down-co2-emissions-through-sustainable-operations>.

measures like route optimisation and technological improvements in conventional vehicles, electrical vehicles and other alternative fuels are becoming more common. For consumers, this is noticeable on the last mile, where innovations such as state-of-the-art electric vehicles and electrically-assisted cargo bikes reduce pollution and thus improve the quality of life, especially in cities. According to Hermes, 36 per cent of UK recipients find the idea of using electric vehicles for deliveries appealing.¹⁵³

Although still limited by their comparatively short range, electric vehicles have become serious alternatives to conventional vehicles as power cell technology improves.¹⁵⁴ They are still limited to short-distance applications such as city deliveries but range extenders, quick recharging and replacement of the power cell with a fresh unit have improved their usability. The obvious advantage of electric vehicles is that they are emission-free – at least when ignoring the production process and how the energy used is generated. Furthermore, electric vehicles include not only classical delivery vans but also e-bikes, which can be used in city deliveries.¹⁵⁵

Several postal operators have already integrated fully electric vehicles in their fleet, such as La Poste and DPDHL. This is one of the fields of technology where postal and parcel operators can actively drive innovation through their demand since they represent an important customer segment for the automotive industry. Royal Mail tested hydrogen-powered delivery vans in a trial on the isle of Lewis in 2010 but has not pursued this further.¹⁵⁶ At the moment, Royal Mail attempts to reach its emission reduction goals through more fuel-efficient diesel-powered vehicles such as double-deck trailers and through improving driver behaviour.

Examples for the use of electric vehicles by parcel operators include Hermes, who moved on to all-electric delivery vehicles for all its central London deliveries in 2014.¹⁵⁷ More recently cargo bikes have been tested as alternatives to conventional delivery by van by UK start-up Outspoken.¹⁵⁸ UPS is testing electrically supported cargo trikes in Hamburg and Basel.¹⁵⁹

153 “British and German online shoppers want more innovative home delivery services”, CEP-Research, 13 Oct. 2015; <https://www.cep-research.com/news/british-and-german-online-shoppers-want-more-innovative-home-delivery-services>.

154 One example: <http://thechargingpoint.azurewebsites.net/news/French-order-15000-Renault-Kangoo-ZE-electric-vans.html>

155 “Why cargo bike deliveries are taking over the UK’s cities”, The Guardian, 10 June 2015, <http://www.theguardian.com/environment/bike-blog/2015/jun/10/why-cargo-bike-deliveries-are-taking-over-the-uks-cities>.

156 “Royal Mail goes green in Hebrides”, The Guardian, 7 Sept. 2010; <http://www.theguardian.com/uk/2010/sep/07/royal-mail-green-hebrides-hydrogen>.

157 Hermes (ed.), Silence is Golden; <https://www.hermesworld.com/en/about-us/hermes-group/hermes-uk/responsibility/>.

158 “Why cargo bike deliveries are taking over the UK’s cities”, The Guardian, 10 Jun. 2015; <http://www.theguardian.com/environment/bike-blog/2015/jun/10/why-cargo-bike-deliveries-are-taking-over-the-uks-cities>.

159 UPS (ed.) (2015), UPS Tests Electric Cargo Bike in Basel; <https://pressroom.ups.com/pressroom/ContentDetailsViewer.page?ConceptType=PressReleases&id=1436209935614-200>.

Overall electric vehicles still play a comparatively small role in energy efficiency measures – especially as both consider themselves as forerunners in electric vehicle usage. This is not surprising as electric vehicles are still relatively expensive and suffer from the abovementioned deficits in terms of limited range which restricts their usability.

Postal operators are also using delivery bikes with electrical motors. Deutsche Post, who has been operating an electric bike fleet since 2000 has started developing a new model in 2013, and La Poste operate a large electric bike fleet. Royal Mail, on the other hand, has stopped using bikes for deliveries and has switched over to light trolleys and vans for safety reasons and because of the shift in the mail mix to parcels over letters.

The future adoption of electric vehicles and alternative fuels in general relies strongly on cost developments as well as technological improvements and an adequate refuelling infrastructure. It also requires official initiatives such as low-emission zones and subsidies. Cost-driven sustainability measures concentrate mostly on improving the operational efficiency with as little investment possible and are subject to change if environmental regulations are adjusted. For example, the London Congestion Charge which applies to most vehicles entering Central London might have a demand-stimulating effect on electrified vehicle solutions in future.

8 Impacts of technology in the postal sector

The following section presents our assessments of the current and future consumer impact of various technologies on market developments and products and services in the postal sector. For this chapter, we have identified 15 trends that have the potential to cause severe changes, challenges, or even disruptions in the postal sector.

We examine all trends with regards to their characteristics, including a short description of the innovation, its current status of development, as well as prospects and preconditions for potential future development. We also assess the impacts (if applicable) on operators costs and supply chains and consumer and retail demand for delivery services and product innovations. Finally, we analyse the impacts on consumers and include potential benefits and concerns.

We have chosen the following innovations for examination:

1. Automation in letter and parcel sorting
2. Extended track and trace for parcels and value-added mail services
3. Growth and competition in the parcel market
4. Sustainability
5. E-substitution
6. Predictable delivery and redirected delivery
7. Same-day delivery
8. Variety of PUDO solutions (pick-up and drop-off)
9. Shipping platforms for consumers
10. Sharing economy
11. Consolidating parcel volumes in rural areas
12. Automated vehicles
13. Robots in postal logistics
14. Delivery by drones
15. 3D printing

8.1 Automation in letter and parcel sorting

Characteristics

Postal operators and parcel carriers rely heavily on advanced technology in daily operations to become more efficient.

State of development

Companies are investing in automation as prices and margins are at low levels and technology is a key enabler for cost savings.

Competition is a main driver for using technology to achieve a higher operational efficiency. In letter sorting, automation helps to a large extent to conquer declining volumes and revenues. In the B2C and C2C parcel delivery market, changes are dynamic as the market is very competitive and growing fast due to e-commerce.

Demand for new and improved services requires parcel carriers to modernise and upgrade their sorting technology including IT.



Prospects

More operational efficiency is generally realised through automation and centralisation. The process gained momentum 10-15 years ago and was driven by privatisation of national European postal operators.

- Many operators have centralised mail operations by reducing the number of mail centres and delivery offices. This results in fewer but larger facilities.
- Letter mail is sorted to a more and more granular level. At most, companies letters are able to be automatically sequenced to post codes and even street level.
- In parcel sorting, carriers start investment programmes to upgrade their networks. Parcel sorting capacities are increasing significantly (eg more than 1 million at Hermes' main hub and more than 1.4 million at DPD per day).

Realisation: Ongoing process



Preconditions

- Letter sorting automation technology has to accurately identify the destination address and has to be able to handle regular letters as well as flats, magazines, catalogues and small packets.
- Parcel sorting facilities have to be connected by linehaul routes that are optimised through software tools that help to deploy the right size and number of vehicles.
- Multi-sorters can be used with all mail items from letters to small and large parcels.



Impact of innovation

... on operators costs and supply chains

- Advanced optical character recognition (OCR) allows sorting of hand-written and printed addresses in over 90 per cent of letters.
- Approximately 70 per cent of non-regular sized letters can be sorted using OCR. This means that operators have still have to do costly manual sorting.
- Sequence sorting of letters to street level reduces time and effort for manual sorting at delivery offices. Manual sorting is mainly concentrated on merging regular letters and larger items into a bundle that the postman carries on delivery rounds.
- Multi-sorters can be efficient for postal operators with low letter and parcel volumes.
- Specialised sorting machines are more efficient for large volumes which can be consolidated through centralised sorting infrastructure.

... on consumer demand

- None.

... on the retail demand for delivery services

- State-of-the art technology allows faster sorting and enables e-retailers to offer next day delivery as a standard option.
- Upgrades in parcel sorting allow carriers to push back cut-off times for next day delivery so that late orders from e-retailers can still be delivered the next day.

... on product innovation

- Automation is generally combined with new integrated options for barcoding and indirectly enables new products that include better track and trace.



Impacts on consumers

Benefits

- Consumers may benefit from steady prices for letters despite volume decrease. This benefits in particular consumers with low incomes and those who do not want or cannot use digital communication services, if for example they lack digital skills or live in areas without reliable internet access.
- Parcel automation enables faster delivery and more convenient e-commerce at low prices.
- Next day delivery to the door has become standard for some groups of consumers.

