The “next day, free delivery” myth unravelled

Possibilities for sustainable last mile transport in an omnichannel environment

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Abstract

Purpose – Currently, it is unclear how omnichannel retailers can create a last mile offer that is both attractive and sustainable from an economic and environmental point of view. The purpose of this paper is to explore to which extent consumers are willing to adopt last mile options that are more sustainable and how these options should be composed to remain attractive.

Design/methodology/approach – To this end, the authors surveyed a representative sample of Belgian consumers, using choice-based conjoint experiments, and analysed their preferences structures.

Findings – Consumers’ preference goes out to free, next day delivery to an address of choice, on regular office hours during the week. However, when free delivery and return are offered, consumers are willing to collect their orders themselves or wait longer for their orders to arrive.

Practical implications – The research findings are important for retailers that (plan to) operate an omnichannel model. For omnichannel retailers with a dense store network, the results indicate that consumers accept their store network as pick-up and return locations, allowing retailers to create a more efficient and sustainable supply chain in which their online and offline activities can be combined.

Originality/value – The research findings contribute to current literature and practice by combining “planet” and “profit” components of sustainability in last mile transport and applying it in the novel omnichannel environment.

Keywords Sustainability, Consumer behaviour, Electronic commerce, Last mile, Omnichannel retail

Paper type Research paper

1. Introduction

Research on last mile transport investigates the final part of the supply chain from the last distribution centre, consolidation point or local warehouse. It focusses on the ways in which products reach their final destination in the consumer market (Xiao et al., 2017). In times of intensifying retail digitalisation, consumers order more and more products over the internet. As these products are often delivered to consumers’ homes, concerns on last mile sustainability are rising (Allen, Piecyk and Piotrowska, 2017; Allen, Piecyk, Piotrowska, McLeod, Cherrett, Ghali, Nguyen, Bektas, Bates, Friday, Wise and Austwick, 2017). In their review of environmental implications of online business-to-consumer (B2C) commerce, Mangiaracina et al. (2015) demonstrate that transport has the greatest impact on sustainability. They refer to last mile delivery as most important transport activity, as there are little differences between online and conventional shopping for most of the other transport activities involved. Accordingly, last mile transport is considered as one of the biggest challenges in B2C e-commerce (Savelsbergh and Van Woensel, 2016).

Next to environmental concerns, last mile transport is also very costly to organise for logistics service providers that carry out these deliveries. Depending on several factors, the last mile accounts for 13–75 per cent of total supply chain costs (Gevaers et al., 2009). Honeywell (2016) estimates that 50 per cent of total costs are attributed to the last mile.

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These high costs are partly caused by retailers who promise to serve their customers in two
days, the next day or even the day of purchase itself. Such short delivery terms hinder
efficient routing and consolidation of parcels (Savelsbergh and Van Woensel, 2016). Low
delivery location density and logistics facilities remote from the consumer market add to the
inefficiencies (Reyes et al., 2017). As a consequence, last mile delivery of a product is between
5 and 23 times more expensive for retailers than product purchases in-store (Allen et al.,
2017). What is more, consumers are largely unwilling to pay for these delivery services.
With an increasing number of retailers that move towards instant and on-demand
deliveries, efficiency and sustainability problems might only become larger.

As there is both an environmental and economic need, more efficient and sustainable last
mile delivery concepts are being explored. In their review of the impact of home delivery on
urban freight transport, Visser et al. (2014) suggest environmentally friendly vehicles
(e.g. electric vehicles and cargo-bicycles) and consolidation. Consolidation makes deliveries
more efficient, as more drops per trip reduce the number of vehicle kilometres per delivery
(Visser et al., 2014). There are several ways to foster consolidation, e.g. longer delivery terms
(Boyer and Prud’homme, 2009) and use of alternative delivery addresses (e.g. parcel pick-up
points and lockers) (Edwards, McKinnon and Cullinane, 2010; Edwards, McKinnon,
Cherrett, McLeod and Song, 2010). Within the recently conceptualised omnichannel retail
model, also retailers’ stores serve as pick-up location (Gao and Su, 2016).

Omnichannel retail implies that online channels, such as web-shops, and offline channels,
such as physical stores, are integrated (Verhoef et al., 2015). For consumers, this means that
they can use various channels throughout their shopping journey in a flexible, convenient
and seamless way that matches their preferences and needs (Peltola et al., 2015;
Juaneda-Ayensa et al., 2016). For omnichannel retailers, channel integration provides a
response to the fierce competition from online-only players and creates more loyal and
profitable customers (Nash et al., 2013; Cao and Li, 2015). Using their store network allows to
reduce the number of expensive home deliveries and increase the overall efficiency of their
supply chain (Buldeo Rai et al., 2017).

