

Innovation in Last Mile Delivery: Meeting evolving customer demands – The case of In-Car Delivery

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Abstract

Parcel delivery today is in urgent need for innovation driven by the imbalance between two forces that can be observed in the market environment. First, the volume of parcels between businesses and consumers is growing rapidly, mainly driven through e-commerce. Second, consumer habits and lifestyles are changing in a way that demands more flexibility and convenience. Ultimately, the feasibility of the delivery moment, reaching consumers at home, is shrinking. Therefore, this thesis deals with service innovations in the Last Mile Delivery of parcels that seek to enhance customer experience and address the insufficiencies of existing delivery models. The emphasis in this work is on In-Car Delivery - a method in which a parcel is delivered to the trunk of a consumer's car. The objective of the paper is to examine whether consumers would accept In-Car Delivery as a novel way to receive parcels. Key findings suggest that In-Car Delivery can solve the deficiencies of today's delivery methods, and consumers are willing to use trunk delivery. Yet, the research also shows that In-Car Delivery brings along an unprecedented set of concerns in parcel delivery, namely customer data and privacy concerns. As the exploration of innovative delivery solutions - beyond In-Car Delivery - is continuing, this research helps parcel companies to prioritize and concentrate their resources on the main value drivers. This study identified the following five factors most important to consumers when receiving a parcel: flexibility, convenience, cost, speed, and variety.

Resumo

A entrega de encomendas hoje passa por uma necessidade urgente de inovação, impulsionada pelo desequilíbrio entre duas forças que podem ser observadas no mercado. Primeiro, o volume das encomendas entre empresas e consumidores está crescendo rapidamente, principalmente através do e-commerce. Segundo, os hábitos de consumo e estilos de vida estão mudando de forma a exigir mais flexibilidade e conveniência. E por último, a viabilidade de entrega, de a encomenda chegar às mãos dos consumidores em casa, está diminuindo. Portanto, esta tese trata de inovações de serviços na entrega de encomendas da Last-Mile Delivery que buscam aprimorar a experiência do cliente e abordar as insuficiências dos modelos de entrega atuais e existentes. A ênfase deste trabalho está no *In-Car Delivery* – um método onde a encomenda é entregue ao porta-malas do carro do consumidor. O objetivo deste trabalho é examinar se os consumidores aceitariam ou não o serviço In-Car Delivery como uma nova maneira de receber suas encomendas. Além disso, este estudo identificou os seguintes cinco fatores mais importantes para os consumidores quando se trata de receber uma encomenda: flexibilidade, conveniência, custo, velocidade, e variedade. As principais conclusões sugerem que o serviço In-Car Delivery pode resolver as deficiências dos métodos de entrega atuais, e em geral, os consumidores estão dispostos a usar este serviço como método de recebimento de encomendas. No entanto, a pesquisa também mostra que o In-Car Delivery traz consigo preocupações sem precedentes quando se trata da entrega de encomendas, principalmente preocupações com os dados e privacidade dos clientes.

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Abbreviations

AGV	–	Autonomous guided vehicle
B2B	–	Business to business
B2C	–	Business to consumer
BOPUS	–	Buy Online Pick Up in Store
CPG	–	Consumer Packaged Goods
CSF	–	Critical Success Factors
DVD	–	Delivery Value Density
FAA	–	Federal Aviation Administration
HDS	–	Home Delivery Service
ICD	–	In Car Delivery
ICT	–	Information and communication technologies
LM	–	Last Mile
LMD	–	Last Mile Delivery
M&A	–	Merger & Acquisition
PLC	–	Product Life Cycle
SIS	–	Supporting Infrastructural Services
USPS	–	U.S. Postal Service
WTP	–	Willingness to pay
X2C	–	B2C & C2C, i.e all parcel delivered to final consumers

1. Intro

This thesis elaborates on service innovations in the field of Last Mile Delivery for parcels that seek to enhance customer satisfaction. The emphasis is on new approaches to bring parcels to the consumer, in particular In-Car Delivery - a method in which a parcel is delivered to the trunk of a consumer's car. Novel approaches in last mile delivery, such as trunk delivery, aim to provide a solution towards an increasing imbalance that is triggered by two major trends. First, the volume of parcels between businesses and consumers is increasing rapidly, mainly driven through e-commerce (DHL Trend Research, 2014). Second, we observe shifting habits and lifestyles in society increasingly searching for flexibility, spending more time at work or outside of home. As a result, the feasibility of the delivery moment, reaching consumers at home, is shrinking.

“For delivery service companies to be successful in the market, it is essential that they develop services in accordance with customer lifestyles and needs as well as to enhance the effectiveness of delivery” (J.D. Power, 2007).

1.1. Problem Statement

With the purpose of understanding if consumers would engage in the use of In-Car Delivery we will focus on assessing and identifying what kind of factors are valued and impact customer satisfaction in the Last Mile in order for the consumers to adopt this mode of parcel delivery.

1.2. Research Questions

RQ1: Which are drivers of customer satisfaction in Last Mile Delivery?

The literature review identifies 5 Critical Success Factors that are most important to consumers in last-mile delivery. Together they form a value proposition that shows on average how well a delivery method - existent or new - is performing along these dimensions. The proposed factors will be tested in the survey to see if they are in fact valued by the sample.

RQ2: What do consumers perceive to be problems with established methods?

The literature review exhaustively examines today's prevalent delivery methods. It shows that each type of delivery has its practical limitations. For each type of delivery, the degree of inconvenience incurred through these limitations is investigated in the survey.

RQ3: Does in-car delivery achieve to mitigate the identified problems?

In accordance with the success criteria for parcel delivery, in-car delivery appears to be a superior solution to existent delivery methods. To validate this claim, the survey tries to answer, which of the identified problems the respondents perceive to be mitigated through the use of in-car delivery.

RQ4: Are consumers willing to use in-car delivery? What kind of new issues/concerns are involved? Are consumers willing to share personal/vehicle data?

Even if research question °3 reveals that in-car delivery adds benefits and solves the limitations of established delivery methods, it cannot be automatically assumed it finds acceptance among consumers. Hence, RQ4 is supposed to explicitly ask for willingness to use. To complement, the survey aims to determine possibly new, emerging restrictions that may hamper the acceptance of ICD.

1.3. Structure & Significance of Study

Significance

This paper generates consumer insights in order to assist decision-making for organizations about investments into Last Mile Delivery services. The need for innovations is driven by the imbalance between two major forces found in the consumer marketplace today. First, the volume of parcels between businesses and consumers is increasing rapidly, mainly driven through e-commerce (DHL Trend Research, 2014). Second, we observe shifting habits and lifestyles in society increasingly searching for flexibility, spending more time at work or outside of home. Hence, the feasibility of the delivery moment, reaching consumers at home, is shrinking.

This study provides both academic and managerial significance.

Academic relevance. The case of In-Car Delivery is terra incognita in literature and academic papers. Customer expectations and preferences in Last Mile Delivery have surely been studied before, for instance in the context of Home Delivery or Parcel Lockers, yet not the specific application of In-Car Delivery as this is a fairly new innovation and not yet commercially available.

Furthermore, this paper distinguishes from existent works as it gathers consumer insights on a clear aspect of Last Mile Delivery, i.e. the delivery address. Studies generally mix the mode of transport, delivery options, and delivery addresses and neglect that their implications are interrelated in many cases.

Managerial Relevance. Current delivery options are insufficient to meet customers' expectations. With In-Car Delivery, the thesis introduces and evaluates a possible solution how e-commerce and delivery companies better delight consumers. Frazer (2000) argues that business managers are increasingly realising that it is difficult to find delivery options that are both cost-effective and satisfying consumers. Executives at incumbent retailers and carriers say they feel compelled to react to threats of new players (Lukic *et al.*, 2013). Yet, they must be wary not to act hastily and bring to life new solutions solely for the sake of reacting. Too often, technology guides the solution, with companies hardly ever pausing to ask: "Is that solution what the user really requires?" (Gourévitch *et al.*, 2016, p. 3). The mere feasibility of a service enabled through technology, such as cloud computing and connected cars, does not guarantee

acceptance by the customer. In fact, “companies should conduct extensive research, testing and piloting before committing to specific initiatives as getting it wrong can be costly” (Capgemini, 2016, p. 15). Hence, the consumer insights from the data collected in this paper, help to get a better understanding of ICD’s market potential and the willingness of customers to adopt trunk delivery. In combination with real-life pilots and field experiments, these findings enable organizations to make market-ready decisions before allocating resources into building the necessary infrastructure and capabilities on a large scale. In a nutshell, “tests and pilots make much more sense than big bets” (Lukic *et al.*, 2013, p. 15).

Structure of Study

As the first part of this study the literature review is presented. This part outlines the landscape of last-mile delivery, examines existent and emerging delivery modes, and identifies the drivers of value-creation in parcel delivery. In addition, it reveals the circumstances making innovation in last-mile delivery imperative and introduces In-Car Delivery, a concept with the potential to address limitations of traditional ways of parcel delivery.

Next, the underlying research methodology is shown. The research design as well as a survey is described in greater detail. Moreover, the statistical analyses used in this study are illustrated. Ensuing, the findings are reported and further interpreted. All research questions are addressed in this part of the study.

Finally, the findings are summarized and while considering the research limitations, implications for further research are given in the conclusion part of the work.

2. Literature Review

2.1. Post and Parcel Industry

2.1.1. Parcel Industry Figures

“Postal services are delivery services for documents and parcels provided by private companies or public undertakings” (Dieke *et al.*, 2013, p. 21). The post and parcel industry has changed significantly over the last decade and continues to do so. Mail used to be the core business of postal companies, yet continues to decrease as a percentage of postal revenues. In 2007 it constituted for the majority of total revenues (55%); today it is below the half at 44 percent. Driven by the growing popularity of e-commerce, the Parcel business is thriving: Global parcel volume is growing at a compound annual growth rate of 5.9% between 2013-15, corresponding revenues grow at 4.8% (see Figure 2). In 2015, growth rates were in a range of 7 to 10 percent in mature markets, such as Germany or the US, and up to 300 percent in developing markets, such as India. In mature markets, this could mean parcel volumes double over the course of ten years (2015-2025) (Joerss *et al.*, 2016).

European postal operators have been forced to modernize their business and services due to globalization, emergence of new technologies and the liberalization of the market. They introduced innovations in production processes, improved quality of services, and diversified, broadening their product and service portfolio (Corrocher *et al.*, 2012).

The post and parcel market is highly contracted on a national level; globally 45 postal operators generate 90% of the revenues (IPC, 2016). Generally, there is one dominant postal operator per country. This is because government authorities define mail delivery to be a universal service that must be accessible to all individuals without restriction to certain geographies, and hence puts obligations onto those firms who want to play in the respective market. Deregulation in the past has led to more competition cross-border and better service quality, many operators remain public though.

The postal industry is largely capital-intensive and traditionally requires large-scale physical networks, infrastructure and assets, including distribution centers, logistic hubs, post offices and delivery vehicles (Kutscher and Mark, 1983). Due to high fixed costs, declining volumes in mail put pressure on margins. In addition, the improved service quality comes at a cost impacting

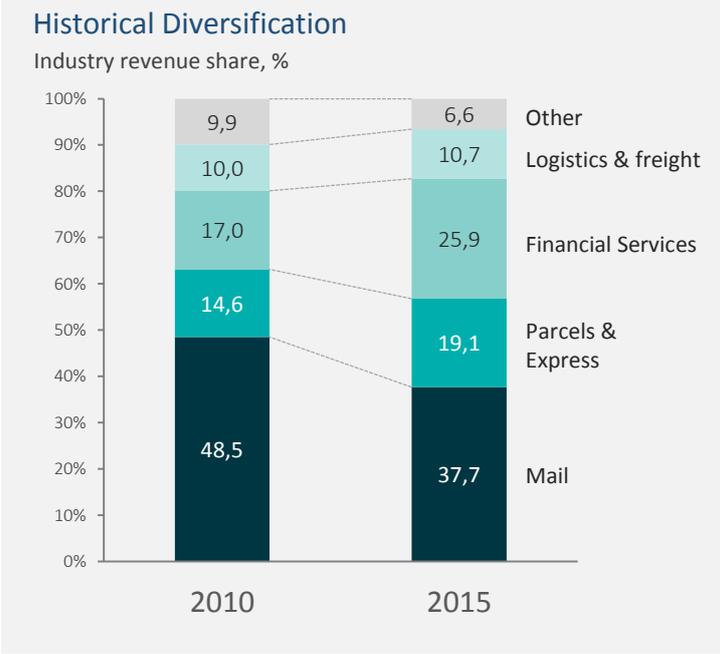


Figure 1: Own representation based on IPC, 2016

profit. Through diversification companies find opportunities to compensate the declining core business, and grow revenue and profit in other, often related, businesses. According to IPC (2016), the industry revenue share of Mail has dropped by 10 percent from 2010 to 2015 (see Figure 1). Postal companies diversify primarily in Retail, Logistics, Banking and Insurances (Buhler and Pharand, 2015). Expansion across the logistics supply chain adds revenue sources while leveraging the existent assets and competencies. Poste Italiane, for instance, improved utilization of their existent post offices, starting to offer mobile telecommunication and financial services at their points of sales (Corrocher *et al.*, 2012).