Concerns

- None.

8.2 Extended track and trace for parcels and value-added mail services

Characteristics

Carriers are introducing new barcoding systems based on 2D barcoding that include more information on shipping and on the receivers' shopping behaviour. Extended track and trace is also being used to develop value-added mail services.

State of development

One-dimensional barcodes are widely established in the postal sector all over the world. They improve automated sorting of letters and parcels as well as enable track and trace services and proof of delivery. 2D barcodes are becoming the new standard in e-commerce as e-retailers use these codes as shipment labels. 2D barcodes can carry more information on the product, the shipment, and the receiver and are a prerequisite for extensive analysis of consumer data.

2D barcodes are also being applied for value-added mail services. They enable retailers to make personalised offers and provide discounts tailored to the customers' preferences rather than sending out standardised mailings. Senders applying 2D barcodes on letters are also better informed on the progress of the delivery process, incorrect addresses and successful deliveries.



Prospects

Overall prospects

- 2D barcodes will become the standard for address information and routing instructions. However, many postal operators still might use one-dimensional barcodes within their sorting facilities because they can be scanned from a larger distance or while they are moving at higher speed.
- Postal operators offer 2D barcode solutions that have to be implemented by their customers.

Parcel services

- 2D barcoding will become the standard in parcel delivery, while it remains to be seen if radio-frequency identification (RFID) tags are a cost-effective and viable solution.
- Extended tracking information will be available to e-retailers and the receivers.
- RFID tags will remain a niche application in postal services within the next three to five years. While they contain more reliable and detailed information, RFID tags are still expensive and fragile. They are used where seamless control of goods (temperature and length of shipping process) is important, such as the field of medical supplies.

- Fingerprinting of parcels is a relatively new option for parcel identification. If prices for high-quality cameras fall this might be a niche for sorting of unreadable labels. However, on the downside fingerprinting does not allow to insert additional messages to the receivers like 2D barcodes do. In addition, it seems unlikely for e-retailers to switch to fingerprinting technology in the foreseeable future.

Mail services

- In future, senders of bulk letter mail will use 2D barcodes to make use of track and trace information and to benefit from additional features.
- 2D barcodes in letter mail can be used for a wide range of applications, from senders of direct mail to public authorities sending legal information and businesses who want to inform customers.
- Business senders may use value-added letter services to reach new customers. Digital marketing response rates are low, so physical mailing is becoming more attractive even if costs per letter are higher. This will drive demand for direct mail and value-added letter services in contrast to other physical mail streams.

Realisation: ongoing process



Preconditions

- Parcel carriers and e-retailers have to use common interfaces to exchange information (standardisation of APIs).
- Online-shoppers can make use of 2D barcode information by using smart phone applications.
- To replace barcodes, costs for tags and RFID readers have to decrease and technical issues have to be solved, such as power supply and life span of tags.



Impact of innovation

... on operators costs and supply chains

Overall

- Costs are not necessarily a driver for the shift towards 2D. Scanners are more expensive and slower in sorting operations.
- Flexibility and capacity for more information are useful for track and trace. Carriers can offer more detailed performance information to senders and new product solutions are made possible.

Parcel services

- Supply chains are extended to the e-retailer who will use the same barcode for marketing as well as customer data and shipment performance analysis.
- 2D barcodes are usually part of an integrated shipping solution with integrated billing services that allow the sender to select or modify shipment and billing details online, print labels and generate all necessary documentations.

Mail services

- In letter services, where tracked services is a new development, senders are able to align other measures (eg staffing of call centres) to the share of mail successful delivered and thus save costs.

... on consumer demand

Parcel services

- Consumers willingness to use online offers increases as tracking accuracy increases.

Mail services

- Additional discount offers included in the 2D barcode can increase demand for parcel delivery. For example, consumers can take the barcode contained within, or on the envelope of, a direct mail letter to the nearest branch of an e-retailer and receive discounts in store. The mailing may also contain a Qualified Response (QR) code leading the customer to a personalised landing page.

... on the retail demand for delivery services

- E-retailers have to use new barcode solutions of each carrier and adjust their systems accordingly.
- Switching between carriers is possible but requires software configurations, new label printers and some staff training. Due to the additional costs of implementing track and trace, smaller e-retailers might refrain from using several carriers to avoid the effort.
- If a sender does not use the 2D barcode system of a carrier this might be reflected in the price for the delivery service.

... on product innovation

- New kinds of services are made possible.
- 2D barcodes contain additional information for use by receivers with smartphone apps.
- Senders of letter mail can include discount offers in the barcode that are personalised.



Impacts on consumers

Benefits

- Tracking information becomes more accurate, making delivery services more reliable for consumers.
- Consumers benefit from personalised offers included in parcel or letter barcodes.

Concerns

- Privacy concerns for consumers may arise if e-retailers use the barcode to add information on personalised offers. This could potentially include personal information.

8.3 Growth and competition in the parcel market

Characteristics

As the parcel market grows, competition will increase. Established parcel carriers will have to compete with courier and express service providers as well as with new players such as consolidators and e-retailers with their own logistics.

State of development

With the growth of B2C parcel volumes, established parcel carriers have been fighting for a slice of the cake. All major parcel operators, even those with a traditional focus on B2B services, have increased their activities in B2C services and expanded capacity during the last few years. In addition, new players have entered the market. Parcel consolidators and platforms do not provide their own logistics but consolidate demand from small business senders and creates pressure on prices. Amazon has built up its own logistics and uses established parcel carriers as a buffer for peak volumes.



Prospects

As the parcel market continues to grow it will attract new players, and incentivize established operators to step up capacity. Market shares of players who are strong in the B2C segment will be under pressure, such as Royal Mail, as B2B players push into this business.

- Margins for parcel carriers will remain tight as long as free and fast delivery is important to consumers.
- Price competition will remain important.
- In addition, competition will also be carried out on delivery options offered by parcel carriers.

Realisation: ongoing process



Preconditions

- Parcel markets depend heavily on development of e-commerce. Growth of online shopping is required to boost parcel markets.
- Positive economic growth also has an impact on parcel markets.



Impact of growth and competition

... on operators costs and supply chains

- In general, increased workload results in lower average costs per piece for parcel carriers.
- Yet if carriers enhance their capacity this effect might partly be compensated.

... on consumer demand

- Competition is an excellent means of preventing excessive prices.
- Consumers will be able to benefit from low price increases, and potentially might also experience price reductions for certain products.

... on the retail demand for delivery services

- Increasing competition will keep margins of parcel carriers low which benefits e-retailers with large volumes to ship.
- E-retailers will benefit from more choice between parcel carriers and will be able to bargain better conditions.

... on product innovation

- Increasing competition will drive the innovation of parcel carriers.
- Innovation will take place in parcel sorting to save costs.
- Innovations with an impact on consumers, such as new delivery options and improved tracking, will also be important factors in a competitive market.



Impacts on consumers

Benefits

- Consumer prices for parcel services will be kept quite low which is important for C2X parcels and returns.
- Prices will remain low, enabling e-retailers to offer free shipping.
- Consumers will benefit from delivery innovations created by competition.

Concerns

- Consumers can only benefit from new services fostered by the competitive parcel market if they have reliable internet access and live in areas served by new players.

8.4 Sustainability

Characteristics

Parcel carriers try reducing their carbon footprint.

State of development

Carriers invest in their facilities and fleet to contribute to a healthy environment, not only because they have to meet regulatory requirements. Sustainability is also driven by consumers' concerns. It can be seen as an important marketing instrument today. Not only e-retailers specialised in eco-friendly clothing or organic food consider the image of a carrier when searching for adequate shipping solutions. Despite this, reducing emissions, using energy saving technology and optimising routes results in cost savings for carriers, especially when prices for energy increase.



Prospects

Programmes for “green” delivery are part of most integrated carriers and national postal operators.

- Many parcel carriers offer carbon neutral services. By investing in environmental programmes they compensate their emissions. For example, in UK Royal Mail has achieved Carbon Trust Standard by reducing carbon emissions.
- Other measures include the implementation of energy-efficient LED lighting and the reduction of emissions through fleet modernisation.
- Several postal operators replace a part of their conventional fleet with electric vehicles, such as La Poste, Hermes, and DHL, or have started trials to do so like Royal Mail. While electric bikes and scooters play a more and more important role, the proportion of electric cars and vans is still comparatively small across all carriers.