The omnichannel retail model is gaining popularity among retailers. Similar to pure
online retailers, who are under pressure to provide efficient delivery in terms of speed, price,
service and quality (Conlumino for Barclays, 2014), omnichannel retailers need to figure out
how to organise last mile transport flows to their customers, using their store network
(Hübner et al., 2016). Currently, it is unclear how omnichannel retailers can create a last mile
transport offer that is both attractive from a customer point of view and sustainable from an
environmental point of view. National and international reports demonstrate the importance
of free and fast delivery (Comeos, 2017; MetaPack, 2016), but consumers’ acceptance of more
sustainable last mile transport options has not been explored. As consumers are not willing
to compromise on quality, cost and convenience when making environment-friendly choices,
a comprehensive and industry-specific understanding of consumers’ decision-making
process is important (Narula and Desore, 2016).

To this end, we set up a survey among a representative sample of Belgian consumers
using choice-based conjoint experiments. By analysing consumers’ preference structures,
we identify which last mile attributes need to be combined to reach sustainability from a
“planet” and a “profit” point of view.

2. Literature review
Two last mile transport options are commonly offered to consumers when they order
products online: delivery at home (or any other address of choice) and collection at a local
pick-up point or locker. From an environmental point of view, home delivery is considered
the least favourable option (Mangiaracina et al., 2015). Several sustainability issues are
raised. First, delivery rounds are organised during regular office hours. Most consumers are
at work during this time of day, which results in failed deliveries (Visser et al., 2014). Exact percentages on the share of product deliveries that fail are scarce and inconsistent. According to Edwards et al. (2009), failure rates can go from as low as 2 per cent to 30 per cent. Other figures are recorded in the UK: 13–14 per cent (IMRG, 2014), 25 per cent (McLeod et al., 2006), 30 per cent (Fernie and Sparks, 1999) and even 60 per cent (Retail Logistics Task Force, 2001). In the Netherlands, deliveries fail in 25 per cent of the orders (Van Duin et al., 2016), while the Belgian postal organisation reports 14 per cent (Gijsbrechts, 2017). The differences in percentages largely depend on logistics service providers’ policies with receivers that are not at home. In general, orders that could not be delivered are dropped off at receivers’ neighbours or at a local pick-up point. However, in 12 per cent of the cases such orders are offered a second time to receivers’ homes (Visser et al., 2014). This re-delivery process can be repeated up to four times (Van Duin et al., 2016). In any case, delivery failure rates increase as home delivery grows (Weltevreden, 2008).

Second, retailers often offer next day delivery as part of their standard service. Fast delivery reduces the opportunity to consolidate orders and organise efficient delivery routes (Allen, Piecyk and Piotrowska, 2017), leading to an increase in vehicles and vehicle kilometres (Verlinde et al., 2012). Similar to figures on delivery failure, knowledge on load rates of delivery vehicles is limited. General freight studies refer to percentages less than 30 per cent in an urban context (Gebresenbet et al., 2011) and less than 50 per cent in a non-urban context (McKinnon and Piecyk, 2009). Taking both a volume and a weight perspective, it is commonly acknowledged that vehicles dedicated to home delivery are not fully loaded (Allen, Piecyk and Piotrowska, 2017; Allen, Piecyk, Piotrowska, McLeod, Cherrett, Ghali, Nguyen, Bektas, Bates, Friday, Wise and Austwick, 2017). Moreover, vehicles often fail to collect additional volume on their return to the warehouse, resulting in empty running (Edwards et al., 2011).

Third, home deliveries are mostly carried out with light goods vehicles or vans. These vehicles consume more fuel and release more emissions per metric ton moved than larger vehicles (Allen and Browne, 2010). In the UK, the number of licensed vans has increased by 70 per cent over the period from 1995 to 2015 (Allen, Piecyk and Piotrowska, 2017; Allen, Piecyk, Piotrowska, McLeod, Cherrett, Ghali, Nguyen, Bektas, Bates, Friday, Wise and Austwick, 2017). The number of vans in Belgium has grown by 55 per cent from 1991 to 2013, while the number of trucks remained stable (Strale et al., 2015). The rise in online shopping is stated as one of the key reasons behind this evolution (Allen, Piecyk and Piotrowska, 2017; Allen, Piecyk, Piotrowska, McLeod, Cherrett, Ghali, Nguyen, Bektas, Bates, Friday, Wise and Austwick, 2017).