Incumbent firms are investing at a record pace in recent years. Capital expenditure has increased by 41 percent from 2013 to 2015. Investments are made to diversify, improve efficiency, generate cost savings, build capacity for increasing parcel volume, and creating new delivery solutions that meet higher customer expectations. Capital expenditure as part of revenues has increased by 2% from 2013 to 2015, and is now at 5.1% on average. Some firms even spend up to one third of their revenue on projects (Accenture, 2016b).

The margins in Mail have been flat to slightly declining only, because postal firms have been able to do pricing. From 2010-13 they priced 5%, and from 2013-16 even 11%. The pricing power in the segment Parcel is lower. Literature and research findings

confirm a high price sensitivity of consumers (Joeress *et al.*, 2016). Figure 2 shows the revenue per package is flat globally, declining only by 0.5% from 2013-2015. However, the yields per parcel have been declining due to a number of reasons (Buhler and Pharand, 2015):

- Parcels are becoming smaller, lighter and travel shorter distances
- There is a shift from air to ground transport
- Lower number of deliveries/parcels per stop (as volume mix shifts from B2B to B2C)
- Higher fluctuation in parcel volumes over course of year with more peaks and troughs

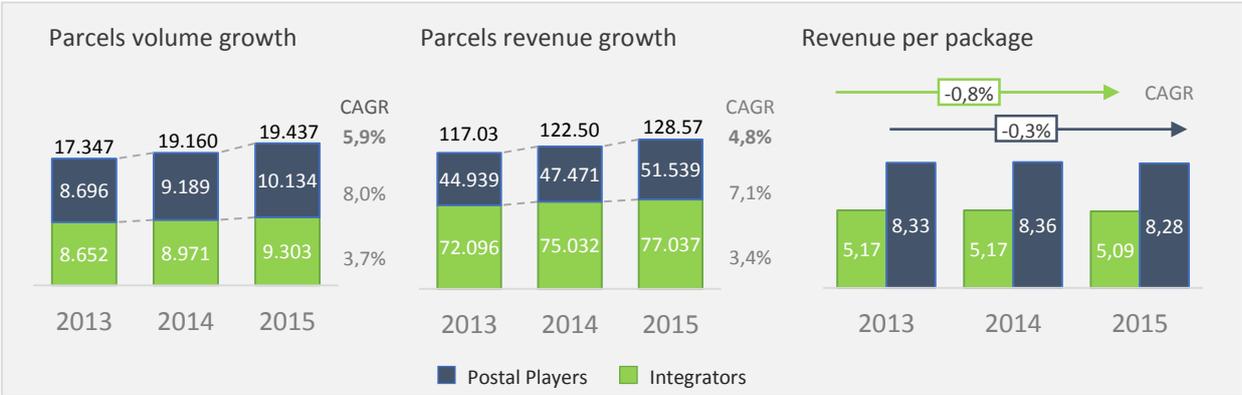


Figure 2: Own representation based on Accenture, 2016b, p. 15

In addition to the above factors, also the “race for capacity” and “emergence of new entrants” impact yields (Accenture, 2016b, p. 14). Therefore, the following paragraph provides a closer look at competition in the Parcel Industry.

The global e-commerce growth is double digit (25%) (Lee *et al.*, 2016). In a market that grows that quickly, there is room for competition and players entering the market. Therefore, it is important for firms to develop their unique selling point and clarify their proposition to their target audience. Examples for differentiation are innovations around technology, service, or price (Lowe and Rigby, 2014).

Incumbent firms face competition from very different players. For one, there are retailers that build up their own supply chains. Secondly, technology firms, such as Google, develop solutions for last mile delivery via autonomous self-driving vehicles. Thirdly, startups enter the market with new business models, such as crowdsourced delivery (Capgemini, 2016).

Historically, the barrier to entry in the parcel industry is high because the industry is asset-intensive and requires upfront investments in delivery vehicles and a network of local delivery units and depots. New entrants and startups challenge incumbents and experiment with an asset-light approach. The idea is to pair supply and demand effectively using the crowd to deliver parcels. Managing fluctuating demand and peak times is a major concern of carriers (Lowe and Rigby, 2014). This collaborative model is highly scalable and allows to add or eliminate capacity seamlessly based on demand. This makes their cost structure almost completely variable (Buhler and Pharand, 2015).

Also retailer and CPG companies challenge the traditional logistic providers as they seize opportunities to integrate up or down the value chain. For CPG companies, backward integration is a way to hedge against rising input costs, and more broadly a means of exerting greater control over the supply chain. Other companies are pursuing forward integration. Amazon, for instance, is experimenting with its own delivery services to gain even greater control of the last mile. Last year Amazon has bought 20 delivery jets and unconfirmed reports claim Amazon is planning to roll out its own fleet of delivery trucks in the United States. The advantages for Amazon are cost savings that help its traditionally thin operating margin of currently 2.3%. The cost structure of Amazon's shipping service is likely to be very similar to FedEx and UPS with a learning curve of many years in the industry. Hence, the savings do not come from a more effective operation. Amazon would, however, not be paying profit margins to its logistic providers (8-9% for FedEx and UPS). Instead its logistics service would be provided at cost (Soper, 2017).

Over thirty percent of logistics providers see a future threat in retailer's own delivery services (Lowe and Rigby, 2014). Not surprisingly, stock prices react sensitive to news of Amazon testing own delivery services. For instance, upon announcement that Amazon would have more deliveries sent straight from the warehouses of its third-party merchants to the homes of its customers, the stock prices of the three biggest postal integrators, FedEx, UPS, and DHL, fell between 2-3 percent pre-market (Soper, 2017).

Given the competitive threats in this highly dynamic industry, incumbents seek to develop an innovation ecosystem to protect themselves from new entrants and win ahead of their traditional competitors. To build a competitive advantage the most

innovative companies “tap into external sources of skills and expertise” (Benson-Armer *et al.*, 2015, p. 6), particularly outside of their core competencies. Today, for instance, carriers are partnering with startups and car manufacturers to develop business models and solutions that address consumers’ unmet needs. For example, carrier DHL collaborates with German car OEM Audi to study and pilot In-Car Delivery of parcels in various German cities. Alike partnerships become more often when there is mutual benefit: DHL seeks to grow its parcel business, while car manufacturers such as Audi seek new consumer-relevant business opportunities in their pivot from manufacturer to service firm.

Besides partnerships, companies also engage in acquisitions. M&A activity in the parcel industry is high (Accenture, 2016b). Different from the last 15 years, acquisitions concentrate now on smaller and more specialized firms.

2.1.2. Classification of Delivery Services

Delivery services are logistics services that are provided in connection with the delivery of goods to the customer. Within the scope of this study, the focus across all chapters is on delivery services to consumers, either from businesses or from other consumers (X2C parcel delivery). This chapter outlines the features and characteristics of last mile delivery and attempts a classification of parcel delivery services along common service frameworks.

Main features of Last Mile Delivery

(i) *Heterogeneity*. While standardization is conventionally found to be lower in services as compared to goods, the post industry has adopted remarkable high levels of standardization in terms of organization, processes and products. This is particularly true for the Mail segment where you have limited range of products, and delivery via letterboxes, without customer interaction required has not changed for decades. Parcels put carriers and customers before new challenges. First, the standard letterbox does not suit the various forms and sizes of parcels. In fact, Barclays projects that in 2018 80 percent of parcels will be larger than letterbox size (Lowe and Rigby, 2014).

Second, attended home delivery, that is the customer/recipient is at home at the moment of delivery, is increasingly unlikely. Parcel carriers have launched a range of delivery options to meet customers' lifestyles and preferences and simultaneously reduce their operating cost of unsuccessful home deliveries; possibilities are ranging from Click&Collect, shipment to neighbors/post offices/parcel lockers or defined time slots for delivery. From a marketing perspective, nonstandardization (i.e. customization) and personalization are the normative goals (Vargo and Lusch, 2004). In-Car Delivery provides a non-standardized solution that is personal (tailored to car owner) and dynamic (in terms of delivery address/location).

(ii) Intangibility. The outcome of the last mile delivery process is intangible, the delivered item itself is tangible. When consumers purchase online, they purchase more than the mere product. They deliberately choose the online channel for intangible characteristics, among others for convenience, for time saving or for choice and availability. In plenty of cases the consumer benefits physically materialize in terms of fuel savings or cost savings via lower price in e-commerce compared to brick-and-mortar. Goal of carriers and e-commerce is however to make delivery more 'tangible' to the consumer. Therefore, they allow parcel tracking along each stage of the delivery process, providing more transparency, planning and a sense of control/grasp over the process.

(iii) Imperishability. The relative inability to inventory services as compared to goods is what the consumer values in delivery. He desires adhoc use of delivery, that is whenever he purchases something online or sends something to somebody. On the one hand, an accumulation of deliveries, for instance receiving a bulk of packages once per month, is of no use for the sender or recipient. On the other hand, a subscription or flatrate of deliveries at a certain cost is perceived positively. Amazon's Prime users for instance pay once and have an unlimited pool of 'stored' free deliveries at hand which they can draw from or not.

Another form of storage is stalling or delaying last mile delivery. Delivery options, as In-Car Delivery or Parcel Lockers, essentially delay the last step of the delivery process, which is the transfer of the parcel to the very consumer. In such cases, the consumer deliberately chooses to delay the process because he gains on another end. For instance, he might save time and money given he does not need to drive to a distant post office to pick up a failed home delivery.

(iv) *Inseparability*. Other than often presented in literature, services are not always simultaneously produced and consumed (Lovelock, 1991; Beaven and Scotti, 1990). This was certainly true in times when home delivery was the only delivery method available. Yet, with the emergence of forms of unattended parcel delivery, e.g. the parcel locker, the level of separability has risen. At the same time, the degree of human interaction has decreased; this relates primarily to the interaction between the consumer at home and the delivery personnel at the doorstep. Nonetheless, interaction shifted from personal to digital communication and digital exchange. Online shoppers receive a notification via email when their parcel has been shipped. This is not a one-way communication as consumers have the option to input an alternative delivery location or course of action in case they won't be home at time of delivery. The shopper's contribution remains critical to the 'production' by entering information on address or alternatives, but with physical, temporal, and mental separation from the other parties involved in LMD process. Furthermore, the ability to track their purchase at each stage along the delivery process leads to transparency and generates trust, even in the absence of human interaction. Trust is an important enabler for In-Car Delivery.

To sum up, the transformation postal businesses undergo when they rely more heavily on parcel growth and introduce new delivery models, brings along significant changes to the main features. The examples given in the last paragraphs demonstrate that the description provided for each of the main features reflects present circumstances and tendencies. The specificities of each feature, however, might develop even further in one way or another, for instance if new regulations come into force on universality of parcel delivery in an aging Western society.

Taxonomy of Services

In the following paragraphs I will apply Castellacci's Taxonomy of Services to position parcel delivery services in the broad landscape of services.

It was Pavitt who originally applied the idea of technological trajectories to the study of sectoral patterns of innovation (Pavitt, 1984). He identified four major patterns of innovation (i.e. four dominant technological trajectories): supplier-dominated, scale-intensive, specialized suppliers, science-based industries. According to Castellacci,

Pavitt’s classification belongs to “technological systems of classification”. Castellacci built upon this model with one important difference: “While typologies of manufacturing and service innovation have so far been carried out separately from each other, the taxonomic model combines manufacturing and services within the same framework [...]” (Castellacci, 2008, p. 982). The taxonomic model identifies four major sectoral groups: Personal Goods and Services, Mass Production Goods, Supporting Infrastructural Services (SIS), Advanced Knowledge Providers.

Main characteristics of the Infrastructural Services in Castellacci’s new taxonomy:

- Supporting Infrastructural Services are more limited to develop new knowledge internally
- Thus, their innovative trajectory tends to be based on acquisition of machinery, equipment and advanced knowledge itself, created elsewhere in the economic system
- Large firm size
- Two sub-groups of sectors, distinguished by a different level of technological sophistication (Miozzo and Soete, 2001):
 1. Network infrastructure services: Telecommunication, Finance
 2. Physical infrastructure services: Transport, Wholesale trade
- The latter sub-group (i) is typically less flexible than ICT networks in terms of customization because it relies on economies of scale and scope, (ii) has low variable costs (Tether *et al.*, 2001)

The table below (Figure 3) summarizes the main characteristics for the Transport sector (as part of SIS). In the following, I will elaborate on each characteristic in regards to Last Mile Delivery.

Taxonomy of (Innovation in) Services					
Service	Type of User	Means of Appropriation	Technological Trajectory	Sources of Technology	Size of Firms
Scale-intensive physical networks and information networks	Price sensitive	Standards, Norms	Cost-cutting networks	Inhouse, Suppliers	Large

Figure 3: Own representation based on Castellacci, 2008, p. 984

Type of user. Users in *infrastructure services* tend to be price sensitive. This is in line with the literature on last mile delivery (Joeress *et al.*, 2016) as well as the findings in

this paper's research. Cost of shipping is the factor most relevant to consumers, even more than speed or convenience.