Realisation: ongoing process



Preconditions

- Consumer concerns and interest in environmental issues has to remain strong.
- E-retailers have to acknowledge the efforts of carriers through prestige advertising and have to be willing to pay shipping prices accordingly.
- “Green” initiatives can be combined with cost savings programmes within the company.
- Electric vehicles are still more expensive than traditional cars but mass production of batteries and tax incentives may reduce prices in future.



Impact of innovation

... on operators costs and supply chains

- Parcel carriers revise their indoor and outdoor operations to save energy. “Green” thinking becomes a part of efficiency measures because it helps reduce costs.
- Companies invest in fully electric vehicles and thus drive demand since they are an important customer segment.

... on consumer demand

- Some consumer segments who would otherwise refrain from online ordering will use e-retailing under the condition that is not harmful to the environment.
- Shopping experiences might become more satisfactory for quality conscious consumers.

... on the retail demand for delivery services

- So-called climate-neutral shipping can also be used as a marketing tool by e-retailers. Companies that sell environmentally friendly goods or high-priced goods respectively are more likely to advertise “green” parcel delivery.

... on product innovation

- New kinds of parcel delivery services are made possible.
- The technological development of long-lasting batteries for electric vehicles, dedicated power stations for faster recharge and options to enhance range and speed of electronic vehicles may be overcome sooner if demand in the postal sector increases.



Impacts on consumers

Benefits

- By using electric vehicles, inner city pollution can be reduced although delivery traffic increases.
- Overall consideration of environmental issues contributes to a safe environment for all consumers. Positive environmental effects could increase if consumers opt for delivery to alternative delivery points and use their bike or electric car to pick up their parcel.
- Cost reductions achieved through green logistics may stabilise consumer prices for postal services.

Concerns

- Programmes that reduce carbon footprints have to be monitored and certified to gain consumer trust and enhance credibility beyond a mere marketing campaign.

8.5 E-substitution

Characteristics

Physical letters are increasingly substituted by digital communication.

State of development

Letter volumes today consist mainly of B2C transaction mail, advertising mail, and newspapers / magazines. C2C communication has almost completely migrated to digital channels. Overall, UK addressed letter volumes have declined by 4 per cent during the last few years. Reasons for this are manifold, but electronic substitution clearly plays a role. Business senders are increasingly relying on digital channels for communicating with customers and suppliers, and use different forms of digital communication such as email, social networks and secure internet-based communication portals.



Prospects

As the Millennial generation is in or approaching professional life, digital communication channels will become more widely accepted. Consumers not only prefer digital communication for sending information to other consumers but also to businesses, conceiving it as the most simple and convenient way of communicating.

- Consumers will prefer digital channels even on the receiving side,.
- Millennials are not inclined to store paper records.
- There will be less security concerns.
- Conversion to digital communication will not be homogenous as some consumer groups are more willing to switch than others.

An exception to this trend might be direct mail. With the decrease of letter mail, receivers spend on average more time with each piece of mail arriving in the letterbox.

- This results in an increasing awareness of addressed advertising mail.
- Advertisers may stabilise or even increase their mail volumes.

Realisation: ongoing process



Preconditions

- The most important preconditions for accelerated substitution have already taken place: the use of digital channels by the generations to come at an early age.
- On the one hand, a more pronounced government strategy towards secure digital communication and public use of digital channels, will promote substitution.
- On the other hand, security concerns, internet fraud and leaks of consumer data will slow down e-substitution.
- Security standards and measures taken by government and / or businesses when communicating with consumers might help to overcome security concerns.



Impact of innovation

... on operators costs and supply chains

- Mail service providers, especially Royal Mail, will have to cope with declining working load of their mail centres and delivery offices.
- Average costs per piece will grow as a result.
- Mail logistics and delivery networks will be oversized.
- It will be essential for providers to re-organise logistics and delivery networks, and to handle remaining mail volumes more efficiently to fight increasing costs.
- Mail access networks will also be under pressure.

... on consumer demand

- Consumers' demand for mail services will decline on average.
- A small share of consumers without reliable internet access will still rely on mail for communication purposes.
- As mail logistics and access networks are re-organised, the density of street letter boxes and Post Offices might be reduced.
- Vulnerable consumer groups, those who cannot access the internet or do not want to do so, might be affected by e-substitution. Those who lack digital literacy are generally not able to benefit from digital technologies as they have no choice between physical or digital communication channels, even if internet access is available. Consumers living in areas without reliable internet access have severe problems communicating digitally by downloading information or receiving emails with large attachments.

... on the retail demand for delivery services

- Retail demand for mail services will decline, with the exception of addressed advertisements.

- Businesses will be less affected by reorganisation of networks as they have means to transport mail to access points or use hybrid mail services including mail production.

... on product innovation

- Mail operators will have find innovative mail products with an added value for business senders.
- Mail services with growth and innovative potential will include direct mail, large letters and tracked services due to demand from e-retailers.



Impacts on consumers

Future impacts of e-substitution on consumers will depend to a large degree on the reaction of mail service providers, businesses using mail services and the government's digital strategy.

Benefits

- Consumers have greater choice between communication channels. They choose those channels which most suit their preferences.
- Digital channels make it easier for consumers with reduced mobility to communicate as they can do it from home.

Concerns

- Ongoing substitution of letters might increase concerns about confidentiality of digital communication and raise security concerns.
- Consumers not able or willing to use digital communication do not have the choice between different channels. Consumers in areas without reliable internet access may not have a choice either. Elderly people are also less likely to be familiar with digital technology.
- Business senders may charge to send out physical letters and statements to consumers.

8.6 Predictable delivery and redirected delivery

Characteristics

E-retailers and carriers announce the exact date and time of delivery and enable the receiver to redirect the parcel to another location.

State of development

Consumers are kept up-to-date about their online orders. E-retailers send e-mails or text message with the exact delivery times. Firstly, the receiver will get a confirmation with the expected date of delivery. Secondly, they will get a notice when the e-retailer has picked and packed the order and hands it over to their logistics partner at the warehouse. Thirdly, the receiver will be informed that the parcel has left the warehouse and is on its way.

In a last step the receiver will get more precise information about the date and time of delivery sent by the carrier. Beyond that, some carriers offer to redirect the parcel to another pick-up point, such as the office address instead of the home address, a near-by Post Office or a Click and Collect partner.



Prospects

Predictable delivery is widely used already and parcel carriers are gradually improving this innovation. Experts assume that predictable delivery will be a commodity in less than three years as online shoppers highly value the convenience of reliable delivery. In addition, predictable delivery reduces the number of delivery attempts and costs for the carrier.

- Track and trace information is already a standard in e-commerce.
- Predictable delivery and real-time redirection of delivery might become a standard within the next three years.
- To reduce time windows for delivery and time-limits for redirection messages is going to be a competitive advantage.

Realisation: < 3 years



Preconditions

- Parcel carriers and e-retailers have to use common interfaces to exchange information (standardisation of APIs).
- Online shoppers have to be “always online”, using smart phones for last-minute redirections.
- For more convenience, online shoppers have to register and rank their preferred delivery addresses.



Impact of innovation

... on operators costs and supply chains

- When e-retailers choose their carriers they will take into consideration their ability to meet predicted delivery times and their options for real-time redirection. Pricing for these offers has to remain competitive. Options will become a standard and not be charged extra.
- Parcel carriers have to invest in more refined track and trace technology and their tools for real-time route-optimisation.
- Supply chains have to be integrated. Parcel carriers services have to be integrated into shop systems of e-retailers.
- More successful first attempt deliveries will help to save costs for re-deliveries or storage.

... on consumer demand

- Better predict solutions might increase demand on time-critical items such as food delivery.

... on the retail demand for delivery services

- Predict solutions can be made available all over the country for the same price. However, the use of redirection options might be limited in rural areas due to fewer pick-up solutions compared to urban areas.
- Predict services can become a distinctive feature of carriers, especially when it comes to reducing the time-window for delivery and time span during the carrier can realise the requested redelivery/redirection request.



Impacts on consumers

Benefits

- Consumers will benefit from predict information because e-commerce shopping will become more reliable.
- As predictable delivery is valued more over same-day delivery carriers will have to invest in a variety of solutions and price structures to benefit consumers.
- Predict services are offered at no extra charge.