To respond to these challenges, innovative variations on regular home delivery are being tested. Notable examples to avoid delivery failure include personal reception boxes (Punakivi and Tanskanen, 2002), in-car delivery (Reyes et al., 2017) and in-fridge delivery (Bauerová and Klepek, 2017). Such innovations rely on technological smartlock solutions to access boxes, car trunks and even houses. Another solution to increase first-time delivery success entails to offer a pre-agreed appointment or time slot in which the delivery takes place (Van Loon et al., 2015). However, this option is not provided often by logistics service providers as it complicates their routing schedules (Edwards, McKinnon and Cullinane, 2010).

Similarly, solutions have introduced to increase parcel consolidation. One of these solutions combines efficient routing programmes with delivery-term flexibility from the consumer’s side. Instead of offering next day delivery by default, retailers offer their customers the option to pick a time slot in which deliveries to their neighbourhood are already scheduled (Cullinane, 2009). This solution opposes the perceived need of companies to deliver faster and faster (Reyes et al., 2017). Although consumers’ waiting time increases, it enables more sustainable deliveries and raises awareness of sustainability issues related to delivery at home.

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Another solution to increase consolidation is created by parcel pick-up points and lockers, which are mostly located in busy and/or residential areas. Pick-up points are manned and organised in small local shops while lockers are unmanned and serviced by technological solutions such as QR-codes and mobile phones (Visser et al., 2014). The main advantage is that 100 per cent of the parcels are delivered (Van Duin et al., 2016), while providing consumers with more locations and time slots to choose from when picking up their parcels (Xiao et al., 2017). By collecting parcels within a certain neighbourhood, such points enable consolidation and efficient routing of delivery vehicles (Allen, Piecyk and Piotrowska, 2017). The negative environmental impact of parcel delivery is even more reduced when consumers visit the pick-up point on foot or by bike and/or combine this trip with other purposes (Xiao et al., 2017).

A similar solution to pick-up points and lockers is offered by so-called omnichannel retailers. Next to delivery at home and pick-up at regular parcel points, omnichannel retailers allow consumers to pick-up their orders in one of their stores (Gao and Su, 2016). For omnichannel retailers, integrating their store network allows to reduce the number of expensive home deliveries and increase the overall efficiency of their supply chain (Hubner et al., 2016). Moreover, consumers are found to prefer this option over regular pick-up points, which are managed by logistics service providers. This is because stores offer advantages such as possibilities to return products and make additional purchases, immediate refund for product returns and specialised product advise (Buldeo Rai et al., 2017).

Alternatives to vans are ubiquitous in urban environments. Most logistics service providers are experimenting with sustainable alternatives such as bikes and electric vehicles. Such vehicles offer many advantages. For example, cargo-bikes are not subjected to congestion and allow to guarantee delivery time accuracy (Gruber et al., 2014). In times of increasing environmental awareness at the urban level, electric vehicles often receive more favourable time windows and can access the city’s low emission zones (Quak et al., 2016).

Despite many innovations that aim to improve sustainability in last mile transport, actual implementation is still limited. Part of the explanation is that retailers are not offering sustainable options that consumers can choose from, acting as a so-called “filter” on the product and service offer (Kostadinova, 2016). Young et al. (2010) found that consumers make green purchases only if available in a range of options, while Theotokis and Manganari (2015) recommended a system in which the most sustainable option is offered as “opt-in”, to which consumers can deviate by explicitly “opting-out”. Another part of the explanation points to consumers that fail to make sustainable choices even when given the option. Research found that even if consumers are inclined to make an environment-friendly purchase, they are not willing to compromise on quality, cost and convenience (Narula and Desore, 2016). Hence, a comprehensive and industry-specific understanding of consumers’ decision-making process is important.

Various studies have investigated what consumers find important in last mile transport. These studies show that consumers prefer free and fast delivery at home (Comeos, 2017; MetaPack, 2016). Although consumers increasingly attach significance to environmental sustainability in their purchase activities (Gonzalez-Lafaysse and Lapassouse-Madrid, 2016; Quarshie et al., 2016; Bask et al., 2013), the topic has received less attention in relation to consumers’ last mile transport decisions. Currently, environmental concerns and arguments seem to play a minor role (Lagey et al., 2016). With this research, we explore to which extent consumers are willing to adopt last mile options that are more sustainable and how these options should be composed to remain attractive. We use choice-based conjoint analysis to examine how consumers trade-off collection and delivery attributes in their choice of last mile transport options when they make purchases online.
3. Methodology
3.1 Choice-based conjoint analysis
Choice-based conjoint analysis is a stated preference technique that simulates a choice situation involving a set of competing alternatives. Various alternatives are composed based on a common set of attributes and presented to respondents. Given this set of attributes, respondents select the option that matches best with their preferences. By observing the preferred alternatives, choice-based conjoint analysis allows to estimate the trade-offs that respondents make among the various attributes. The method has a long track record in measuring preferences and understanding choices and trade-offs that consumers make (Louviere, 1994). A major advantage of choice-based conjoint analysis is the realism it provides in modelling consumers’ decision-making processes (Hair et al., 2010). The method has been applied in retailing since the early work of Green and Srinivasan (1978). For investigating the importance of sustainability in consumers’ decision-making, it is the most commonly used method (Bask et al., 2013; Lebeau et al., 2016).