Means of appropriation. Standards and norms are not applicable in the context of Last Mile Delivery. One form of appropriation used by postal companies is the lock-in effect. DHL, for instance, has its own network and infrastructure of post offices, parcel shops and parcel lockers. Amazon is growing its proprietary network of Amazon Parcel Lockers across Europe. Hermes has its own network similar to DHL. These customer access points are not interchangeable. A DHL parcel locker cannot be chosen by a consumer receiving a parcel through Hermes. The companies with the largest network of access points provide the most convenience and flexibility for consumers and win their preference. Another aspect are exclusive partnerships. For testing purposes of In-Car Delivery Amazon partners up with Audi, DHL with Smart, Hermes with Volvo. Again, consumers who want to use ICD need to decide for which network they opt because using ICD requires registration, a smartphone app, and the setup of the car. All of which is unique to the various firms. A third mean of appropriation is the barrier to entry which traditionally is high given the scale-intensity of the sector.

Technological Trajectory. There is in fact a cost-cutting side to developments in Last Mile Delivery, however a strong focus area of carriers is currently investments into enhancing consumer experience. The case of Sunday Delivery demonstrates that cost cutting is not above all in this sector: Consumers desire parcel deliveries on Sundays, primarily because that is the day during the week that they are most likely to be home. Many delivery firms explore this option for future development despite knowing that it may imply a negative bottom-line impact (Lowe and Rigby, 2014). In face of competition, however, they are willing to accept this hurt. Yet, ideally, carriers find solutions to improve service quality and cut costs at same time. Two examples are (i) Parcel Lockers and (ii) In-Car Delivery. (i) Parcel lockers provide a solution to the not-at-home problem, allowing consumers to receive parcels 24/7, making them independent from opening hours of post offices as alternative or the necessity to stay at home. At the same time, carriers reduce their costs due to less failed (home) delivery attempts and the higher drop density at a parcel locker, i.e. the number of parcels per stop/customer. (ii) From consumer perspective, In-Car Delivery provides a high degree of convenience as the parcel is essentially delivered right to his whereabouts without the need for participation in the transfer process. For carriers, unsuccessful delivery

attempts at home are reduced, also having the possibility to deliver during night times, spending less time and fuel compared to congested day times.

Sources of Technology. According to Castellacci, supporting infrastructural services are limited in their ability to develop new knowledge internally. Innovation is strongly dependent on the acquisition of advanced capital equipment. Providers of distributive and physical infrastructure services (e.g. transport industry) have scarce capabilities to make “heavy use of ICT’s developed by other advanced sector in order to increase the efficiency of the productive process and the quality of the services” (Castellacci, 2008, p. 985). Today’s market developments appear to confirm his findings, in a sense that incumbent postal players source external knowledge and technology, via partnerships, joint ventures, and acquisitions. For the development of In-Car Delivery, logistic providers (e.g DHL, Hermes) have teamed up with car OEMs (Smart, Volvo). Another prominent example is DHL’s acquisition of the start-up StreetScooter. StreetScooter, a project from the university RTWH Aachen, is a German manufacturer of electric vehicles. Today DHL deploys already 3,000 vehicles, with plans to replace its entire global fleet of 92,000 diesel powered vans with electric vehicles. Since the acquisition in 2004, production has been scaled up to 10,000 e-vans annually (DHL Trend Research, 2016).

Size of Firms. Firms in the group *physical infrastructure services* are typically large (Tether *et al.*, 2001). Combined, the top three players UPS, FedEx and DHL constitute for almost 50 percent of global market share (Statista, 2016).

On a national level, concentration is even higher. In Germany, for instance, DHL alone has a market (volume) share of 45% in the domestic parcel market. Followed by Hermes (~27%) and DPD (12%) on second and third place. Together, the three largest national actors are shipping almost 9 out of 10 parcels (DHL, 2017).

Furthermore, technological progress will impact firm size in terms of employees. Today’s industry is largely capital- and asset-intense. As discussed earlier, new small entrants push into the market with a completely different model – an asset-light approach. Depending on the uncertain success of these ventures that focus in particular on the last mile of the delivery process, firm size and asset-intensity may decline slightly over the medium term. In the long run, however, the capital-intensity is expected to surpass today’s level, while the number of employees shrinks. The means

of delivery will be primarily autonomous ground vehicles (AGV) and drones that are highly expensive, whilst reducing the need for manual labor (Joeress *et al.*, 2016).

To conclude, the review of the main characteristics of *Scale-intensive Physical Networks* demonstrates that service providers in the Last Mile differ in some aspects from the average Transport sector. While *Firm Size* and *Source of Technology* in LMD are in sync with the category average, *Means of Appropriation* and *Technological Trajectory* appear to have more in common with information networks. This is not surprising, as Moete and Miozzo emphasize that “sectors can reside in more than one of their categories” (Tether *et al.*, 2001, p. 1120).

Service 4.0

The review of the Taxonomy of (Innovation in) Services for Last Mile Delivery and the transport sector - in light of today's status quo and future developments - has shown that the traditional industry characteristics do not comprehensively capture the latest service innovations. For this reason, the following paragraphs build on the insight that modification to such characteristics is needed and tries then the application to In-Car Delivery.

BCG analysed a broad range of service sectors and observes a “fundamental transformation” in the provision of services (Rehse *et al.*, 2016). However, few service industries have fully transformed and reached an advanced service level, which BCG describes as Service 4.0 (in accordance to versionizing such as Web 2.0 or Industry 4.0). The evolution to Service 4.0 enables service providers to respond to three key challenges, the ones they face also in Last Mile Delivery: evolving consumer behavior, increasing cost pressure and an uncertain competitive environment. It helps companies to meet the challenges by fundamentally transforming the way services are both offered and delivered (see Figure 4 and Figure 5).

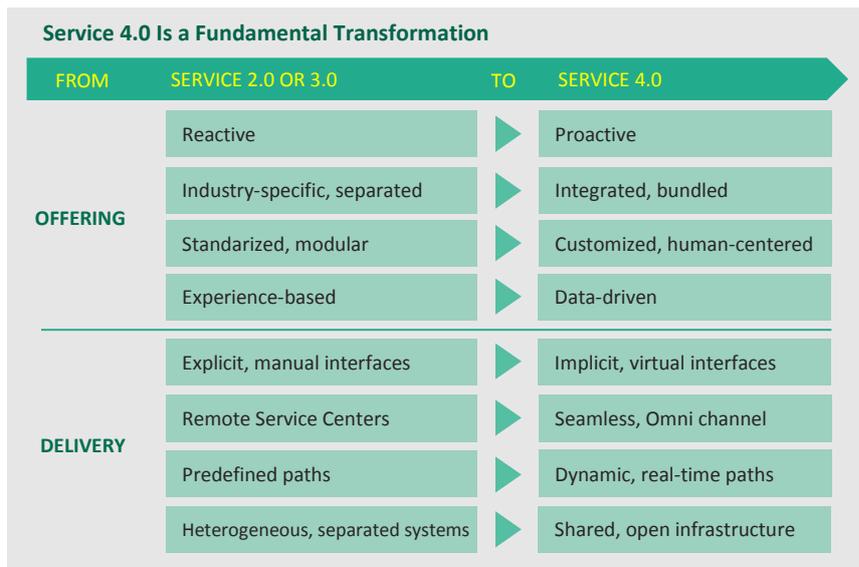


Figure 4: BCG | Rehse et al., 2016, p. 6

Overall, Service 4.0 brings significant changes to performance, allowing firms to offer customized, data-driven services, and deliver them via dynamic and responsive channels and infrastructure (Rehse et al., 2016). The enabler for Service 4.0 is technology. This encompasses especially: Cloud Computing, Big Data & Analytics, Smartphone dispersion, ubiquitous connectivity and Internet of Things. The postal sector is a technology adopter, i.e. its innovative trajectory relies on the acquisition and deployment of machinery, equipment and advanced technological knowledge that is created somewhere else in the economic system (Castellacci, 2008, p. 985).

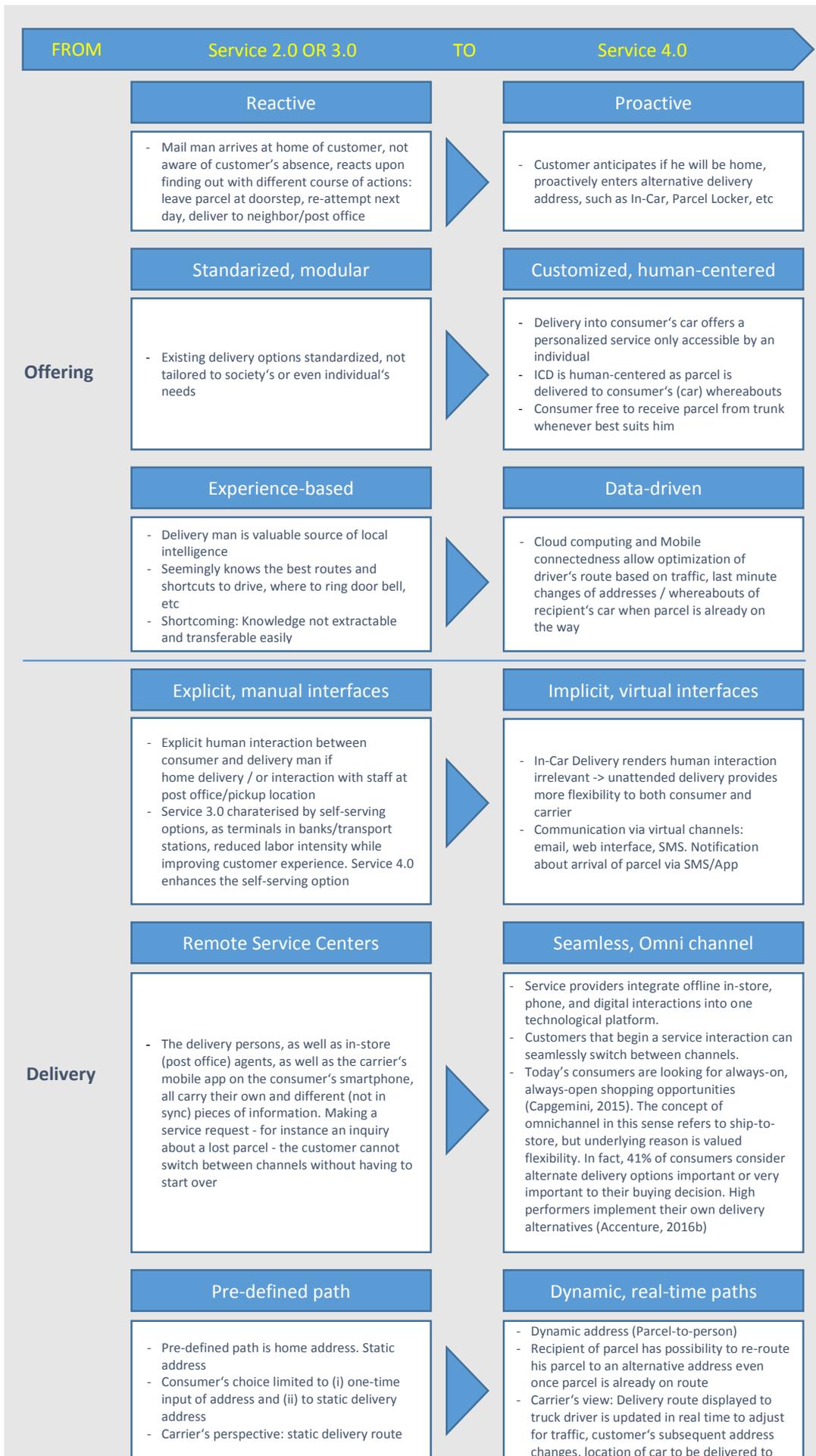


Figure 5: Own representation of Service 4.0 framework applied to Parcel Delivery

The Service 4.0 framework applied to In-Car Delivery provides a detailed overview of the concept along the characteristics of Service 4.0. In the next step, I will review In-Car Delivery under the aspect of novelty.

Four Dimensions of Novelty

The characterization of service activities is sometimes problematic when too much grounded in a traditional manufacturing logic. Therefore, den Hertog (2000) suggests that service innovation is better thought of in four dimensions of novelty.

1. Service concept – a service new to its market or a new value proposition.
2. Client interface – changes in the way clients are involved in service design, production and consumption, e.g. higher level of self-service.
3. Service delivery system – changing the ways in which service worker perform their jobs delivering critical services. For example, electronic delivery of services.
4. Technology – IT used for many types of innovations. It allows for greater efficiency and effectiveness in information processing.

Many service innovations involve a combination of more than one of the four dimensions. For example, a new IT system (*Technology*) may be used to allow customers to track a package (new *Service Concept*), or allow self-serving via a website or vending machine (*Client Interface*) (Hertog, 2000).

How the four dimensions relate with In-Car Delivery is explained in the following.