Concerns

- Consumers must inform different service providers about their location during the day or even during the week. For example, office times and absence from home can be concluded from delivery preferences.
- The registration of preferred delivery addresses with several e-retailers and carriers imply the risk of misuse of sensitive data or data infringements by third parties.
- Consumers in rural and remote areas might not benefit to the same extent as in urban areas. Predict and redirect services are much more precise in urban areas where distances between delivery addresses are short and parcel volumes are higher.
- Consumers can only participate in redirecting or postponing delivery if they have a mobile device with internet access. Some vulnerable consumer groups like the digitally excluded and elderly consumers with low-income may not benefit at all.

8.7 Same-day delivery

Characteristics

Online shoppers receiving goods the same day as ordering the product. Same-day will become a widely used delivery option.

State of development

Same-day delivery is increasingly offered by large e-retailers. Amazon is a forerunner in this field and has set a standard in UK and other European countries. Main options include:

1. Point-to-point same-day delivery: goods are picked up by a courier where they are stocked and are delivered to the customer. This model also allows one-hour delivery or other options where the delivery window is defined.
2. Off-peak same-day delivery: orders are consolidated and delivered on a delivery round in the evening when the receivers are at home. Time windows for these delivery options are the same day goods are ordered.

Same-day delivery is already on offer for inner city regions within the UK, by Amazon in London, Birmingham, Newcastle and others. Cross-channel retailers are able to offer same-day as a delivery or pick-up service.

Large e-retailers like Amazon have expanded the choices for same-day delivery to the choice of delivery windows, within one hour, within two hours or customer-defined delivery slots, even at weekends.



Prospects

Same-day delivery is less popular than a predict delivery service. Consumers favour reliable delivery services over prompt delivery. Willingness to pay for delivery in e-commerce is low. However, large e-retailers like Amazon are pushing same-day options aggressively.

- Next day delivery is no longer premium service, it is the new standard. Two day delivery might stay as an economy option in future.

Experts expect two possible developments for same-day delivery:

- (1) In the short run, same-day remains a niche for certain products, such as food, gifts and flowers. Some assume that delivery of alcohol will be one of the most successful products.
- (2) Within the next three years, dominant e-retailers will aggressively push same-day services and set a standard in the market.

- Today, the main area of same-day delivery is B2B and not B2C e-commerce and this will be the case during the next few years.

Realisation: < 3 years



Preconditions

- Retailer warehouse networks have to be decentralised to allow instant shipping. Most UK retailers use only one warehouse centrally situated in the Midlands. Amazon has established a network of several warehouses all over the country.
- Same-day delivery, or options like one-hour delivery, require the implementation of a differentiated price structure for delivery. For example, premium customers will pay a flat rate to participate in same-day delivery and additional surcharges for one-hour delivery.



Impact of innovation

... on operators costs and supply chains

- Smaller parcel courier companies gain new business opportunities. Large e-retailers that normally award contracts to few integrated postal operators rely on several regional couriers for same-day delivery.
- Parcel couriers have to employ more flexible personnel. Employees in same-day delivery have to work mostly off-peak hours and weekends.
- Point-to-point same-day delivery remains cost-intensive and stays niche.
- Consolidated same-day deliveries require a limit for the product range and region. Same-day delivery is not a cost-efficient option for remote areas.
- Some large e-retailers with a decentralised warehouse network or retailers with many local branches are able to expand same-day delivery to a larger radius, but same-day will not be on offer everywhere and for everyone.

... on consumer demand

- If surcharges for same-day delivery are reduced and time-windows for delivery are more precise, the number of consumers who order food and convenience products online will increase.

... on the retail demand for delivery services

- Small e-retailers without decentralised storage cannot realise same-day delivery throughout the country.
- They will not be able to organise same-day shipments at an affordable price with couriers because of low volumes.

... on product innovations

- Differentiated price structures for same-day and time-window deliveries are developed.



Impacts on consumers

Benefits

- Consumers are offered more options for same-day delivery in the short run but high surcharges and intransparent price structures will affect demand. Availability of same-day delivery will be better in urban areas.

Concerns

- Consumers in remote areas will not profit from same-day deliveries unless local stores can participate in the development.
- Price structures for services become more intransparent and need explanation, especially for some vulnerable consumer groups such as those who lack digital literacy.

8.8 Variety of (pick-up and drop-off) PUDO solutions

Characteristics

A wide variety of alternatives to delivery to door are evolving. Delivery options will be more refined and better adapted to needs of customers.

State of development

Online shoppers during regular working times can choose between several alternatives to home delivery to make it more convenient to receive their parcel. Among the existing solutions, click and collect is the most popular in the UK.

In addition to retailers' own stores, third parties offer also pick-up and drop-off points. Among these are parcel carriers such as Hermes with MyHermes-stores, Royal Mail via Post Office branches and also independent providers like Doodle with its PUDOs in train stations. Parcel lockers, whether located at central points for pick-up, or parcel boxes at the garden fence, are available but not yet very popular in the UK.



Prospects

Offering several delivery options will be a must for retailers to enhance convenience and choice for consumers. More providers of PUDOs will enter the market, and the variety of solutions will amplify. Examples of future developments include delivery to the boot of a car, extended networks for click and collect as well as third party PUDOs.

- The acceptance of parcel lockers and home parcel boxes will grow but remain niche.
- Consumers will pick the solution which suits them most for that particular order.
- Preferences for a specific PUDO solution will vary depending on the nature of the item delivered – for a heavy supply of cat food; consumers will accept delivery to local supermarket but not to train station on their way to work.

Realisation: < 3 years



Preconditions

- E-retailers will have to support new PUDO solutions, and point out benefits to consumers.
- Whether e-retailers or providers of PUDO solutions decide to charge consumers will be a key aspect in consumer acceptance of PUDOs.
- Integrating different options for delivery in a convenient way into online shops will be important.



Impact of innovation

... on operators costs and supply chains

- PUDO solutions require no changes to parcel carrier supply chains as the PUDO acts as a delivery address.
- The impact on operator costs can be substantial. Delivery to PUDOs are nearly always successful in the first attempt, and can significantly reduce operator costs.

... on consumer demand

- Consumers benefit from extended choice of delivery options.
- For those who are not at home during standard working hours and want to avoid a 'something for you' card will have more options to receive their parcel conveniently. Increased density of PUDO networks will help to avoid detours.
- PUDOs are less available in rural and remote areas, limiting the benefits for consumers. The distance to the nearest available PUDO might be a barrier.
- Information on prices for delivery options and the exact location of the next PUDO when purchasing online is required to prevent frustration.
- Consumers with reduced mobility may not be able to access PUDOs as conveniently.

... on the retail demand for delivery services

- For a retailer selling goods online, offering more convenient delivery options to customers compared to other online shops can provide the competitive advantage if the product and price are the same.
- For retail demand as a whole, offering alternatives to home delivery is important to make online shopping more attractive and to further develop this channel.
- Enhancing and refining PUDO solutions to consumer needs is an incentive for e-

retailers use to stimulate demand for online shopping. This will also enhance the demand for parcel services.



Impacts on consumers

Benefits

- More delivery options and a variety of alternatives to home delivery offer consumers greater choice and enhance their ability to receive the parcel at the time and location they prefer.
- Further extension of existing PUDO networks will reduce the distance to a convenient PUDO point.
- Development of more options for delivery will better adapt delivery to customer needs.

Concerns

- Vulnerable consumers groups might not be able to benefit from PUDO solutions.
- In rural areas, PUDO networks will not be as dense as in urban areas.
- Consumers might have to travel longer distances if they use delivery to a PUDO point.
- Consumers with reduced mobility prefer to have their parcels delivered to the door.
- E-retailers may charge delivery to PUDOs differently. It will be important to inform consumers about delivery options and potential surcharges to avoid a lack of transparency and customer frustration.

8.9 Shipping platforms for consumers

Characteristics

Service providers on the internet act as re-sellers of delivery services and offer additional shipping services as well as pricing information.

State of development

Shipping platforms consolidate demand for delivery services in order to get higher discounts from parcel carriers. The business model mostly consists of re-selling functions, web-based price comparison tools and integrated labelling and billing services. E-retailers are offered a “single stop shopping” for various delivery options.



Prospects

Re-sellers and price comparison sites have become much more common in the UK but there seems to be more potential for growth in the e-commerce market.