The selection of attributes is critical in choice-based conjoint design. According to the literature review, many aspects influence the choice for last mile transport options. According to Hair et al. (2010), a maximum of six attributes is recommended. To identify the most relevant attributes, we analysed consumer preference surveys and validated a final attribute set in focus groups with consumers. The survey results were reported in 35 national and international reports and published by various parties: logistics service providers (e.g. UPS, PostNord), communication agencies (e.g. Walker Sands, Bizrate Insights), financial agencies (e.g. Barclays), consulting agencies (e.g. McKinsey, KPMG) and associations (e.g. IMRG, Comeos). We collected and categorised all aspects of importance to consumers in last mile delivery in a spreadsheet file. Six focus groups were organised in June and July 2017 in three major Belgian cities: Brussels, Ghent and Antwerp. Each focus group counted four respondents and lasted approximately 3 h. These respondents were equally distributed in terms of motivation, frequency and experience with online shopping, their perception of sustainability and also age, gender and language (either French or Dutch). A topic list guided the conversation in a semi-structured way and introduced several topics, including the respondents’ online shopping journey, perception of the online retail landscape, perception of and expectations about last mile delivery and the future of online retailing. It is considered good practice to introduce focus group discussions at the beginning of a research project that aims to identify factors that influence behaviour, motivation, opinions or feelings and ideas that people have (Krueger and Casey, 2000). Ultimately, we selected four attributes: “delivery price”, “delivery term”, “delivery reception” and “return possibility”. Delivery location and delivery time were grouped into one attribute or “composite factor” (Green and Srinivasan, 1978) that we named “delivery reception”, as both aspects are linked. For example, delivery in a parcel locker allows for 24/7 pick-up possibilities and a slotted 2 h delivery timeframe is only relevant for delivery at home (or any other fixed address). Similarly, the “return possibility” attribute combines both the return location and price.

Several last mile transport aspects were ultimately excluded from our final selection as they were considered less relevant for consumers: delivery information, delivery vehicle, delivery flexibility, executing logistics service provider and aspects related to sustainability. Remarkably, our focus groups showed that consumers do not feel responsible for enhancing sustainability but instead expect businesses – including retailers and logistics service providers – to act in a sustainable way.

Table I lists our final set of attributes and their possible values or “levels”. These levels were selected to reflect a realistic last mile offer in omnichannel retail. Similarly to attributes, the number of levels should be limited to ensure an efficient design. Moreover, levels need to be both communicable and actionable (Hair et al., 2010). In this respect,
communicable levels enable respondents to understand them in the same way and evaluate them correctly, while actionable levels allow them to be put into practice. As some attributes could be unclear for respondents, specifically “loyalty programme” and “time slot”, we added a short description below every choice task. A loyalty programme is offered by the retail group, based on purchase frequency and/or purchase amount, and offers free deliveries and returns. The time slot represents a period of time in which the delivery takes place, in this case of 2 h.

3.2 Utility computation
Different estimation methods are available to model preferences using the collected data. We applied the multinomial logit model, which is the most frequently used model in choice-based conjoint studies. This model is highly versatile and based on sound theoretical assumptions (Rao, 2014). In this way, consumer utility values are calculated. Utility values indicate the relative importance of attributes’ levels and illustrate the extent of desirability for a certain attribute level: the higher the utility, the more desirable the attribute level. Levels with high utilities have a large positive impact on influencing respondent’ choices (Hair et al., 2010).

3.3 Survey sample and design
A large retail group in Belgium is expanding its online activities for non-food products. In accordance with the omnichannel retail model, its online channel will be integrated in the retail group’s dense store network. For the group, sustainability and customer service are key values and drive internal and external actions and operations. Therefore, last mile transport options offered to their customers should be attractive from a consumer point of view and sustainable from a “green supply chain” point of view. This is important, as sustainability initiatives ultimately depend on customer support (Quarshie et al., 2016). The green supply chain concept integrates environmental considerations into supply chain management, including product design, manufacturing processes and delivery of products to consumers (Srivastava, 2008).