1. Service concept – Delivering parcels is not new to the market. Using the trunk of the consumer's car to drop off parcels, however, is a new value proposition. For the first time the consumer is offered unattended delivery in a way that is convenient, secure, accessible 24/7 and requires very little participation on his behalf (i.e. no need to pick up parcel from post office, etc).
2. Client interface – Consumers' involvement in the process is reduced significantly compared to existing delivery alternatives. Firstly, he does not need to be present at time of delivery. Secondly, In-Car Delivery does not 'split the last mile' between consumer and carriers as other forms of unattended delivery tend to do.
3. Service delivery system – The vast majority of the delivery process remains unchanged for the delivery person. Only the last stretch of the Last Mile - the actual drop-off or transfer - is novel. Opening a consumer's car requires some

form of additional training for the work force on privacy, legal issues, and the actual technology to get access to the recipient's car.

4. Technology – Enables this service offering. There are changes to the backend as well as front end. The backend processes need to account for the current geographical location of consumer's car when planning an optimal and dynamic route. The delivery person needs a smartphone and app always connected to the Cloud in order to open the car. The consumer needs to have some equipment installed in his car to track GPS. In the front end, for instance, retailer websites need to allow for the consumers' car as shipping address.

After discussing main features, novelty and classification of Delivery Services in this chapter, in the following chapter I will (i) introduce Last Mile Delivery from a logistical point of view in the supply chain, and then highlight its relevance (ii) for carriers and (iii) for retailers alike.

2.1.3. Last Mile Delivery

DHL defines the last mile as the “final segment of a sales chain that leads directly to the customer or household” (DHL, 2017c). Competition for the last mile is often “particularly intense”, e.g. in the European express and parcel business (ibid.).

Barclay describes Last Mile Delivery as the “movement of goods between a transport hub to a delivery address” (Lowe and Rigby, 2014, p. 3). This segment is becoming increasingly competitive and innovative.

According to DHL, last mile delivery is often the “least predictable part of the entire journey” (DHL Trend Research, 2014, p. 30). Parcel delivery takes place in an environment that is both complex and dynamic. Capgemini (2016, p. 15) goes as far as to label it the “frenetic, frantic, and critical end of the market”.

With e-commerce on the rise, consumer preferences have moved more and more to the center of attention in the formerly business-oriented parcel delivery market. Logistic firms as well as e-commerce players have identified last-mile services as a “key differentiator vis-à-vis their competitors” (Joerss *et al.*, 2016, p. 9).

There are three main stakeholders (3C) in last mile delivery, each with their own set of expectations and challenges: Consumers, Commerce, and Carriers.

Consumers are generally the shoppers and recipients of items purchased online. The Commerce is represented by the (online) retailers. Finally, Carriers are the logistical providers responsible for shipping and delivering the parcel from retailers to the consumer. The flow of goods and information between the three entities is presented in Figure 6:



Figure 6: Own representation of Shopping & Supply Chain

Mentzer and Williams (2001) emphasize the strategic importance of logistics services for an organization’s overall success. Superior delivery processes should be developed as a way to create a competitive advantage. Overall, excellent logistics can have a positive impact on profit.

However, the last mile and its profits are “under attack” driven by disruption, competition and evolving consumer demands (Buhler and Pharand, 2015, p. 3). In these times, strong relationships between retailers and logistics providers are essential in ensuring positive experiences for end consumers (ibid.)

2.1.4. Role of Delivery for Logistics Providers

The biggest issue logistics providers are facing is delivering goods when the recipient is not present. The second highest concern of carriers is ‘managing costs’ (Buhler and

Pharand, 2015, p. 18). The last mile is regarded as the most expensive section of the entire logistics chain. In fact, last mile accounts for approximately 50% of total parcel delivery cost (Joerss *et al.*, 2016).

The **hard benefit** of a more efficient delivery is therefore cost reduction. Last mile delivery is characterized by operational inefficiencies. Carriers bear high costs due to unsuccessful deliveries. Unattended deliveries, for instance In-Car Delivery or parcel lockers, reduce the risk of a failed delivery. The carrier not only saves vehicle idling time, truck miles travelled, but also the opportunity costs to re-attempt the same delivery.

Another aspect how In-Car Delivery has the potential to reduce costs and still provide high levels of convenience, is related to deliveries to the non-urban population. Longer distances in rural areas significantly increase LMD costs. In fact, parcel business is only profitable in large urban environments with a high parcel volume within a limited geographical area due to the density of customers (Corrocher *et al.*, 2012). With a growing rate of online shoppers in rural areas as well as an increasing community of daily commuters travelling into urban city centers for work, a parcel delivery into the commuter's car appears to be beneficial for commuter and carriers equally. The recipient has his parcel right after work, while the couriers have to cover less distance into rural outreach.

In a competitive market, logistics providers have to win with both retailers and consumers. Their strategy is to achieve competitive differentiation via innovations and service enhancements. The collateral or **soft benefits** of innovation are higher market share and volume from retailers. Carriers can avoid being viewed as commodity provider through investments in value-added delivery services, such as In-Car Delivery and specific delivery windows (Lukic *et al.*, 2013). Those players that add value to retailers through cutting-edge technology, flexible delivery, and efficient return service will emerge as the winner (Lowe and Rigby, 2014). When carriers prioritize return handling as a valuable capability instead of a "necessary evil" they demonstrate meaningful differentiation as an e-commerce delivery partner (Accenture, 2016b, p. 40). When e-tailers assess potential delivery providers, the carrier's capabilities of return handling are among the most decisive factors (Temando, 2016).

Whereas retailers have many insights on consumer's shopping habits and preferences, logistics providers collect valuable data about customer's lifestyles and daily routines given the physical proximity to the consumer, something that retailers lack.

“To fully exploit data and analytics, companies must manage data from multiple sources, build models that turn the data into insights, and translate the insights into effective action.”

(Benson-Armer *et al.*, 2015, p. 7)

Carriers can leverage the data captured in the last mile by developing new and improved offerings that are more suited to the consumer's needs. Furthermore, they can intensify their relationship with retailers by sharing the insights, with the prospects of monetization or increased volume share.

2.1.5. Role of Delivery for E-Commerce

In this section I will present the critical role of delivery services to online retailers. The main argument is increased sales opportunities. Delivery offerings that are valued by consumers have a positive impact on sales growth. On top of that, retailers view delivery services as an opportunity to provide collateral benefits to their customers. They aim to increase customer loyalty, grow share of wallet, enhance consumer's brand perception of the retailer, and finally boost purchase frequency (Lukic *et al.*, 2013).

When shopping online, the consumers tends not to differentiate between the role of the etailer and the role of the carrier in the process. Mistakes made by the carrier are attributed to the retailer. Product reviews on Amazon, for instance, often contain comments about the delivery, both positive as well as negative.

"In the current digital age, the last mile is where consumer relationships are made or broken."

(Capgemini, 2016, p. 3)

The leading e-commerce players place great attention on shipping as "the only tangible element of a digital customer journey" (Temando, 2016, p. 25). Consumers evaluate a company based on their 'end-to-end' shopping experience: taking into account not only retailer's website and online shop, but also the ensuing email communication, delivery options and actual received delivery service. Amazon, for instance, acknowledges the consumer's expectation for a seamless shopping experience and proactively sends email updates on the status of the delivery in their name. In short, the last mile is critical to the consumer's overall evaluation of the purchasing process online (Kinnes, 2006).

The majority of retailers that started out with traditional brick-and-mortar outlets and have entered the e-commerce business later, state that online shopping and delivery services have increased their sales, but are detrimental to their cost structure and profit. To convert the incremental sales into a positive bottom-line impact, they must find ways to optimize cost, primarily addressing inefficient deliveries (Lowe and Rigby, 2014). This is a problem especially for smaller retailers, because their profit and chances to be competitive are directly influenced by the cost of shipping. On the other side, larger retailers are less worried about shipping costs and more concerned to meet

their customers' expectations (Temando, 2016). This strategy can pay off as shown by the example of Amazon's Prime program. In the US, Amazon Prime grants two-day shipping and free shipping for an annual lump sum of 79\$. When it was launched in 2005, Amazon took a huge risk because shipping was now provided as a flat rate, while it was unclear if additional sales could offset this investment. Apparently, Amazon meets their customers' expectations as Prime helped to quadruple its share of wallet with some customers (Lukic *et al.*, 2013).

In the same way that positive delivery experience can generate more sales for retailers, negative experiences can harm the retailer's image and sales. Shoppers who had a negative shipping experience can jeopardize a firm's reputation as they leave negative reviews and spread damaging word-to-mouth within their network (Figure 7).



Figure 7: Own representation based on Temando, 2017, p. 22

Table 1 provides a collection of literature findings that underline the relevance of delivery services to retailers.

45% of consumers would order online if delivery options were improved	Lowe and Rigby, 2014
50% of respondents have abandoned a purchase online due to unsatisfactory delivery options	Graham, 2013
63% of US consumers abandon shopping cart because shipping cost was too high	Temando, 2016
44% abandon cart because free shipping wasn't offered	Temando, 2016

34% abandon cart because they did not qualify for free shipping	Temando, 2016
56% of customers refrain from shopping online due to failed delivery risk (due to no-one at home to receive item)	IMRG, 2015
60% do not shop online due to the additional cost of home delivery versus offline shopping	IMRG, 2015
47% of customers do not shop online because of the risk that goods may not arrive on time	IMRG, 2015
45% of US online shoppers have abandoned their cart on finding they don't qualify for free shipping	UPS, 2015
64% of respondents would buy more online if they had more delivery options, with unattended delivery at top of their wish list	Annon, 2004
86% ofetailers experience increased sales, after increasing the number of shipping options at checkout	Temando, 2016
75% ofetailers experience a reduction in cart abandonment, after increasing the number of shipping options at checkout	Temando, 2016
86% ofetailers report a higher ability to meet customer expectations by increasing the number of shipping options at checkout	Temando, 2016
Non-satisfactory delivery schedule topped the list (34%) of dissatisfaction with e-shopping	Charatan, 2001
59% of shoppers would shop more online if free shipping was offered	Temando, 2017
43% of shoppers would shop more online if free and easy returns were offered	Temando, 2017
16% of customers take their business elsewhere after even 1 negative delivery experience	O'Shea, 2015

Table 1: Impact of delivery options on sales

The figures in Table 1 suggest that significant sales opportunities exist foretailers. Essentially, the results can be characterized in two ways. On the one side,etailers can generate more sales convincing consumers that currently only shop in traditional brick-and-mortar stores to engage in online shopping. On the other side, purchase frequency and purchase intensity appears to increase with the right delivery services in place. Looking at the factors impacting sales individually, reveals that an increasing number of delivery options tends to have a strong positive influence on sales.

In this chapter, I have dealt with the first two stakeholders in Last Mile Delivery – e-commerce and carriers – and discussed why delivery services and innovation within the last mile are critical to their business models. In the next chapter, I will turn to the consumer, reviewing the changing consumer landscape and identifying critical success factors (CSF), that is the factors most valued by consumers in LMD.

2.2. Changes in the Consumer Landscape

Giving an outlook and providing examples how the consumer landscape changes over the next 15 years, lays the foundation for further discussions what consumers value in general and in particular in Last Mile Delivery. Innovation of and around new delivery services is more customer-centered than ever. Thus, organizations must consider the following forces and underlying trends when ideating, developing and marketing new delivery services.

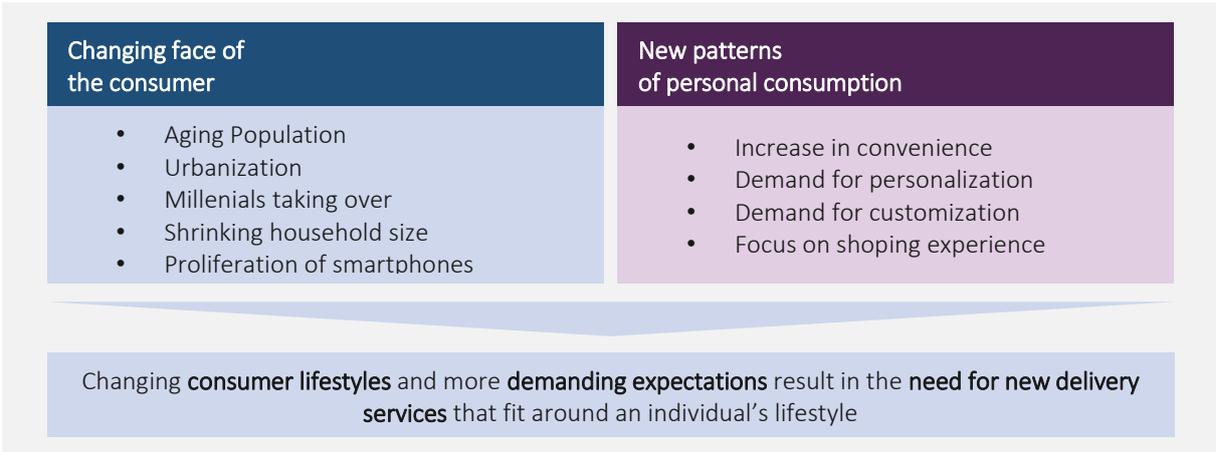


Figure 8: Own representation based on McKinsey, 2015

Changing face of the consumer

On a macro level, the average consumer will be older due to growth among the **aging population** in developed markets. **Millennials taking over** has a huge impact on society. This generation has grown up in a time of rapid change. The last two decades have shown how fast the world can change. Back then Facebook, a network of 2bn users today, was not even founded yet. Also e-commerce was in its early stages, Amazon's business not even 1 percent of its size today. The generation of millennials whose set of priorities and expectations are very distinct from previous generations is about to move into its prime spending years. Also elderly people are becoming increasingly Internet and e-commerce savvy. The growing popularity of convenient online shopping among this age group has implications on delivery. Concerning the various delivery options, they are not as mobile and not as willing to travel the distance to and from post offices or lockers, potentially carrying heavy items themselves. This increases the need for drop-offs close to the recipient, for instance home or in-car delivery.