- Companies like Metapack, Parcel Monkey and NetDespatch are already in operation.
- Before the rise of the e-commerce market, re-sellers concentrated on the B2B segment because of higher volumes and margins.
- Lately, shipping platforms are increasingly operating in the growing B2C market to compensate for stagnating B2B volumes by sending volumes from SMEs and private marketplace sellers.

Realisation: < 3 years



Preconditions

- Re-sellers have to win parcel carriers for framework contracts to negotiate reductions for their customers' consolidated volume.
- The platform provider has to integrate several parcel carriers into a new IT system and develop a single API for its customers.
- Thus, the re-sellers' customers have access to different shipping options via a single API.
- Barriers to market entry are comparatively low. Shipping platforms that use comparably low priced cloud computing technology for data storage or software-as-a-service options are easily scalable and can grow with consumer demand.



Impact of innovation

... on operators costs and supply chains

- From the view of parcel carriers, re-sellers create relatively stable demand and potential savings in sales staff costs.
- Shipping platforms may generate additional volume from small sellers that are in a growth stage. When these sellers have reached a certain volume they can be offered reductions based on fixed volume levels.
- Re-sellers are also competitors for parcel carriers and put pressure on margins.

... on consumer demand

- Some price comparison sites and shipping platforms can also be useful for occasional private marketplace sellers and may influence demand for shipping based on carriers' list prices.

... on the retail demand for delivery services

- Shipping platforms improve transparency of existing delivery options and offer a convenient single user interface to many different parcel carriers.
- Integrated price comparison sites with specific search options allow quick price comparison for different weights and dimensions to different destinations.
- Billing processes for delivery services are more suitable for senders, especially for SMEs. Senders will receive only one bill from the re-seller and not several bills from each carrier.
- Senders with low volume, such as very small e-retailers or retailers who are setting up an online shop, can participate from volume based reductions.
- Small senders that would like to expand their business cross-border are able to compare different shipping options. An additional advantage is that insurances

and customs services are automatically taken into account.

... on product innovation

- Shipping platforms can expand their services to same-day or time-window options to benefit from increasing demand from e-retailers for these services.
- E-retailers can obtain analysis as carrier prices, tariff structures and quality performances when re-sellers compile their customer data.



Impacts on consumers

Benefits

- Shipping platforms can help to reduce shipping costs for consumers who would like to order from small sellers or sellers abroad
- Private sellers or emerging e-retailers can benefit from more price transparency and comparison tools.
- Consumers get more information on shipping costs.

Concerns

- Private or very small sellers have to reach a certain volume level to register with a shipping platform.
- Consumers may become confused about liability. Terms and conditions of re-sellers may not be always clear to all consumers.
- Consumers without access to reliable internet as well as digitally excluded consumers may not be able to benefit from reduced shipping prices.

8.10 Sharing economy

Characteristics

Companies act as virtual couriers by implementing a technological platform for matching buyers and sellers of delivery services.

State of development

Shared or crowd-sourced deliveries are based on internet matching platforms and involve private consumers or registered couriers for deliveries. An e-retailer implements the application in his business. Then consumers can choose the “crowd-sourced” option as their delivery method in the online shop. The most prominent sharing economy example in delivery is UberRush. The company is only operational in some US cities but experts expect them to start their business in Europe within the next two years. Today, only Uber passenger transport services are available in UK.



Prospects

Sharing economy solutions are already widespread and can be found in the hotel industry (Airbnb) or in car and bike sharing. Large investors operate globally in this field and shared services will soon become an additional option for e-retailers and other senders.

- Barriers to market entry for sharing economy solutions are low. Implementation of an IT platform requires only lean management structures and no high investment in technology or personnel. There is no need for a delivery network or fulfilment centres. Marketing strategies seem relevant for dissemination and further adoption.
- Today, shared services are already adopted by certain segments of the population such as consumers on low incomes who also have a high degree of internet affinity, so-called digital natives.
- Regulatory issues are still unsolved, however, in practice, legal questions concerning liability or other risks seem to be less important for users of sharing economy technologies.

Realisation: < 3 years



Preconditions

- High internet and smartphone penetration is a prerequisite for sharing economy solutions.
- The number of potential couriers is higher in densely populated areas. Shared delivery is not likely to be offered in rural areas.



Impact of innovation

... on operators costs and supply chains

- Shared delivery fits in the niche for ultra-fast same-day deliveries. Private consumers or pre-registered couriers can provide a fast service at comparatively low prices.
- Shared delivery is much more flexible than delivery by conventional parcel carriers.
- Shared delivery operates in the point-to-point same-day segment and competes with regional courier companies who cooperate with e-retailers that offer same-day delivery.
- Parcel carriers are not so much affected by the evolving of shared delivery as they usually do not operate in the courier segment.

... on consumer demand

- Consumer demand might be affected with regards to last minute gifts, fresh food and flowers.
- Demand for last-minute deliveries in rural regions will hardly be affected because crowd-sourced deliveries are offered mostly in inner city areas.

... on the retail demand for delivery services

- Shared delivery options enable a flexible solution for same-day delivery. Low parcel volumes are not a barrier for participating e-retailers.
- Small retailers in inner city areas have the opportunity to become e-retailers in their region in an instant. Contracts with courier services for same-day deliveries or with parcel carriers are not necessary.

... on product innovation

- Shared delivery of items to consumers.



Impacts on consumers

Benefits

- Consumers benefit from a wider range of products that can be offered online and suppliers for delivery.
- Prices for same-day delivery by shared service couriers can be less expensive and without a minimum order requirement.
- Sending is facilitated for consumers with reduced mobility or special needs as couriers will pick up items at the door.

Concerns

- The question arises as to how shared service companies deal with customer complaints.
- Shared delivery services are a grey area when it comes to liability.
- Private consumers as "couriers" have to consider health and transport insurance issues. They might risk being a part of illegal transactions. Safety issues are unclear in the case of accidents.
- In rural areas, shared delivery might not be available to the same extent as in urban areas due to less senders/receivers as well as less potential couriers.
- Participating in shared delivery requires at least a mobile device for internet access.

8.11 Consolidating parcel volumes in rural areas

Characteristics

Parcel carriers consolidate their parcel volumes for delivery in rural and isolated areas. A carrier delivers parcels of its competitors jointly with its own parcels.

State of development

Consolidating parcel volumes is being undertaken by some parcel carriers for Scottish Highlands and Islands areas. There is currently a single carrier consolidating parcels, Menzies Distribution, who organises collections as well as deliveries of parcels for several other carriers. The parcels can be tracked via an integrated IT solution and drivers use a single handheld device which can process data for all the connected operators. However, not all operators delivering to Highlands and Islands areas have joined, due to the importance of brand prominence.



Prospects

The costs of delivering to very rural or isolated areas are high. With strong and potentially increasing competition in the UK parcel market, reducing costs especially in high cost areas will be a strong incentive for parcel carriers to expand joint delivery of parcels to larger areas. The development of more sophisticated track and trace solutions will contribute to a refinement of integrated solutions.

Realisation: < 3 years



Preconditions

Preconditions for success

- Integrated IT solutions for joint delivery have to be developed in line with the refinement of parcel carriers' own tracking solutions.
- If alternatives to home delivery, such as click and collect and parcel lockers, develop more strongly than expected in rural and isolated areas, the costs of delivery will decrease and limit carrier need for joint delivery.



Impact of innovation

... on operators costs and supply chains

- The requirements on supply chains of participating parcel carriers are high.
- Carriers joining the consolidation have to either agree on a standard for exchange of information, or develop an IT solution that is able to process information in different formats.
- Handheld devices used for delivery must be interoperable with different systems.
- For carriers participating in consolidation of parcel volumes, the effect on costs will be noticeable.

... on consumer demand

- Consolidation of parcel volumes has no impact on service level or price and consumer demand should not be affected.

... on the retail demand for delivery services

- E-retailers often demand a surcharge for delivery to Highlands and Islands areas. It is unclear whether this is reflected in the true costs of delivery or based on a strategic decision.
- Consolidation of parcel volumes leads to a reduction in operator costs. Prices for delivery of B2C parcels could decrease as long as e-retailers pass on these price reductions.
- If retailers pass on these reductions to consumers, the volumes of e-commerce parcels sent to Highlands and Islands areas could increase.