The choice-based conjoint analysis is based on a survey conducted among a sample of one-thousand consumers. The sample is representative for the Belgian population according to age, sex, degree, language, family composition and social class (CIM, 2017). The survey

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Return possibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery price</td>
<td>Delivery term</td>
</tr>
<tr>
<td>Free</td>
<td>Within two hours</td>
</tr>
<tr>
<td>Free as from €25</td>
<td>Tomorrow</td>
</tr>
<tr>
<td>Free as from €50</td>
<td>Day after tomorrow</td>
</tr>
<tr>
<td>Free as from €75</td>
<td>Within 1–3 days</td>
</tr>
<tr>
<td>€2.95</td>
<td>Within 3–5 days</td>
</tr>
<tr>
<td>€5.95</td>
<td>Minimal 3 days, but delivery date of choice</td>
</tr>
<tr>
<td>Free with a loyalty programme</td>
<td>Minimal 5 days, but delivery date of choice</td>
</tr>
</tbody>
</table>

Table I. Attributes and levels

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was administered online by using Sawtooth software (www.sawtoothsoftware.com/). Web-based surveys are efficient and convenient (Bask et al., 2013). It allowed us to reach an appropriate sample size and sample composition within a limited timeframe. To reach the envisioned target group, three selection criteria were applied: all respondents are older than 18, made an online purchase in the last year and endorse the retail group. In total, 13 per cent of respondents were rejected from the final sample because of this third criterion. Accordingly, they did not receive access to the remainder of the survey. The data collection was in collaboration with a recognised market research company (iVOX). Preceded by a technical pre-test with 100 respondents, the survey ran two weeks (from 18 September 2017 until 29 September 2017).

We organised the survey in three parts. In the first section, screener questions were asked to reject respondents based on the previously defined criteria. This part also contained questions on socio-demographics to compose the sample. The second section was dedicated to behaviour, preferences and experiences with regard to online shopping: purchase frequency, product types, online stores and order collection and delivery. In this section, we also proposed statements related to last mile transport: 12 on innovations (including crowd logistics) and 9 on sustainability (including electric vehicles). The third section comprised the on-screen choice tasks, providing a realistic last mile offer from which respondents could choose. To generate the various choice tasks, it was necessary to make several decisions concerning the choice-based conjoint design: number of alternatives, number of choice tasks and the method for generating the choice tasks. Figure 1 illustrates an example of a choice task included in the survey.

First, the number of alternatives presented in a choice task needs to be decided. More alternatives provide richer trade-offs but reduce the design’s efficiency. An increasing number of alternatives also require more efforts by respondents. Following the recommendation by Hair et al. (2010), we include three alternatives per choice task. Second, similar considerations have to be made regarding the number of choice tasks. Generally recommended is not to exceed 10–15 choice tasks, as it does not provide additional insights into the preference structure of respondents (Hoogerbrugge and van der Wagt, 2006). We decided to present respondents with eight choice tasks, given that the survey also included additional questions. Third, choice tasks are composed
by combining levels from each attribute. In our design, no pairs of levels were prohibited from occurring together. The method for choice task generation needs to take two key principles into account: orthogonality and balance (Hair et al., 2010). Orthogonality of the design means that no correlation should exist among the levels of an attribute. The balance of the design means that each level of an attribute should appear the same number of times. We used the balanced overlap option provided by Sawtooth software to generate the choice tasks.

4. Results

4.1 Attitudes of consumers

To evaluate consumers’ attitudes towards sustainability in last mile transport, we proposed nine statements. These statements capture general attitudes (statements 1–3) and attitudes towards delivery characteristics with a positive environmental effect (statements 4–9). These delivery characteristics comprise the use of parcel pick-up points (Edwards, McKinnon and Culline, 2010; Edwards, McKinnon, Cherrett, McLeod and Song, 2010), consolidation of parcels and longer delivery terms (Boyer and Prudhomme, 2009) and the use of environmentally friendly vehicles (Visser et al., 2014). Figure 2 illustrates responses on these statements. These responses are useful for interpreting the choice-based conjoint analysis. Moreover, attitudinal insights are important, as intentions to perform a certain behaviour can be influenced by attitudes (Azjen, 1991).

The results of the survey show that approximately half of consumers take their environment into account when making a purchase and agree that achieving less vehicle kilometres for last mile deliveries is important. Consumers attach more importance to reducing vehicle kilometres in general (52.5 per cent) as compared to reducing vehicle kilometres in their specific neighbourhood (48.5 per cent). Therefore, we assume that consumers experience limited nuisances from local delivery activities. Nevertheless, in line with Macharis and Milan (2015), the results show that consumers are concerned about the overall negative impacts of these activities.