Another trend is **smartphone proliferation**. In 2017, in Western markets the percentage of smartphone users in the population is around 80%, with growth coming mainly from senior citizen aged 65 years and older. The use of smartphones reaches far beyond communication. Smartphones serve as 'life management devices' and 'virtual shopping assistants' (Accenture, 2016b, p. 41; Deloitte, 2016, p. 4). Eighty percent of smartphone owners use their devices for shopping, this includes getting product information, reading reviews, comparing prices, and carrying out the actual purchase (Deloitte, 2016).

Also, the way people live changes. By 2030 the majority of people will live in urban areas. At the same time, the average **household size is shrinking**. There are less married couples and more single households. In addition, their lives are less planned and more uncertain. People spend less time at home: Instead they spend a great amount of time at work. On top, more women are working. As spending in the middle class grows, and spending shifts towards experiences, people are eating away from home more often, go out and travel more.

New patterns of personal consumption

Consumers increasingly view and value **shopping as an experience** rather than the mundane task it used to be. Shoppers blend offline and online shopping to optimize their shopping experience and make their purchase at the best terms possible. In a study for retailers that have an online presence as well as brick-and-mortar stores, Deloitte (2016) finds that half of the shoppers first go to a store to look for an item, then search online for the best price, and then purchase online (showrooming); while two thirds first look at items online, then go to a store to see the item, and then make the purchase in store (webrooming). The reason for going to physical stores is the ability to see, touch and feel the product. Described omnichannel experience also concerns delivery. Four in ten customers take advantage of buying online and pick up their order in store (ibid.).

Expanding on personal consumption, **flexibility** gains in importance. The use of smartphones and tablets is driving round-the-clock purchasing habits. Looking at the number of online purchases throughout the day, there is a peak at noon around lunchtime. However, the second peak and many times larger is at night between 11-12pm, suggesting that shoppers may even browse on their phones while in bed. That

behavior has implications for deliveries. Retailer need to manage expectations about the date of delivery. Shopping late makes next-day deliveries unlikely. For this reason many retailers have introduced cut-off times as by when an order needs to be placed to be still delivered the next day versus in two days or later (Lowe and Rigby, 2014). Another example for consumer's search for flexibility is Sunday delivery. 70 percent of consumers believe that couriers should deliver on a Sunday, which is not surprising considering people do value the convenience of shipment right to their doorstep but are not at home during the regular work days (ibid.).

Increase in convenience. As mentioned before, people spend more time at work. DHL finds that in developed countries the average number of working hours has increased. Personal success in the work environment is now the top priority. Employees feel the need to be permanently available and ready. Likely, mobile workstations and permanent connectivity through smartphones, even after work, have contributed their part towards this development. As a consequence, many people feel under pressure. Not uncommonly, employees don't use their full vacation or spend it on training. This said, they try to counteract this stress by organizing their private lives as simple as possible. With such levels of pressure in their work lives, there is little free time left, with the result that there is substantial demand for convenience. People seek to obtain simple and comfortable lifestyles and are willing to pay for it. Especially when shopping, convenience plays a decisive role (DHL, 2016a).

Personalization and Customization. Referencing consumers' ever-evolving lifestyles and habits, McKinsey states: "[The way] consumers live, think, and shop [is] only going to accelerate" (Joerss *et al.*, 2016, p. 2). Accenture (2016b) builds on Artificial Intelligence to be able to keep up with and ultimately anticipate consumer's behavior in the future. They leverage customer data to create 'consumer genomes', which are "living profiles of preferences, behavior, motivations and needs" (Accenture, 2016b, p. 38). The advantage is to go beyond offering choices to consumers, but to understand why choices are made.

"In the last mile delivery space, this approach equates to anticipating every factor that could prevent or delay delivery and knowing the best response based on the individual customer. Ultimately, customers will proactively get delivery when and where they want it, and delivery personnel can stop knocking on the doors of or leaving cards at empty houses" (Accenture, 2016a, p. 15)

While the broad application of such 'customer genomes' is not yet in sight, logistics providers go other ways to offer personalized delivery services. Compared to only five years ago, consumers have now a multitude of options how, when and where they want their parcel to be delivered to. Many carriers now allow customers to (i) specify certain days and time slots when they want to receive their package, (ii) choose a neighbor or a certain location (e.g. porch, garden) where to drop off the parcel, or (iii) determine the communication frequency and channel how they prefer to be kept up-to-date on the delivery progress (e.g. via SMS, Email, App). Significantly broadening the limited number of drop-off locations for parcels today, would be the introduction of In-Car Delivery, enabling customers to receive and send parcels virtually anywhere.

In summary, the first set of trends "New patterns of personal consumptions" indicates that it will be increasingly difficult to reach customers at home. For this reason, Barclay predicts that the number of home deliveries is going to fall, while delivery via other - possibly new - channels surges (Lowe and Rigby, 2014). The second set of trends, dealing with "Personal Consumption", provides the requirements that these other channels need to satisfy. Any delivery option shall therefore allow for a high degree of convenience, flexibility and personalization.

In this chapter I have been analyzing the market and consumer developments and top-down drawn conclusions from it, what consumers value and delivery services need to fulfil. In the following, I will take a bottom-up approach and determine what consumers themselves say they find most important in delivery services. For this purpose, I will first introduce the concept of the service-profit chain and secondly present the critical success factors, a result of the study of research papers and consumer studies.

2.3. Value Creation in Last Mile Delivery

2.3.1. The Service-Profit Chain

The service-profit chain shows how service value influences profit. It draws relationships between profitability, customer loyalty, customer satisfaction and perceived service value. In a nutshell, value drives customer satisfaction. Customer satisfaction drives customer loyalty. Customer loyalty drives profit and growth (Figure 9).

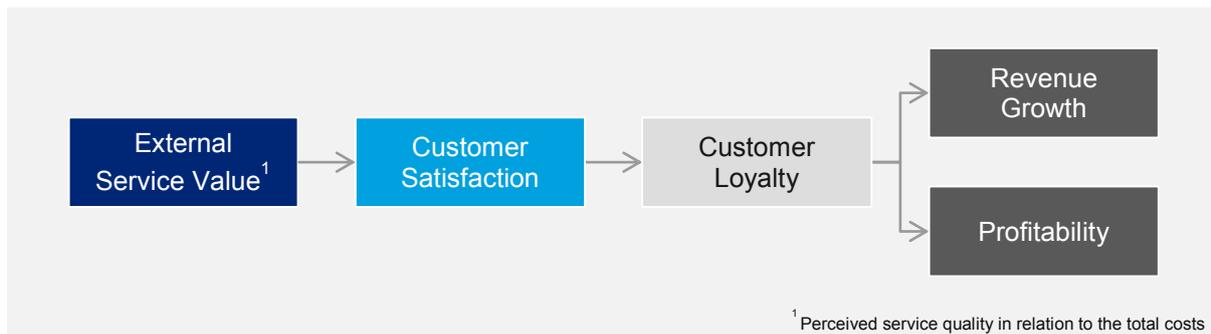


Figure 9: Own representation based on Heskett, 1994

As the starting point of the chain, the emphasis is on 'External Service Value' and how to impact it. 'External' here refers to the value as it is perceived externally, meaning by the customer, not the company providing the service.

Service value means the perceived service quality in relation to the total costs ('value for money'). Value is always relative because it based on the customer's perception of the actual service received and his initial expectations. When companies want to measure value they usually do it using the reasons that customers give for a high or low satisfaction score.

Total costs include the price as well as all other costs that a customer incurs in obtaining the service. Costs do not need to be monetary only. As far as delivery is concerned, price would be the regular shipping cost, while other costs can be the time required to pick up a parcel from the post office.

Perceived service quality is the gap between the perceptions of the actual service experienced and the expectations that the customer had before (Parasuraman *et al.*, 1985). Expected service quality, on the one side, is determined by the customer's past experience, his personal needs, word-of-mouth, and other external communications, such as advertising (see Figure 10). Received service, on the other side, can be conceptually divided in soft elements and hard elements, sometimes also 'human ware' and 'hard ware' (Kristensen *et al.*, 2000, p. 1008). Soft elements are associated with the interactive components in the service, for example the atmosphere of the service environment. But it also includes dimensions, such as the reliability and timeliness of the service, or the competence and empathy with which the service is carried out. Hard elements consist of the quality of the product/service attributes and tangible proof of the performance (Heskett, 1994).

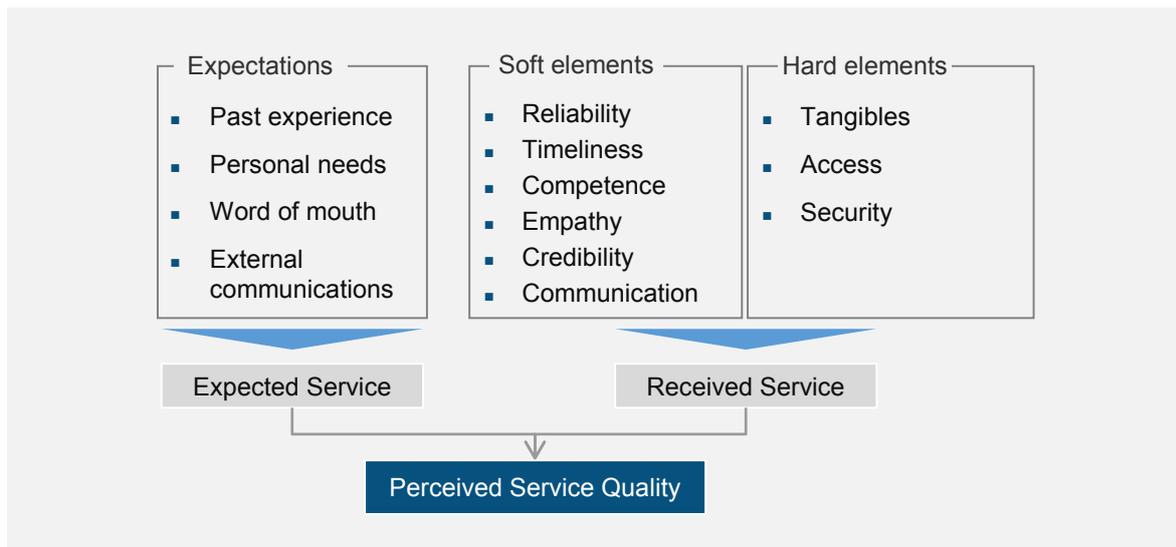


Figure 10: Own representation based on Heskett, 1994

The fundamental idea of the service-profit chain is evident across many empirical studies that seek to measure customer satisfaction and service quality. Two measurement models close to the service-profit chain are SERVQUAL and SERVPERF. Both scales are strongly related to overall service quality (Hsu *et al.*, 2011). In the context of delivery, the Kano model and ESCI model have successfully been applied. The Kano model was applied to identify the customer requirements for home deliveries, and how these requirements, for example convenience, correlates with customer satisfaction (Matzler and Hinterhuber, 1998; Hsu *et al.*, 2011). The European Customer Satisfaction Index (ESCI) methodology was applied to measure customer satisfaction for the postal firm Post Denmark. The ESCI model was originated as a generic model for measurement of customer satisfaction to make results comparable across geographies and industries (Kristensen *et al.*, 2000, p. 1014).

Directionally the results resemble each other. Kearney (1991) for instance, states that firms should offer value-added and differentiated services in order to improve customer satisfaction. Especially in competitive industries, service firms must provide high quality services to foster customer satisfaction and maintain profit (Garbarino and Johnson, 1999). This is echoed by Thompson *et al.* (1985) claiming, that the provision of superior service quality has many benefits, including cost reductions, increased market share and higher profits.

In order to determine those factors most valued by customers in delivery services, Hsu *et al.* (2011) recommend to directly listen to the customers' voices. By identifying the most important elements, logistics providers know in which elements to invest to best

satisfy consumers. In some cases, it is necessary to create new combinations of elements rather than strengthening individual elements of existent combinations. In-Car Delivery serves as example for this type of recombinative innovation. ICD takes the appreciated aspects of home delivery (i.e. convenience & delivered-right-to-you) and delivery to parcel lockers (i.e. unattended delivery & round-the-clock accessibility) and creates a new offering re-combining all these elements.

Which service elements consumers most value is explored in the following chapter. Based on market research, consumer studies and surveys, a list of Critical Success Factors is developed. According to McKinsey, there still seems to be “little consensus as to the kind of delivery services consumers actually desire” (Joeress *et al.*, 2016, p. 7). The next chapter aims to lay the foundations to answer this question, as it defines those aspects of delivery services most important to consumers.