Impacts on consumers

Benefits

- Consumers in rural and remote areas could benefit from reduced delivery surcharges to rural areas. This, however, depends on the pricing decision of operators and retailers.
- As a result, consumers in rural and remote areas might benefit from an increased choice of carriers and delivery options.

Concerns:

- If e-retailers do not pass on cost reductions, consumers will not benefit from lower delivery prices.

8.12 Automated vehicles

Characteristics

Vehicles with an increasing level of automation are used for long-haul postal logistics.

State of development

Especially in long-haul transport, trucks today are equipped with a number of assists in order to increase road security and reduce human failure resulting in accidents. Basic systems like brake and lane departure assists have been available for a few years. Recently, trucks have been equipped with new radar sensor technology and cameras. This allows a higher level of automation and enables trucks to be moved fully automated.



Prospects

The advances of sensor technology and enhanced capacity of data processors enable vehicles to be operated safely on public roads. While drivers will be required to take over control under certain circumstances like poor weather or road conditions in the near future, it will be possible in the long run to operate fully automated vehicles without drivers.

Realisation: < 10 years



Preconditions

- Regulatory circumstances play an important role for operating automated vehicles.
- The UK's Department for Transport has analysed the legal and regulatory framework for testing automated vehicles. It found the framework is not a barrier to the testing of automated vehicles on public roads. The UK has not ratified the Vienna Convention on Road Traffic requiring a driver to control his vehicle.
- However, future use of automated vehicles depends largely on future prescriptions on vehicle automation.



Impact of innovation

... on operators costs and supply chains

- The technology has the potential to substantially lower operator costs.
- Automated vehicles will reduce fuel consumption due to anticipatory braking and accelerating.
- Self-driving vehicles might not need a driver at all and reduce labour costs.

... on product innovation

- Self-driving cars will be a major step in automation technology and have an impact on other areas of postal logistics.
- Automated vehicles in delivery will be the next step.



Impacts on consumers

Benefits

- Automated trucks reduce the element of human failure. Improvements in road security will result in less collisions and traffic deaths.
- Automated trucks' use of sensor technology enables them to optimise road space and speed which reduces traffic jams.
- Consumption of fossil fuel is reduced due to optimised speed and driving style.

Concerns

- Automated vehicles may cause other and new kinds of road security concerns, such as unforeseen events where reaction is required.
- IT security has to be ensured.
- Automated vehicles will exchange data with other vehicles such as road conditions and traffic jams, speed, brake action and vehicle position.
- This data can be used to send warning signals to other vehicles to prevent collisions but they also reveal a lot about the driver and the passengers.
- Protection of passenger data against unauthorised access and collection has to be ensured.

8.13 Robots in postal logistics

Characteristics

Robots in parcel logistics are used in parcel sorting, loading and unloading, or picking in warehouses.

State of development

Robots in postal logistics are used for a variety of applications. In warehouses, they facilitate picking and increase the efficiency of human workers. Robots can also be used for loading or unloading activities, either by means of specialised robots or by using robot technology in exo-suits. Currently, postal operators mainly use robots in trials because costs and efficiency have room for improvement.



Prospects

Robot technology will be applied on a broader basis in postal logistics. Advances in sensor technology will enable robots to seize objects of different sizes and weights.

- In our ageing society, robots support human workers with lifting and moving heavy parcels.
- Activities in parcel logistics with a high degree of standardisation such as loading/unloading parcels will be more likely to be performed by robots than others.
- Use of robots for picking in warehouses is more difficult due to very different sizes, weights and textures of goods. Robots will have to be able to pick a floppy shirt as securely as a heavy-weighted and bulky barbecue grill.
- Robots in delivery activities are not realistic during the next ten years.

Realisation: < 10 years



Preconditions

- The development of relevant technologies used in robots is very important, such as sensor technology and automated gripping of items with adapted force.
- Costs of robots suitable for parcel logistics will have to go down.



Impact of innovation

... on operators costs and supply chains

- Robot technology has the potential to reduce the share of human labour in postal logistics.
- Operators will be able to save costs and increase efficiency.
- Older postal workers or workers with constraints will be able to perform physically demanding labour if supported by robots or exo-suits.



Impacts on consumers

- Robot technology will not be used in consumer-related activities in the next ten years, and do not have an impact on product features either. There are no perceptible impacts on consumers yet.
- Future benefits of the use of robots in postal logistics might include potential for cost reductions and lower parcel prices as well as product innovations.

8.14 Delivery by drones

Characteristics

Delivery of parcels are made by unmanned aerial drones.

State of development

Many parcel carriers are testing aerial drones for parcel deliveries. Due to security reasons, drone deliveries underlie quite tight regulations and have to be steered by a pilot. Automated drone delivery is not possible under actual legal circumstances. Tests with aerial delivery drones are being undertaken in remote areas with low population density and delivery to islands.



Prospects

Delivery by aerial drones will remain niche in the next ten years. Fields of application will include deliveries of an urgent nature such as pharmaceuticals and spare parts in rather remote areas which are not easily accessible by delivery vehicles. These could be very rural areas, islands and mountain areas.

Realisation: 10 years and beyond



Preconditions

- Regulation for operating drones is a crucial precondition for further adoption.
- Operation of automated delivery drones that do not require control by a pilot would facilitate drone delivery and lower costs for operators.
- If current drone regulation is maintained, drone delivery might not be economically viable on a broad basis.
- Security concerns will have to be smoothed. Effective tools ensuring safe drone operations even in unforeseen situations have to be developed.



Impact of innovation

... on operators costs and supply chains

- In the case of drone delivery, supply chains will be mainly impacted on the last mile to the consumer. Long haul transport of parcels will not be changed due to energy and cost aspects.
- Drone delivery operators will have to define starting locations for drones. These could either be flexible, depending on the destination or a standardised 'drone base' attached to a hub or delivery office.
- The costs of drone delivery will depend to a large extent on future regulation in this field. The most important question here is whether a pilot will be needed to steer the drone to its destination.
- Energy costs of drones will also play a role. Although drones could potentially take a bee-line route and reduce the distance covered to the point of delivery, each drone can carry only one parcel and fly back 'empty'. In addition, airborne transport will always use more energy than land transport.

... on consumer demand

- Drone operations for B2C delivery will be complex as well as costly and require significant investments. Drone operations for C2X deliveries might be the next step but is not expected during the next 10 years.

... on the retail demand for delivery services

- As costs of drone deliveries will be quite high, and future regulation is not yet foreseeable, retail demand for drone deliveries will be limited.
- Drone deliveries will be offered for situations in which demand is very urgent, or the delivery area is not easily accessible.

... on product innovation

- Drone delivery could lead to completely new ways of covering the last mile, such as locations transmitted by smartphone as opposed to fixed address.



Impacts on consumers

Benefits

- Consumers can benefit from very fast delivery, especially in emergency cases.
- Drone delivery might be possible to any location, independent of house or shop addresses. Consumers could therefore receive parcels when not at home, and when the need for delivery is not foreseen.
- Drones could facilitate delivery under difficult weather circumstances, especially in rural and remote areas and islands during adverse weather conditions.

Concerns

- The aviation security of delivery will have to be ensured. Technical solutions to avoid collision with planes, helicopters, kites and cranes and high lorries will have to be fail-safe.
- Parcels delivered by drones might be dropped-off in places accessible to other persons than the receiver. Solutions to secure the parcel against theft, as well as security measures against intercepting drones will have to be found.
- If drones deliver to an address, it will be important to locate the exact point of delivery to avoid placing the parcel on house roofs, garages and into the garden pond. Exact geomapping services will be needed.
- It remains unclear how delivery can be confirmed. Standardised confirmation by signature currently used by parcel carriers will not be applicable.

8.15 3D printing

Characteristics

3D printing technology allows items to be produced on demand. Machines for printing three-dimensional objects process raw material and are available in desktop size for businesses or consumers.

State of development

3D printers for the consumer segment are available for as little as £200. They allow people to create objects up to the size of a small shoebox at a maximum which consist of a single material and a plastic filament available in different colours.

Industrial 3D printers are much larger in size and allow printing of different material. Industrial 3D printing is used for applications where individualisation is important – prototyping, dental prostheses – or where other technologies like casting fail. As the speed of 3D printing is not comparable to other production technologies, the costs are quite elevated compared to mass-production.

In the consumer segment, 3D printing is used for creating individualised items including art, modelling and fan-art for figures from action films or comic strips.