A reduction in vehicle kilometres is feasible by decreasing home deliveries in favour of pick-up points and increasing delivery times. Survey results indicate that 56.2 and
44.6 per cent, respectively, of consumers are willing to contribute to this. However, consumers are not willing to pay for deliveries that employ more sustainable alternatives to standard delivery vans, such as electric vehicles (57.1 per cent) or cargo-bicycles (55.2 per cent). Research shows that consumers tend to resist new technologies that are considered alien or unproved (Egbue and Long, 2012). In line with deliveries with conventional vehicles (Allen, Pieczyk and Piotrowska, 2017; Allen, Pieczyk, Piotrowska, McLeod, Cherrett, Ghali, Nguyen, Bektas, Bates, Friday, Wise and Austwick, 2017), consumers’ willingness to pay is low. In total, 70.9 per cent of consumers want all products of the same order delivered together, but only 60.5 per cent is prepared to wait longer.

Among the survey results, we detect a high percentage of neutral responses to the statements (29 per cent on average). Consequently, we assume that interest in and/or knowledge about sustainability in last mile delivery among consumers is low. Research has shown that knowledge is an important predictor of green consumer behaviour (Kostadinova, 2016). Possibly, it indicates that (a part of) consumers can be convinced to make more sustainable choices. This interpretation is in line with the green and social delivery report published by B2C Europe (2018), which demonstrates that many consumers lack knowledge on the environmental impact of deliveries, but are willing to choose sustainable alternatives when negative impacts are explained.

### 4.2 Consumers’ choice behaviour

As the findings reported in this section were analysed for the whole sample, analysis is based on 8,000 choice tasks. The examined model was statistically significant relative to the fixed model, using a $\chi^2$-test ($p < 0.001$). Consequently, respondent choices are significantly affected by the attribute composition presented (Hosmer et al., 2013). Table II shows the utility of attribute levels and the relative importance of attributes in percentages. Together, these findings represent what consumers view as best last mile option.

The most important attribute to consumers is delivery price (53.47 per cent). The second most important feature is return possibility (20.21 per cent), followed by delivery term (13.67 per cent) and delivery reception (12.64 per cent). Consumers’ preference goes out to free, next day delivery to an address of choice, on regular office hours during the week and with a free return possibility in a local pick-up point. This agrees with current preference figures of collection and delivery alternatives in Belgium (Comeos, 2017).

Next to free delivery, consumers indicate a positive preference for a minimal purchase amount of €25 that allows free delivery, the lowest purchase amount among the price levels, and free delivery using a loyalty programme. This finding is in accordance with Xing et al. (2010), who point out the increasing price sensitiveness of consumers in the retailing market. Loyalty programmes’ importance has increased in the last few years (Hagberg et al., 2016). Internationally, consumers are found to use and appreciate such programmes and want free or quick delivery as a reward (MetaPack, 2016). At the time of research, loyalty programmes were just gaining ground in Belgium. Consumers avoid high minimal purchase amounts (€75) and high delivery prices (€5.95).

The results for the delivery-term attribute show a preference for levels that allow faster deliveries, including delivery tomorrow, day after tomorrow and within one to three days. Preference decreases as delivery terms increase. Most unfavourable to consumers is a delivery term that can take at least five days, despite the possibility to freely choose a delivery date within this term. Clearly, consumers do not mind unknown delivery dates. Accordingly, a study found that 73 per cent of Belgian consumers do not consider this as a limitation of online shopping (Bpost, 2017). Moreover, the results indicate that consumers have no preference for instant orders that are delivered within 2 h, which contradicts
recently formulated expectations (Dablanc et al., 2017). Also contrary to assumptions made by Agatz et al. (2013), consumers have no distinct preference for slotted deliveries. For receiving deliveries, consumers prefer an address of choice. Only small preference differences are detected among the exact delivery times. Delivery during the week or the weekend, during regular office hours or after and during a slotted two-hour or unknown timeframe, consumers appear to be indifferent. In comparison, they avoid collecting parcels in one of the retail group's stores or parcel locker boxes.

The results for the return possibility attribute point out that consumers strongly prefer to return unwanted or faulty orders free of charge, or free by employing a loyalty programme. Returning goods in a pick-up point is valued most, next to stores of the retail group or parcel locker boxes. Consumers avoid paying for their order returns, in particular when the return location is a locker.

In accordance with the above analysis, delivery price is by far the most important factor in consumers’ choice behaviour for last mile options, the other attributes are less sensitive. Creating a last mile offer that is both attractive and sustainable requires investigating the trade-offs that consumers make in a more detailed way. To this end, we carry out market simulations. Simulation is one of the key features of conjoint analysis (Rao, 2014). It is used to predict individual choices under hypothetical scenarios, entered in the simulator as full-profile descriptions. Individuals’ utility functions are used to compute preferences for each of the competing items (Green and Srinivasan, 1978). In this way, simulation helps in answering various “what-if” questions based on conjoint data (Rao, 2014).