This is a brief side remark why this paper does not apply one of above frameworks for the research. As per the definition, measuring customer satisfaction and perceived value requires feedback from customers that have in fact experienced and received a service. Given the stage of development of In-Car Delivery, only a few test users have used this method for delivery so far. The participants in the survey of this paper have not had an actual experience with ICD before, with most of them not even aware of this form of delivery (70% of respondents state they have not heard of ICD before). Consequently, the evaluation of ICD is based on consumers’ expectations, not on consumers’ perception.

2.3.2. Critical Success Factors

This chapter describes which criteria customers perceive important and need to be met for them to be satisfied with a delivery. Delivery services today need to have a compelling value proposition because consumers have developed a ‘profusion of new demands’ (Capgemini, 2016, p. 3) and, moreover, consumer expectations of online shopping policies continue to rise, particularly when it comes to shipping. Surely, Amazon has acted as catalyst in this area. The term ‘Amazon Effect’ or ‘Prime Effect’ describes the reality that fast delivery without premiums is now the standard, or more

in general, consumers getting accustomed to high standards with less willingness to pay (Deloitte, 2016, p. 4).

The list of critical success factors is done based on recurrence of appearances and mentions across a number of sources. The following five factors are prevalent in literature and tend to score high in rankings of customer importance: Cost, Choice, Convenience, Speed, and Flexibility. The order of listing is not based on quantitative ground. The heterogeneous nature of reviewed literature does not allow to derive a cogent ranking. This is also not the goal. In the first step the goal is to identify the factors. In the next steps – through my survey – I test if these CSF can be found among the sample and how they stand relative to each other in importance. The corresponding hypotheses are developed throughout this chapter.

There are several aspects that make the comparability between the studies difficult.

- In most cases the studies lack an explanation of their used terminology or the provision of an example what this term is supposed to describe. Think of the word 'Flexibility'. Barclay, for example, lists Delivery Flexibility in the top five factors most important when choosing a delivery option but doesn't elaborate on what it understands by it (see Figure 11). It is a very generic term that can have multiple meanings.
- This causes other studies to use the same term with a different understanding of it. The 'variety of delivery options offered' is another of the key factors. Undoubtedly, it creates flexibility. However, it is not clear whether Barclay meant to encompass this in the term "Flexibility" or lists it as a separate factor as other studies do.
- Furthermore, a quantitative examination is prevented, because each study uses different scales and models, and rankings (as in Figure 11) depict the factors only relative to each other without absolute values.

Most important factor for consumers when choosing a delivery option



Figure 11: Lowe and Rigby, 2014

Cost

Cost may be the only exception. Cost is consistently listed in first place as most important factor in delivery. Free delivery and low prices are more important to consumers than same-day delivery and other speedy forms of delivery, guaranteed delivery timing, and flexibility of delivery time and place (Lukic *et al.*, 2013). When online shoppers are asked explicitly, which of the two promises is more important to them - *Free* shipping or *Fast* shipping - 87% state Free Shipping, 13% state Fast Shipping (Deloitte, 2015).

Regarding delivery costs an interesting distinction can be made between small and large retailers. Smaller retailers are passing on *all or part of* their shipping cost to their customers because they are dealing with tighter margins and less volume. The larger the retailer, the less burden they place on their customers (Temando, 2016).

Affordability drives customers' shipping choice. Click&Collect is a very preferred shipping option among customer's that shop online at retailers that also have regular physical stores. Click&Collect describes the option to pick up ('collect') your purchase at a retailer's store after having it ordered on the Internet. The fashion retailer ZARA is one of many to offer this shipping option. The great appeal of Click&Collect with consumers is that it is free or cheaper, not because it is more convenient than delivery (Temando, 2017).

For the "better-off and the wealthy" convenience is above price. For the vast majority, price is still the pivotal factor.

Hypothesis: Consumers care about the cost of parcel shipment

Choice

The vast majority of people find it important to have many delivery options. Consumers appreciate choice in delivery location, delivery timings, delivery speeds, and a range of extra options. According to J.D. Power (2007), the variety of delivery services is within the top three factors driving customer satisfaction with receiving parcels.

Accenture finds that over 40 percent of people consider alternative delivery options as important or very important to their buying decision (Buhler and Pharand, 2015). This is echoed by McKinsey claiming that variety of delivery options is a major decision

criterion for online customers and therefore directly impacts e-commerce player's success in the market place (Joeress *et al.*, 2016).

In fact, this direct impact on sales is affirmed by 50% of customers stating they have abandoned a purchase online due to unsatisfactory delivery options (Graham, 2013). Retailers report that more shipping options at the online checkout led to an increase in sales (86% of respondents), reduction in cart abandonment (75%), and a better ability to meet customer expectations (86%) (Temando, 2016).

Deriving from this I would formulate the hypothesis:

Hypothesis: Consumers value Choice in Delivery services

Speed

Delivery speed generally refers to the time passed from order completion until successful delivery of a parcel. The time of the parcel journey has two components. On the one side, the customer can actively opt (and pay) for different delivery speeds, for example choose same-day delivery over standard shipping. On the other side, there is the component that is out of the control of the consumer and in the hand of the carrier, the environment, or chance. The chosen delivery time is not met, for instance, when a first delivery attempt fails. This could result in a delay of one day until the next delivery attempt. In case the consumer chooses a pick-up location, such as a kiosk, for the delivery drop-off, the perceived delivery speed is slower because upon delivery to such drop-off point, it hinges on the consumer when to go there and collect it.

Overall, one must distinguish between two critical moments in last mile delivery, one being a successful delivery of a parcel, the other being the successful transfer of the parcel to the recipient. These two moments can occur at the same point in time - as in the case of home delivery - however in most cases they fall apart.

The importance of a fast delivery is reported throughout literature. To understand what does it mean "fast delivery", Deloitte asked consumers what they consider to be "fast" shipping for two consecutive years, and, not surprisingly, found that consumer expectations continue to rise. Unlike, the previous year 2015, in 2016 shoppers no longer considered 3-4 day shipping to be "fast". In 2016, most shoppers perceived "fast" to be shipping within 2 days or less (Figure 12).

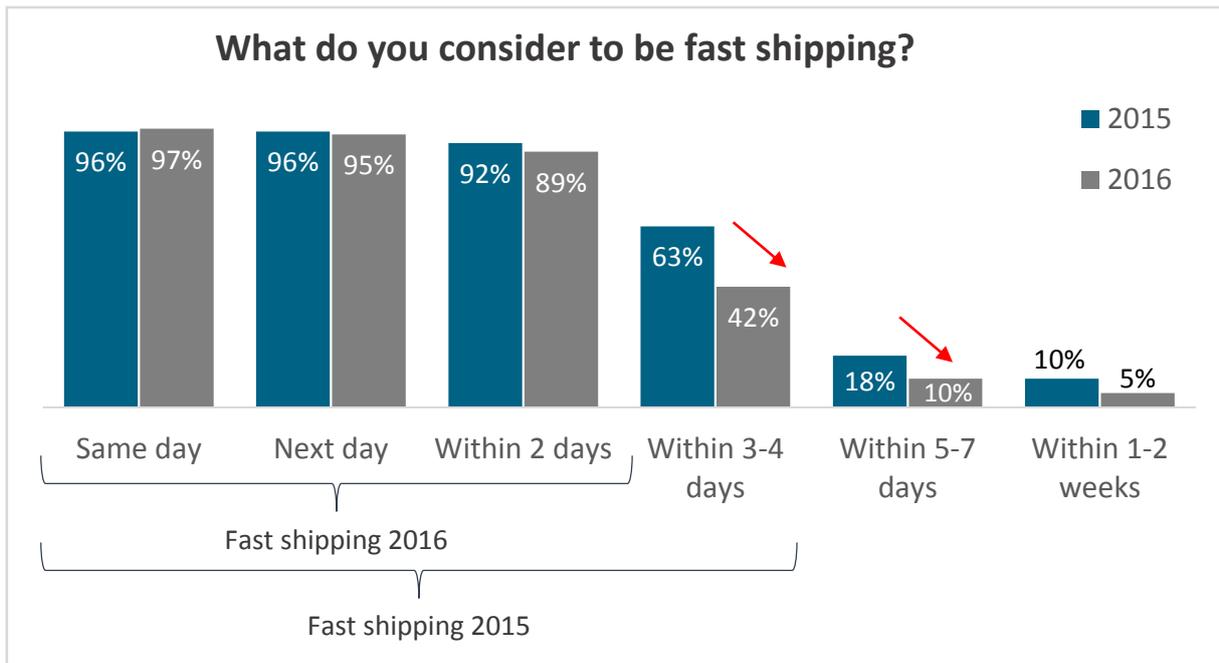


Figure 12: Deloitte, 2016, p. 39

In most cases, the importance of speed is not explicitly investigated. Instead it is determined through relative comparisons towards other success drivers. Temando (2016), for instance, lists speed among its four items most important to the consumer, along with cost of delivery, security and flexibility.

Late deliveries and unmet expectations lead to lower satisfaction (Lee and Whang, 2001).

Deriving from this I would formulate the hypothesis:

Hypothesis: Consumers value fast deliveries in Delivery services

Convenience

Convenience has many faces. In principal it refers to everything that simplifies the consumer's life, gives them more freetime, and matches their busy lifestyles. In e-commerce convenience is "key to unlocking loyalty" (Accenture, 2016b, p. 40). Indeed, for the majority of people convenience is the most important motivational factor for using online-shopping services (Morganosky and Cude, 2002). Those consumers who can afford it opt for convenience above all else. As DHL (2016a, p. 16) states it: For the "better-off and the wealthy" convenience is above price.

Examples providing convenience by matching delivery with consumers' lifestyles are unattended delivery, weekend delivery, delivery windows/time-slots, or delivery within 1-3 hours. These options are gaining momentum and have the potential to become demand generators (Temando, 2016).

The above described findings are entirely in sync with the "New patterns of personal consumptions". Therefore, I hypothesize:

Hypothesis: Consumers value Convenience in Delivery services

Flexibility

With regards to Last Mile Delivery, DHL distinguishes two dimensions of flexibility. (i) Firstly, flexibility as "free choice of delivery destination". Today the amount of delivery destinations a consumer can address their shipment to is large. Beyond the traditional home delivery, a consumer can choose between dozen alternative locations. In urban centers the number of parcel shops, collection points, post offices, and parcel lockers within one's proximity is larger than in rural areas. Yet, not only the number of existing alternatives continues to grow, but also do logistics firms introduce new alternatives, such as In-Car Delivery. Especially in rural areas parcel lockers are installed, because the cost of failed delivery to the carriers is even higher. The underlying concept of all mentioned alternatives is of course unattended delivery, unequivocally resulting in the biggest surge in flexibility so far. (ii) Secondly, flexibility as "change of delivery at short notice" (DHL, 2016a). For example, if a business meeting takes longer than expected, the consumer can ask the parcel to be send to his office, rather than to his home. 65% of consumers globally consider the ability to change delivery instructions an important factor when selecting a delivery company (Accenture, 2016b). The degree of delivery flexibility is based on the supplier's delivery system. If it is possible to respond to the customer's special needs, the degree is high (DHL, 2017d). The kind of flexibility that allows the address to be changed after the purchase is made and parcel already on its way, is sought after also when using In-Car Delivery. For one thing, the recipient's car may not be at the place where it has been during the purchase. For another thing, if at home, the consumer prefers the parcel to be delivered to him directly, rather than the car.

Flexibility and *Choice* represent two success factors that are interlinked. More choices enable more flexibility. Unsurprisingly, I also hypothesize:

Hypothesis: Consumers value Flexibility in Delivery services

Returns

When it comes to returns, shoppers care most about flexibility, in particular easy (refunds and) returns across channels (Deloitte, 2016). Consumers want to be allowed to drop off return parcels across channels, including channels different from the one they used to receive the parcel. For example, a customer buys a piece of clothing *online*, tries it on, realizes he picked the wrong size and now wants to return it via a *store location* of that fashion retailer.

Interestingly, 75% of retailers do not allow returns to be collected from the original destination address (Temando, 2016). What does this imply for home deliveries? In many cases it is not possible to simply leave your return parcel in front of your doorstep or hand it over to the mail man directly, for him to take it along in his truck. Fortunately, this is changing. Parcel companies, such as DHL, now offer customers the possibility to drop off their mail and parcels right with the staff that is actually delivering. While this may sound promising at first glance, this way of returning is connected to the same downside of home delivery, namely the need to be home. Here, In-Car Delivery can play its strengths, because it is by no means a one-way street. The trunk cannot only be used to non-attendantly and conveniently receive parcels, but also to place in your returns, waiting safely for a carrier to pick them up.

Nonetheless, the most widespread approach of return handling is still that the consumer himself has to bring his return to a post-office or any other form of parcel shop. Of course, this is not the most popular way with customers.

Return handling is so important among consumers because the most bought item online is clothing, followed in second and third place by electronics and books (Temando, 2016).

“With clothing & accessories purchases proving popular, retailers can continue to expect high rates of returns as online shopping continues to lack the ‘touch and feel’ experience.”