Prospects

The technology nourishes the idea of a world in which 3D printing might be able to produce items of any material, complexity and size on demand instead of buying them from a retailer or manufacturer. Yet this will evolve, if ever, beyond the next 10 or even 20 years.

In the short and long run, 3D printing will remain a niche method to produce goods due to the limitations of technology regarding material, costs and size of printed items. Similar to the evolution of other new technologies, 3D printing will have its followers who are willing to pay more for 3D printed objects just for the excitement.

- There will be online platforms and shops where 3D printed objects can be ordered.
- The demand for 3D printed objects will grow as the technology becomes more sophisticated and increasingly known to the wider public.
- Demand for 3D printers from consumers with an interest in technology and engineering will grow.

Realisation: 10 years and beyond



Preconditions

- 3D printing technology would need to be developed further. Currently, 3D printers can only process plastic material in the consumer segment. This quite strongly limits the potential applications.
- 3D printing will be able to substitute purchasing goods only if printers could process several materials at a time and create objects of greater complexity than what is possible today.
- Costs of 3D printing will have to be reduced significantly, especially by reducing the time for printing.



Impact of innovation

... on consumer demand

- Consumer demand for delivery services will grow. The size of a 3D printer for consumer usage allows it to be shipped by parcel carriers.
- In addition, raw materials will have to be shipped to consumers.
- For the next ten years, 3D printing will not be able to substitute online shopping from retailers due to the limitations of technology.

... on the retail demand for delivery services

- Printing platforms and online shops for 3D printed items will further increase the demand for delivery services when shipping printed items.



Impacts on consumers

Due to the limited applications of the technology, 3D printing will not improve the supply of rural areas in the foreseeable future.

Benefits

- For tech-savvy consumers, 3D printing is an exciting new technology. It provides an opportunity to create individualised goods. Beyond these immediate benefits, it will not affect their position as postal consumers.

Concerns

- None

9 Final impacts of technology on consumers of postal services

One of the core objectives of consumer-centred policy is to promote consumer rights and enhance options and choice. Our study shows that the recent developments in the postal sector as well as in e-commerce have left the consumer in an empowered position.

UK online shoppers are part of the most advanced e-commerce market in Europe. E-commerce solutions are improving while a greater variety of goods and services are being sold online at low prices. Consumers get “free” delivery for an ever increasing amount of goods ordered online. Delivery services are also becoming faster and more personalised. Table 8 below summarises the effects on consumers of the various innovation trends identified by this study.

Convenience for consumers increases, too. For example, online labels can now be printed even by small senders, parcels can be paid online and get picked up at the door. PUDO solutions are offered by different carriers, predicted services and last-minute redirection of delivery becomes possible and is available from many e-retailers in cooperation with parcel carriers. In the future, there might be even more options for remote areas to receive their mail more frequently if new technologies become more widely used.

Delivery to the door means new opportunities for vulnerable consumers because delivery of all kinds of goods has become available at no extra charge for many consumers. Food deliveries and medical supplies offer advantages to elderly people or persons with reduced mobility who cannot go to local shops anymore, let alone remote specialised shops. New options for picking up and dropping off parcels have arisen while at the same time a dense network of door-to-door delivery services and post offices remains.

Competition in e-commerce and parcels markets leads to attractive pricing for goods, services and delivery. E-commerce also brings greater choice of goods and services at a lower price to urban and rural areas alike. Price comparison for online shopping and for delivery options increases transparency and competition. In the end, consumers enjoy more choices supported by new consumer rights.

Table 8: Impact of innovation trends on consumers of postal services

Trends	Realisation (years)	State of progress in the UK	Impact on consumers	
			Benefits	Concerns
1. Automation in letter and parcel sorting	ongoing		faster delivery; next day service as standard; stable prices	-
2. Extended track and trace for parcels and value-added mail services	ongoing		better information on delivery; more options	privacy concerns
3. Increasing competition in the parcel market	ongoing		low prices for parcel services; innovations	benefits to consumers only if reliable internet access is given / consumers live in areas serviced by new players
4. Sustainability	ongoing		reduced pollution and less use of fossil fuels	independent monitoring important
5. E-substitution	ongoing		greater choice between communication channels; consumers use channels according to their needs; prices for internet-based communication services decline overall	data security of digital communication; the digitally excluded; senders might surcharge receivers of physical letters
6. Predictable delivery and redirected delivery	<3		more reliable and convenient delivery	consumers reveal sensitive data; predict services might be less precise in rural areas
7. Same-day delivery	<3		faster delivery; more options	high surcharges, consumers in rural areas may not receive the service
8. Variety of PUDO solutions (pick-up and drop-off)	<3		more options; greater choice; denser networks help to reduce distance travelled and to avoid detours	consumers might prefer home delivery; lack of transparency on delivery and pricing options; limited PUDO access in rural areas
9. Shipping platforms for consumers	<3		improved transparency; reduced shipping costs; even for senders with low volumes	minimum volume required; limited or no benefits for consumers without reliable internet access / digitally excluded consumers
10. Sharing economy	<3		wide range of products and suppliers available; delivery prices less expensive; beneficial for consumers with reduced mobility; less expensive than traditional courier services	liability and complaint issues remain unclear; consumers as carriers might breach law; limited availability in rural areas

Trends	Realisation (years)	State of progress in the UK	Impact on consumers	
			Benefits	Concerns
11. Consolidating parcel volumes in rural areas	<3		reduced delivery surcharges for rural areas; more choices; lower prices	if e-retailers do not pass on cost reductions; consumers will not benefit
12. Automated vehicles	<10		improved road safety; less traffic jams; less fossil fuel	other/new road hazards; IT security; sensitive information sent by automated cars
13. Robots in postal logistics	<10		potential for cost reductions and low parcel prices; innovations	-
14. Delivery by drones	10 and beyond		very fast delivery to any location	security of delivery; of delivered parcels
15. 3D printing	10 and beyond		create individualised goods	-

Explanation:



Innovation is not at all applied



Innovation is has become a standard

Note: State of progress in the UK is based on WIK/ITA research and on interviews with sector experts in the UK. For a more detailed description of state of progress see chapter 6.

In addition to more choice and service improvements in many areas, we identify a number of trends that may negatively affect vulnerable consumers. In those fields, technology intensifies existing challenges rather than enabling new choices and options.

We would like to highlight the impact of technological changes on the following aspects of vulnerability:

- vulnerabilities depending on the area of residence: the variety of options on offer is connected with population density, such as potential consumers who might use new shipment innovations, but also geographic parameters. In rural, remote areas or on islands the availability of innovations is limited or offers are more expensive.
- vulnerabilities depending on income: consumers with low income are less likely to benefit from new innovations if this includes the need to buy new devices or to upgrade internet connection to more costly broadband options.
- vulnerabilities depending on age: younger people are more likely to be internet-savvy consumers than elderly people.
- vulnerabilities depending on individual needs: new technologies might require physical skills that exclude consumers with reduced mobility/disability and special needs.

- vulnerabilities depending on knowledge: consumers who lack digital skills or do not have access to the internet face considerable barriers to use new digital technologies.

These are not exclusive groups, indeed there are vulnerable consumer groups that might endure several negative effects at the same time. This is especially true if we look at the area of residence as a potential discriminating factor, such as “rural and remote or island” and “urban” (see Table 9). In these areas potentially vulnerable consumer groups can be identified and accumulate several disadvantages. As additional layers of vulnerability are added, disadvantages for sub-groups of vulnerable consumers increase.

Therefore, these groups should be examined in more detail and have to be in the focus of consumer protection authorities in future:

- low income young consumers
- low income elderly consumers
- consumers with reduced mobility, disability
- consumers who lack digital skills or are non-users of the internet.

Table 9: Areas of vulnerability for consumers

Areas of vulnerability for consumers				
Rural, remote, island	low income young consumers	low income elderly consumers	reduced mobility, disability	Low digital literacy/skills, non-users of internet
Urban				

Furthermore, even if there are distinct signs for negative effects on these consumer groups, we would like to emphasise that positive effects can be expected, if technology is shaped accordingly and framework conditions are set in a consumer-friendly way.

Consumers in rural and remote areas, on the one hand, gain access to more sections of the retail market and will have more choice. If provided for their orders they can choose from more and faster delivery options than before. E-commerce, in that sense, can carry the potential to overcome structural deficits of rural and remote areas. In addition, small traders, craftsmen, or farmers in rural areas gain new sales opportunities for their products online if they are able to invest in implementing digital platforms and delivery options.