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Attribute levels</th>
<th>Utility of attribute levels</th>
<th>SE</th>
<th>Relative attribute importance (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery price</td>
<td>Free</td>
<td>1.24960</td>
<td>0.03098</td>
<td>53.47</td>
</tr>
<tr>
<td></td>
<td>Free as from €25</td>
<td>0.55657</td>
<td>0.03091</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free as from €50</td>
<td>−0.07456</td>
<td>0.03358</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free as from €75</td>
<td>−1.02177</td>
<td>0.04448</td>
<td></td>
</tr>
<tr>
<td></td>
<td>€2.95</td>
<td>−0.17266</td>
<td>0.03399</td>
<td></td>
</tr>
<tr>
<td></td>
<td>£5.95</td>
<td>−1.03270</td>
<td>0.04484</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free with a loyalty programme</td>
<td>0.49552</td>
<td>0.03093</td>
<td></td>
</tr>
<tr>
<td>Delivery term</td>
<td>Within 2 h</td>
<td>−0.08625</td>
<td>0.03471</td>
<td>13.67</td>
</tr>
<tr>
<td></td>
<td>Tomorrow</td>
<td>0.22022</td>
<td>0.03301</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Day after tomorrow</td>
<td>0.14189</td>
<td>0.03310</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Within 1–3 days</td>
<td>0.18667</td>
<td>0.03288</td>
<td></td>
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<tr>
<td></td>
<td>Within 3–5 days</td>
<td>−0.07804</td>
<td>0.03418</td>
<td></td>
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<tr>
<td></td>
<td>Minimal 3 days, but delivery date of choice</td>
<td>−0.02114</td>
<td>0.03388</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Minimal 5 days, but delivery date of choice</td>
<td>−0.36335</td>
<td>0.03571</td>
<td></td>
</tr>
<tr>
<td>Delivery reception</td>
<td>Address of choice, during the week (9u-18u)</td>
<td>0.20582</td>
<td>0.03335</td>
<td>12.64</td>
</tr>
<tr>
<td></td>
<td>Address of choice, during the week (18u-22u)</td>
<td>0.14333</td>
<td>0.03305</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Address of choice, during the weekend (9u-18u)</td>
<td>0.08163</td>
<td>0.03360</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Address of choice, during two-hour time slot</td>
<td>0.13788</td>
<td>0.03320</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retail group's store (during opening hours)</td>
<td>−0.20334</td>
<td>0.03515</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pick-up point (during opening hours)</td>
<td>−0.03140</td>
<td>0.03364</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Parcel lockers (24/7)</td>
<td>−0.20334</td>
<td>0.03591</td>
<td></td>
</tr>
<tr>
<td>Return possibility</td>
<td>Free, retail group's store (during opening hours)</td>
<td>0.24136</td>
<td>0.03288</td>
<td>20.21</td>
</tr>
<tr>
<td></td>
<td>Free, pick-up point (during opening hours)</td>
<td>0.41717</td>
<td>0.03240</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free, parcel lockers (24/7)</td>
<td>0.23179</td>
<td>0.03257</td>
<td></td>
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<tr>
<td></td>
<td>€2, retail group's store (during opening hours)</td>
<td>−0.30370</td>
<td>0.03539</td>
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<tr>
<td></td>
<td>€2, pick-up point (during opening hours)</td>
<td>−0.25181</td>
<td>0.03526</td>
<td></td>
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<tr>
<td></td>
<td>€2, parcel lockers (24/7)</td>
<td>−0.44561</td>
<td>0.03651</td>
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</tr>
<tr>
<td></td>
<td>Free with a loyalty programme, retail group's store (during opening hours)</td>
<td>0.11078</td>
<td>0.03304</td>
<td></td>
</tr>
</tbody>
</table>
We undertake this market simulation using several scenarios that we developed based on consumers’ most preferred last mile option that acts as base scenario. These scenarios are formulated as more sustainable variations on the base scenario. To guarantee attractiveness of the last mile options, we retain free of charge order delivery and return. Six scenarios are tested:

1. Scenario 1 is the base scenario consisting of next day delivery on an address of choice during the week (9u-18u), with return possibility in a pick-up point.
2. In scenario 2, orders are delivered on an address of choice during the week (9u-18u) and returned in a pick-up point, although consumers have to wait one to three days.
3. In scenario 3, orders are delivered on an address of choice during the week (9-18u) and returned in a pick-up point, although consumers have to wait three to five days.
4. In scenario 4, orders are delivered next day and returned in a pick-up point, although consumers need to collect their orders in a pick-up point.
5. In scenario 5, orders are delivered next day and returned in a pick-up point, although consumers need to collect their orders in the retail group’s store.
6. In scenario 6, orders are delivered next day on an address of choice during the week (9u-18u), although consumers need to return their orders in the retail group’s store.