(Temando, 2017, p. 15)

In 2013, 30% of clothing deliveries were returned. Clothing and footwear, in 2018, constitute for 20% of all parcels generated through e-commerce (Lowe and Rigby, 2014). In my survey, roughly 60% of participants have ordered clothing online in the past six months.

Consumers today are accustomed to no-cost returns, meaning they don't have to bear the costs for shipping back to the retailer. Especially large retailers, for example Amazon, Zalando, or ASOS, offer free returns. In response to consumer wishes for more flexibility across channels, German fashion retailer Zalando allows consumers to choose between returns through Hermes or DHL. This way, it nearly doubles the amount of drop-off locations for returns.

Tracking

Tracking belongs to the class of factors that are not mentioned frequently as critical success factors in Last Mile Delivery despite the fact that they are perceived very important to consumers nowadays. The reason for little awareness in literature is because they have become 'hygiene factors'. Those factors have become the standard. If asked for, those hygiene factors will score very high in importance, however, increasingly low in willingness-to-pay.

The demand for transparency has risen with the dispersion of the Internet and e-commerce. Consumers expect to be kept in the loop from the moment of placing an order until ownership transfers onto the recipient (Temando, 2016). All carriers today offer parcel tracking, some even going as far as showing the live geo-position of the delivery truck on a map. Tracking has lots of facets to it. Among others, consumers demand:

- Visibility of the expected delivery date, and ideally delivery time
- Email/text/SMS communication throughout the shipping process
- Easy tracking of the status and whereabouts of their delivery online and via their mobile devices
- Notification when the parcel was delivered (to their Car, Parcel shop, kiosk, neighbor, etc)
- Ability to make changes to their shipment while goods are in transit

Delivery Condition

Alike tracking, the delivery condition of a parcel belongs to the group of hygiene factors. No customer would accept their parcel and especially their purchase inside to be delivered in a damaged condition, not to mention pay for it to be delivered undamaged. The condition of the delivery largely depends on how well the packaging performed its job of protecting the delivery of goods. Delivery quality describes the condition of goods when they are received by the customer (DHL, 2017d). Despite not being mentioned in literature as critical success factors, I have still incorporated this factor in my survey, to validate the hypothesis that it scores highly in importance, and therefore the reason it does not appear in literature is in fact because it has become a basic requirement.

Before summarizing this chapter, I would like to highlight a couple of interesting aspects related to the success criteria. Recalling the Barclay's ranking of importance in delivery options (Figure 11), service quality is ranked fifth. Interestingly, the study also mentions that service quality is only valued by a customer once he or she had a bad delivery experience.

In a second step, Barclay measured satisfaction across five aspects of the delivery process (service, range, speed, cost, innovation). They find, that although consumers rank cost as one of the most important factors of delivery service, satisfaction with delivery pricing scores low. This only appears plausible to me, given the continuing evolution of higher demands combined with lower WTP. What strikes me though, is the fact that consumer satisfaction with Innovation scores lowest with only 4.4 out of 10 achievable points. This is interesting because plenty innovative methods surrounding delivery services exist, for example In-Car Delivery or Drone and autonomous vehicle usage. A potential reason could lay in the communication, marketing and promotion, which focuses on the underlying technology that enables the service, not on the benefit to the consumer (Lowe and Rigby, 2014).

A study from BCG about the delivery aspects most important to consumers, clusters the offerings in three categories, namely Basics, Value-Added Services, and Premium Services (Figure 13). This approach allows to draw interesting conclusions about the relevance of the offerings over time. The BCG survey took place in 2012. At that time the possibility to change delivery address of a parcel when in transit was considered very premium (see "Alternate delivery locations" and "Dynamic Rerouting" in Figure

13). Now, more than half a decade later, these factors have gained in importance. They are contributor to a flexible service, and Flexibility being one of the CSF. Furthermore, those two offerings are essential to new offerings such as In-Car Delivery. Overall, a shift between the categories can be observed: Former value-added services becoming the “basics” of today; yesterday’s premium offerings becoming today’s value-added services. Alongside this development, the implications for postal companies are threefold. First, they must revise their pricing strategy to remain competitive and acknowledge consumer’s diminishing willingness-to-pay. Second, postal companies need to strengthen and re-allocate their resources and investments in line with the temporal shifts between clusters. Third, firms must build new service offerings at the upper end of the ladder, to create value and generate the profit that is eroding at the lower end. With the emergence of new premium offerings, firms must develop the necessary capabilities to deliver such services.

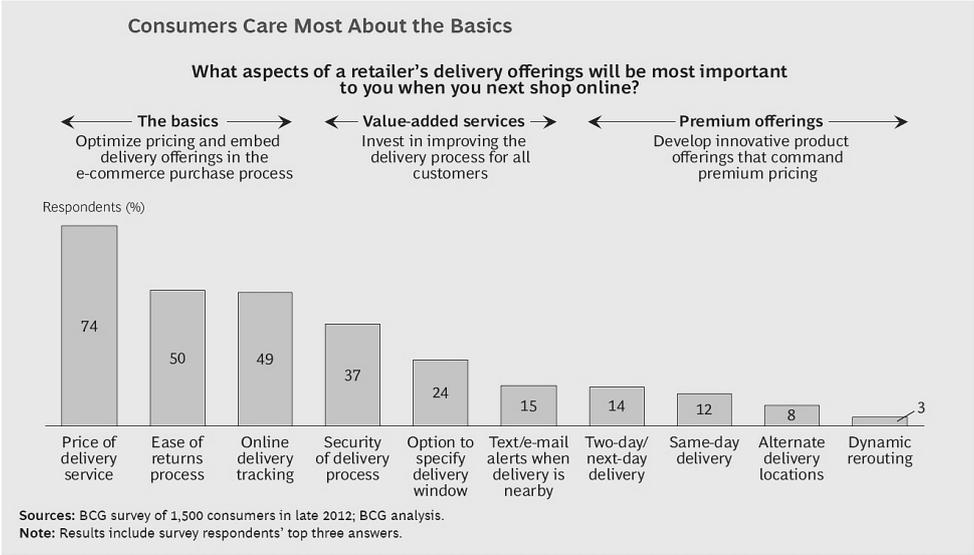


Figure 13: BCG | Rehse et al., 2016, p. 10

To sum up this chapter, the following Critical Success Factors have been identified as those perceived most important by consumers in the area of parcel delivery: Cost, Choice, Convenience, Flexibility and Speed (and second-tier Returns, tracking, condition). Together they form a value proposition that players in the Last Mile need to take into consideration when reviewing their current portfolio of service offerings and developing new value-creating services ahead.

The hypotheses developed throughout this chapter will be tested in the survey.

The two big take-aways from the identification of the CSF are:

1. The value proposition in Last Mile Delivery is non-static. As indicated, the consumers' habits and profiles are evolving fast. Today's value equation may be outdated in five years from now. The main changes to the value proposition will not occur due to the substitution of CSF by other factors. The main driver of change will be a shift in perceived importance, preference, and lastly WTP among the CSF.
2. There is no one-size-fits-all solution. With Choice and Flexibility, two out of five Critical Success Factors, there is a strong signal towards the need for individual solutions that are mass compatible but reflect an individual's need and lifestyle at the same time. Customers increasingly seek for customized and personalized solutions that seamlessly integrate into their lifestyles. Additionally, different customer segments prioritize the 5 CSF differently. This creates opportunities for postal companies to differentiate and skim off the existing WTP, for example for those segments that value convenience above all and are willing to pay for it.

2.3.3. Willingness to Pay

According to McKinsey, 25 percent of customers in the US, Germany and China are willing to pay significant premiums for the privilege of same-day or instant delivery. However, the remaining 75% still prefer the cheapest option of home delivery. Most customers are highly price sensitive (Joeress *et al.*, 2016).

The term 'Amazon Effect' or 'Prime Effect' describes the reality that consumers are getting accustomed to high standards. What used to be a premium option is now perceived the standard. The development can take one of three manifestations. (1) Either the WTP remains constant, while the consumer demands 'more' of that service characteristic. For instance, faster than before delivery. (2) Or, the consumer's willingness-to-pay for a specific service characteristic is shrinking. (3) Or thirdly, in the most extreme case, WTP is decreasing and expectations rising at the same time.

Consumer research suggests that although customers expect their increasingly demanding needs (for instance, responsiveness and customer-centricity) to be met, they are not prepared to pay more for the improved level of service (Capgemini, 2016). Example Case 1: In the previous Chapter 2.3.2, I have shown what consumers

consider to be a 'fast' delivery. From one year to the next 3-4 day shipping was no longer perceived fast.

Example Case 2: An example is the decreasing willingness to pay for shipping. From one year to another, shoppers expect to pay less for fast shipping (Figure 14). Looking at it in absolute terms, the value shoppers attribute to the same exact delivery option has plummeted. For example: For a 2-day delivery in 2015, shoppers would pay an extra of \$2.4 on average. In 2016, this number decreased almost \$1, down to only \$1.5. That equals a decrease of 40% within a time frame of 12 months. If the drop in WTP translates into topline impact, retailers and carriers need to make strong efforts to offset these losses (Deloitte, 2016).



Figure 14: Deloitte, 2016, p. 40

In 2002, consumers were asked if they are willing to pay for delivery to a parcel locker on top of the regular delivery charges (i.e. charges for home delivery). The research suggests that parcel lockers are only attractive for 'upscale consumers' who value convenience and round-the-clock access (Borrus, 2002). More than 15 years later with parcel volumes multiple times higher, lockers are free of charge and certainly no premium service. With the growth in e-commerce also the number of failed delivery attempts has risen. Parcel lockers are of mutual benefit to carrier and consumers, for which they are free today.

An interesting discussion point is brought up in a study from McKinsey, claiming that only a minority of respondents indicated willingness to opt for unattended delivery, e.g. parcel lockers, even at discounted prices (Joerss *et al.*, 2016). This contradicts all other

research stating that consumers tend to opt for the cheapest delivery solution. Given the popularity of BOPUS (Buy online pick-up in store) which is offered for free or cheaper than home-delivery, as well as the high acceptance rates of unattended delivery services, McKinsey's findings may be shaped by their particular sample and other factors, however do not sufficiently challenge the general assumptions.

It is noteworthy that consumer's WTP for pay extra for speed does not depend on the product category. Only groceries, small electronics, and automotive parts stood out with slightly higher WTP for speed compared to other product classes. If it is of strategic importance to significantly expand its share of total last-mile volume in a specific segment, sellers or senders will probably have to bear the additional cost of same-day or instant delivery themselves, given the consumers' reluctance to pay for it (Joeress *et al.*, 2016).

WTP for In-Car Delivery

The determination of consumers' willingness to pay for In-Car Delivery and the pricing strategy for that service are not straight-forward.

One question is: In what currency does the consumer pay? Money or data? It is crucial to note that willingness to share (data) is not willingness to pay (Bertoncello *et al.*, 2016). Companies need to provide a compelling value proposition in exchange for data. The immediate data required for trunk delivery is the geo-location of the consumer's car. The secondary data that carriers would receive are personal insights about the type or car, usage patterns, etc.

During the current phase of tests and pilots, In-Car Delivery is free of charge. This includes the shipment cost per parcel, as well as the one-time cost for installation of a telematics box into the car. This box enables to remotely open the trunk as well as the transfer of the GPS signal. In a commercial mode, shipment per parcel will likely be line-priced with home delivery or alternative forms of unattended delivery (Volvo, 2017). The telematics box will probably be charged to consumers who opt for In-Car Delivery. However, in the mid-to long run cars won't need to be upgraded with such box because the necessary technology will readily be built-in as enabler for autonomous driving and other connectivity-enabled services, apart from ICD. One of the companies offering trunk delivery is German car manufacturer SMART in cooperation with DHL. In regards to pricing after finishing the pilot phase, Annette

Winkler, CEO of SMART, states: "We will learn if customers are willing to pay for this kind of service" (Preuß, 2016).

In the scenario that In-Car Delivery will initially be premium-priced versus home-delivery, there can be uncertainty about the amount and timing of payment. Rules would need to be established which party bears the cost delta between car delivery or home delivery, in case the parcel is - other than initially requested - delivered not into the car's trunk, but some alternative location, that has normally lower delivery fees associated to it. Is it the recipient, the sender, retailer, or carrier? The reasons for this can be manifold and don't need to be failed delivery attempts only. It could be that the recipient along with his car is home at the time of delivery and would therefore spontaneously opt for home delivery.

Overall, In-Car Delivery can be viewed as one of many future business models/use cases of the so-called connected car. With scale the cost of the necessary hardware will decrease and become standard in modern cars.

2.4. Modes of Delivery

This chapter first introduces a new classification of delivery methods, then goes on to an overview of the existent delivery options, and finally closes with an outlook of future delivery services, with a particular focus on In-Car Delivery. Future as well current delivery methods will be discussed with respect to benefits, downsides as well as customer acceptance.

As In-Car Delivery brings a new dimension to existing delivery options, I propose a new classification of delivery methods. The new dimension is the liberation of pre-defined geographical spots for parcel delivery.

In this model, there are three classes of delivery methods. Their position is determined along a two-dimensional matrix (see Figure 15).