On the other hand, there is a risk that consumers in rural and remote areas may be worse off than urban consumers to a certain extent. Firstly, some e-retailers may put high surcharges on orders to remote areas regardless of the price they often have to pay to the carriers. Access to new delivery options is less convenient in rural areas and same-day delivery will probably not be on offer there in future. Furthermore, access to internet is more limited in rural areas like those found in Wales and Scotland, making it harder to participate in the benefits e-commerce offers.

In general, it can be assumed that consumers with low income benefit from lower prices due to competition and innovations more than other groups no matter where they live and how old they are. Special offers and free delivery options make it possible for everyone to participate in e-commerce. However, access to e-commerce offers requires investments in infrastructure for broadband access and devices such as computers, tablets and smartphones. This access is limited for these groups and value added services in e-commerce that involve surcharges or require minimum spending which may not be affordable and can apply to consumers in rural, remote and island areas. At the extreme, consumers with low income who cannot afford fixed or mobile internet through smartphones are excluded from the availability of goods and services online, price reductions achieved through online shopping and the convenience that new shipment solutions can bring about.

Access to e-commerce is potentially more expensive in rural, remote and island areas because of less competition in the delivery sector and also less competitive offers for internet access. Younger consumers might be less affected than elderly consumers with low income as they are more internet-savvy than elderly consumers and are more able to use their knowledge to find attractive alternative offers.

Elderly consumers gain the opportunity to compensate some disadvantages in daily life through online-shopping. E-commerce and convenient delivery brings benefits which traditional retailing does not offer such as instant price comparisons and convenient delivery. But if these groups have only very limited resources they are unable to take full advantage of these benefits. Elderly consumers in rural, remote and island areas will face additional costs compared to elderly consumers in urban areas experienced through surcharges, higher prices due to less competition in the parcel market and they will more often have limited choices for broadband access such as availability, bandwidth and different tariffs. As they are probably less mobile than younger consumers they will heavily depend on shipment to door.

Consumers with reduced mobility and special needs, including visually impaired people, will profit from predicted and redirected delivery as it facilitates online shopping. Same-day deliveries of medical supplies or food enable a more independent life at the own home. E-commerce in itself has led to more and better access to niche products, more competition and falling prices. However, people with reduced mobility cannot fully participate in new pick up and drop off options and are to a large extent dependent on

delivery to door. In rural, remote and island areas the variety of delivery options will be reduced compared to urban areas. Finally, e-commerce offers and choices can only be used by all consumers if applications and websites are barrier-free and designed for use by all special needs groups, including visually impaired persons.

Consumers who lack digital skills or are non-internet users can be excluded from e-commerce altogether. They are most affected by e-substitution as they cannot choose between communication channels. Price increases for traditional letters or reductions in quality of service features for mail and parcels will have the most negative impact to these consumer groups. At the same time, they can hardly participate in the opportunities that e-commerce and digital services offer. Consumers living in urban areas are also more likely to find resources and training to help them get online than consumers in rural, remote and island areas. However, there are initiatives underway, such as “Go On UK”¹⁶⁰ which give practical guidance in many local communities to help to improve basic digital skills and fight digital exclusion.

Finally, all consumer segments alike will face multiple requests from different companies – e-retailers, carriers, advertisement agencies, big data service providers – that seek to make use of their data in combination with their current or future purchasing habits. As a result, there is a risk that consumers might unwillingly reveal more sensitive data than necessary and remain unsure about the future use of their personal data. This clearly involves new challenges for data protection policy. Consumers who lack digital literacy may also be elderly and will need more advice and support understanding e-commerce and sharing information over the internet. Namely understanding the implications of informed consent for companies to use of personal data and gaining skills to use privacy-enhancing technologies and skills.

¹⁶⁰ Go ON UK! (<https://local.go-on.co.uk/>), a UK digital skills charity, founded in 2012.

10 Recommendations

Computerisation and digitisation has finally arrived in the postal sector. Disruptions from digitised supply chains and the sharing economy have shown their first effects and will have a significant impact on the development of the market and the consumers in the future. The exact shape of innovation and how they will be adopted is unpredictable but the key trends are likely to be a continuation of those described in this report.

New technologies in the postal sector do not necessarily lead to less convenience, higher prices, or less consumer-oriented services. On the contrary, our study shows that innovations in the postal sector lead to empowered consumers and to more choice for many consumer groups. Technology is the key enabler for such new services. Consumers in general benefit from new technology which enables them to access an increasing range of new services, particularly in relation to online retail fulfilment.

Consumers are driving the shape of technological innovations through their choices but it seems important for consumer protection authorities to ensure that these choices as expressed through the market do not have adverse impacts on vulnerable consumers. Now and in future essential needs for the postal service, especially with regard to those groups, have to be understood and protected.

As outlined in the previous chapter, we have identified downfalls and risks for some groups and consequently there is need for action in certain areas. We conclude that Citizens Advice should carefully observe e-commerce and postal market developments to signpost any challenges or risks from new innovations. In particular, further research on consumers' future needs for postal services is needed. Analysing the economic and social impact of a changing postal market, in particular the emergence of alternative means of communication and distribution as well as changes to the postal services network will offer a solid basis for Citizens Advice to address the concerns of postal consumers. It will be important to observe further technological developments in postal and delivery markets and discuss implications for consumers.

Citizens Advice will need to continue monitoring the rapid developments in the postal sector that are driven by digitalisation in order to become aware of critical issues for vulnerable consumers and offer appropriate support and advice. Our research has identified six major areas of concern in the postal and delivery sector which are highly relevant for consumers:

- 1) The development of surcharges by e-retailers for delivery to online shoppers in remote areas: these surcharges may not be based on price calculations or delivery rates actually charged by parcel carriers. High delivery surcharges limit consumers' delivery options and could repress consumer demand in these areas.

- 2) In remote areas, consumers' choice of parcel carriers is limited as some parcel carriers and many local couriers do not provide their services nationwide. In addition, consumers in remote areas do not have access to the same delivery options as urban inhabitants, such as same-day delivery or delivery to alternative delivery points. Consumers in remote areas are much more likely to lack reliable internet access and they may not be able to benefit from discounted parcel prices offered by online re-sellers and shipment platforms.
- 3) The impact of completely new logistics solutions: drones and automated vehicles are technologies whose impact on the postal sector in general and on road and aviation security is not yet fully explored. Apart from a missing regulatory framework on commercial use of delivery drones, a number of issues around drone delivery are unsolved. How can a safe delivery be ensured? How can delivery to the right person be confirmed? How can delivery drones be protected from illegal capture?
- 4) Data privacy and data security related to postal services: consumers may be incentivised by e-retailers and parcel carriers to reveal sensitive data in order to make tailored offers and improve delivery. Although this is in general beneficial to consumers, data protection issues should be monitored closely, and it should be ensured that consumers are aware of the effects of their decision to reveal personal data.
- 5) Sharing economy solutions generally create issues for consumers with regard to liability and complaint management. Consumers as senders and receivers might not always be aware of liability issues when using shared delivery services. As these services become more popular, the number of complaints and cases requiring application of liability rules will also increase.
- 6) The overall quality of postal services: as margins for parcel services are under pressure, carriers might be tempted to lower service standards in parcel delivery. In the busy season around Christmas, parcel volumes are exceptionally high and carriers need to employ even inexperienced staff to cope with the peak-load. This might result in leaving 'sorry you were out'-cards when receivers are at home, delays, or wrongly delivered parcels.

Citizens Advice should continue to monitor these six areas of concern and clearly state out the interests of consumers and in particular of vulnerable groups. Close market and regulatory monitoring and analysis of developing consumer needs and potential detriment will ensure that Citizens Advice can carry out its tasks as a consumer watchdog in an environment of rapid technological change.

Another corresponding task already performed by local Citizens Advice is to inform a range of British consumers about their rights when shopping online. As the study

shows, the focus in the growing field of e-commerce is shifting from questions about how to order goods online to how they can be delivered and returned affordably. Pricing structures and additional charges, redelivery options and the range of new solutions like shared delivery might overwhelm some consumer groups. The work by local Citizens Advice to advocate on behalf of postal consumers is highly relevant and should be continued and expanded.

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