The results of these simulations are shown in Table III. The simulation results demonstrate that 81.42 per cent of consumers would choose for the most preferred base scenario. The fifth scenario is preferred least: 76.92 per cent of consumers would choose this option, while preference shares for the remaining scenarios are in between. The difference in preference share between the most and least preferred scenario is 4.5 per cent. This fairly small difference confirms the fact that consumers are largely indifferent towards delivery term and delivery reception conditions when delivery and return are free. Accordingly, consumers are willing to wait longer for their orders to arrive or collect their orders themselves instead of dedicated delivery to an address of choice.

Our research contributes to current literature on sustainable last mile transport, by demonstrating that consumers are in fact making trade-offs in their choice of last mile transport options. This contradicts Gevaers et al. (2009), who state that consumers do not make trade-offs that are able to improve environmental issues related to the last mile. Our research also has practical implications. For omnichannel retailers with a dense store network, the results indicate that consumers accept their store network as pick-up and return locations, allowing retailers to create a more efficient and sustainable supply chain in which their online and offline activities can be combined.

Retailers with an omnichannel retail model offer their customers complete flexibility throughout their shopping journey (Piotrowicz and Cuthbertson, 2014). Accordingly, retailers offer several last mile options to their customers, instead of merely one option as

<table>
<thead>
<tr>
<th>No.</th>
<th>Scenario description</th>
<th>Share of preference (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Base scenario</td>
<td>81.42</td>
</tr>
<tr>
<td>2</td>
<td>Base scenario with variation on delivery term “within 1 to 3 days”</td>
<td>81.09</td>
</tr>
<tr>
<td>3</td>
<td>Base scenario with variation on delivery term “within 3 to 5 days”</td>
<td>78.22</td>
</tr>
<tr>
<td>4</td>
<td>Base scenario with variation on delivery reception “pick-up point”</td>
<td>78.92</td>
</tr>
<tr>
<td>5</td>
<td>Base scenario with variation on delivery reception “retail group’s store”</td>
<td>76.92</td>
</tr>
<tr>
<td>6</td>
<td>Base scenario with variation on return possibility “retail groups store”</td>
<td>79.63</td>
</tr>
</tbody>
</table>

Table III. Market simulation
investigated in this research. Agatz et al. (2013) advocate for delivery service differentiation coupled with dynamic pricing, to exceed the one-size-fits-all strategy that is unable to serve a heterogeneous consumer market (Agatz et al., 2013). Moreover, not only consumers differ, but also their purchases are characterised by variations that influence the delivery needs at hand (Bpost, 2017). In line with this argument, we propose omnichannel retailers to apply appropriate mechanisms to steer consumers towards a last mile option that is more sustainable. An example of such strategy is a combination of free order collection in-store and a small charge for delivery to an address of choice, or slow delivery free of charge to an address of choice and fast but paid delivery to an address of choice. In this way, a sustainable last mile transport offer for omnichannel retail can be created, while still capturing the interest of consumers.

5. Conclusion

Last mile transport is a critical part of the supply chain and entails the various ways in which products reach the end-customer in the consumer market. Not only is it a very costly process for retailers and logistics service providers to organise, its environmental impacts are also significant. Home delivery is considered the worst last mile option but several more sustainable alternatives exist, including local pick-up points and lockers. Retailers that adopt an omnichannel model add their stores as an alternative location for consumers to collect (and return) their online orders. By means of a survey with choice-based conjoint experiments, this paper investigates to which extent consumers are willing to adopt last mile options that are more sustainable and how these options should be composed to remain attractive. Results show that almost one third of consumers reflect a neutral attitude towards sustainability in last mile transport, indicating low interest in and/or knowledge about this topic among consumers. It also provides an opportunity to convince consumers to choose for more sustainable last mile options. Although the research shows that consumers’ preference goes out to free, next day delivery to an address of choice, on regular office hours during the week, they are willing to collect their orders themselves or wait longer for their order to arrive when delivery and return are free. The research confirms that consumers accept omnichannel retailers’ store network as pick-up and return locations, allowing retailers to organise their supply chain in a more efficient and sustainable way.

References


Bpost (2017), *Explaining the Omnichannel Path to Purchase*, Bpost, Brussels.


The “next day, free delivery” myth unraveled


Further reading

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