The vertical axis determines how location-bound the delivery method is. A position at the lower end means the delivery service is stationary. The delivery location is restricted to one physical address. A position at the upper end means that the delivery location is free from geographical restrictions. In theory, there are limitless delivery locations and parcel delivery is made not towards a place but rather the person. The two extremes at the horizontal axis are static versus dynamic. Static models describe delivery models with little ability to change and adapt. Dynamic models have a high degree of flexibility.

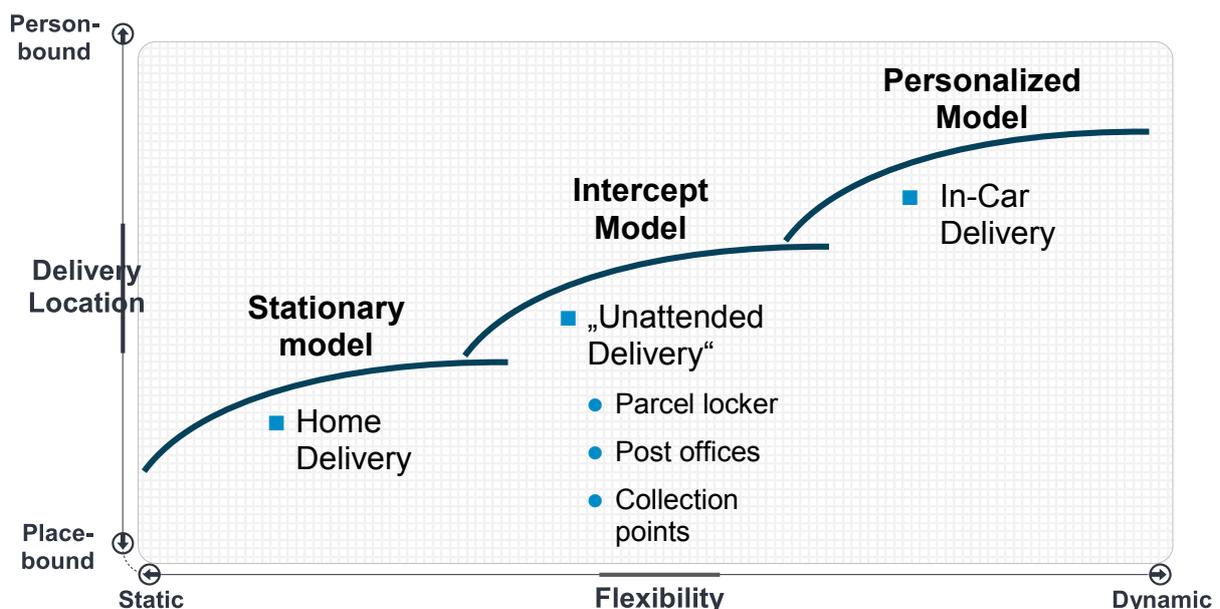


Figure 15: Own representation - Classification of Delivery Methods

In brief, the proposed classification distinguishes three models.

1. **Stationary Model.** The typical and foremost representative of this type of delivery is Home Delivery. It is stationary, requires consumer attendance but it is also the most direct form of customer contact.
2. **Intercept Model.** Delivery within this model does not require attendance of the customer. However, it does require customer interaction, as it gets the customer to handle the last mile partially himself. He has to pick up/collect his parcel from a variety of options: parcel lockers, post boxes, kiosks, post offices, etc. This provides greater flexibility for the consumer and also benefits the carrier as he can drop off several parcels during one stop. Ring and Tigert (2001) call this model the Intercept Model.
3. **Personalized Model.** The key difference in a personalized delivery is that a parcel is delivered to a person rather than a place. This concept is known from the military where delivery is not place-bound, instead person-bound. Thus, it is highly dynamic and virtually endless delivery locations exist. The car's trunk is the proxy for the person, as the concept In-Car Delivery assumes the recipient's car to be close to its owner's whereabouts. If that was untrue, the recipient would be unlikely to pick ICD from the range of delivery options. Flexibility is high due to unattended delivery, round-the-clock accessibility and most prominently the delivery within close proximity of the recipient himself.

2.4.1. Current Delivery Options

In the following, I will describe the three prevalent delivery methods that are currently commercially in use: Home Delivery, Post office/Parcel Shops/Collection points, and Parcel Lockers.

Home Delivery

Home delivery is the most classic form of parcel delivery and works from a consumer point of view exactly like mail delivery, with the difference that the delivery person does not leave the parcel with the mailbox but rings the doorbell and attempts to hand the parcel over to the recipient in person. The delivery person employed by the parcel delivery service provider picks up the parcels at a consolidation point and delivers them

directly to the recipients. Home delivery service (HDS) is the only form of attended delivery. It requires the physical presence of the recipient.

While HDS is still the most popular and mostly used form of delivery, its popularity among consumers declines. In the UK for example, Barclay predicts direct deliveries to a consumer's address to reduce from 72 to 62 percent from 2013 to 2018. Delivery volume to other addresses, including parcel locker and parcel shops, is anticipated to rise from 26 to 38 percent (Lowe and Rigby, 2014). In Germany only 50% of all DHL deliveries are still issued via home delivery (Kniepkamp, 2016).

According to McKinsey, over 70% consumers still prefer HDS compared to the other options (Joeress *et al.*, 2016). Consumers place high value on the convenience of delivery right to their doorstep.

Given the vast majority of consumers favors the concept of HDS, but the relative number of home deliveries is falling, reveals the insufficiencies of HDS in practice. Due to these weaknesses, Barclay projects the number of home deliveries to fall, while delivery via other channels surges (Lowe and Rigby, 2014).

The second and third largest parcel operators in Germany in terms of market share, Hermes and DPD, express their belief that home delivery will not be the standard way of delivery in the future. Already as of 2018, they plan to introduce extra delivery charges for home delivery. This would be a fundamental change for the consumers, however is very much in line with the way the consumer landscape shifts. CEO of DPD, Boris Winkelmann, states: "In the future, it may happen, that parcel firms deliver to parcel shops by default, and that delivery to consumers' home costs, let's say, 50 cent extra" (Ksienrzyk, 2017). This is supported by Hermes CEO, Frank Rausch, mentioning the high costs of last mile delivery and soaring parcel volumes: "Parcel



Figure 16: Home Delivery (Joeress *et al.*, 2016, p. 20)

delivery to a consumer's front door must become more expensive, given the effort incurred" (Ksienrzyk, 2017).

Problems with Home Delivery

Recipients not being home at the moment of delivery is the number one problem for carriers and consumers alike. DPD UK identified 50-70% of households as empty during the day (Lowe and Rigby, 2014).

According to Park and Regan (2004), the 'Not-at-home at the time of delivery' problem becomes the most critical factor for the success of home delivery. They go on claiming that failure leads to inconveniences and eventually lower satisfaction among customers (Park and Regan, 2004).

While HDS can be a compelling vehicle for busy people that have limited time shopping at stores, people with hectic lifestyles can be put off using home delivery because they are unwilling to wait for hours for their delivery to arrive (Hsu *et al.*, 2011; Blyth and Geoghegan, 2002).

In 2000, 42 percent of home shoppers had to collect a missed delivered item from a post office or collection point (Annon, 2001). Among my sample, this number is as high as 90%. The consequences of a failed delivery are troublesome. On average, a person has to travel 5km (round trip) to collect a parcel and spends on average 30min to do so (IMRG, 2015). At the same time, he must adhere to the opening hours of the collection point, which often is only during regular working hours. On top, additional cost may occur for public transport or parking. Furthermore, after collection the recipient has to carry the potentially heavy parcel home himself. All these factors are the exact opposite of the consumer expectation for home delivery.

Many prefer home deliveries to be made on weekends and after business hours, to avoid exposure of the package to weather and potential theft (Lee *et al.*, 2016).

Obviously, postal companies have taken a number of measures to reduce the number of failed deliveries, as it is not only inconvenient for the customer, but also creates significant costs to the carrier for vehicle idle time, vehicle fuel consumption, new delivery attempts the next day, extra storage, etc.

In the following paragraph I will give a brief overview of the tools offered to improve HDS and discuss why they are not able to mitigate the deficiencies of HDS sufficiently.

1. **Communication.** Via proactive and transparent communication, the consumer no longer perceives the delivery process to be a blackbox. From the moment of order completion on the e-commerce platform until the moment of delivery, the

consumer is kept in the loop about the status of the order (has the order been shipped already), the whereabouts of the parcel, the next steps in the logistics chain (e.g. proceed to consolidation hub, en route to customer, etc), and expected date and time of delivery. The last piece of information allows for better planning for those people who would stay home to receive a parcel or do home office. Yet, for the larger part of working people, more certainty and accuracy in estimated delivery time does not add much value, because they cannot afford to wait at home for a parcel to arrive.

2. **Time window.** Some carriers allow recipients to pick certain week days on which they want to receive parcels. Some also offer the recipient to choose certain time slots, often 2-3 hour windows, during the day in which they are available to receive their parcel. Depending on the carrier, this service is charged extra. A survey by the UK Department of Trade and Industry (2001) found that most shoppers would choose a slot between 6-8pm. This creates a large demand for a short period of time which would result in delivery fleet overcapacity for 80% of the day. Therefore, carriers at some point do not allow free choice of time slots to consumers, but offer only slots that are still within capacity - similar to plane or train tickets where there is limited seats for a specific flight slot.
3. **Secure drop-off location.** Some carriers allow recipients to define a drop-off location for the parcel around their house, garage, garden in case they are not home themselves to receive the parcel in person. In many cases though, a parcel is left at the doorstep without such formal request by the recipient. This bears security concerns. Besides the risk of theft, leaving a parcel unattended in the garden or doorstep, is unsuitable for perishable items. Furthermore, in urban centers people don't have a safe place, because they live in an apartment and have no house, garden or garage. If recipients opt for "secure drop-off" they have to sign an agreement stating that ownership and liability is automatically transferred to them when the delivery person places the parcel at the 'secure' drop-off location. Natalie Berg, an analyst at Planet Retail RNG, comments on the frequent (US) phenomenon of so-called 'porch thieves': "It's not the financial cost but also the impact that a failed delivery can have on brand reputation and customer loyalty. Nothing makes shoppers more irate than missing a delivery"

(Kim and Farr, 2017). According to a survey by Shorr Packaging, 31 percent of US shoppers have experienced package theft (ibid.).

4. **Neighbors.** Many customers are not in favor of delivery of their parcels to neighbors, when they are not home themselves. For this reason, DHL has introduced an option in 2016 that precludes delivery persons from handing parcels to neighbors. It is an ad-hoc option that retailers can book. With this service DHL wants to ensure discretion for deliveries with sensitive content, for example medical and erotic products, tobacco, or alcohol (DHL, 2017a). According to Barclay, consumers will request delivery to a neighbor or friend's home less frequently in the future, because more convenient options and safer methods negate this need (Lowe and Rigby, 2014).

Taken together, the disadvantages and contingencies on which successful home delivery hinges appear to outweigh the conveniences that delivery right to your doorsteps brings along. At least, there are delivery methods that are less associated with the above listed downsides. Deriving from this I would formulate the hypothesis:

Hypothesis: HDS has a number of inconveniences linked to it, foremost the not-at-home problem.

Post offices, Parcel Shops, and Pick up Locations

Given the large number of people not at home during the day, more and more people opt for unattended delivery options. When shopping online, the consumer can choose from a wide range of delivery locations other than his own home address. He can view the possible delivery locations on a map and select according to his needs in terms of proximity, opening hours, or accessibility.

The recipient has the advantage that he does not need to be present during the delivery and that he can choose from a growing number of locations. In Germany, for instance, DHL as the largest parcel service provider has a network of 28.000 customer access points. These are physical locations where consumer can either send or retrieve parcels. This number splits into:

- 13.000 Post Offices
- 11.000 Parcel Shops
- 3.000 Parcel Lockers
- 1.000 Parcel boxes

Besides DHL, there are three other relevant parcel players in Germany: Hermes, DPD and UPS. They have a combined market share of 55% and own around 23.000 customer access points. They have a similar split of interfaces as DHL (Figure 17).

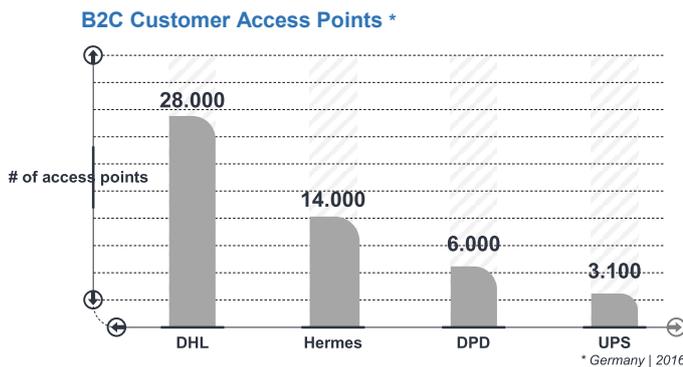


Figure 17: Own representation based on DHL, 2017b

Post offices offer the whole range of services of a particular postal company, among others parcel and mail handling, financial services, or telecommunication. They are generally owned and operated by the respective postal firm.

Parcel shops (or collection points) are not owned and operated by the postal companies. They are operated by third-party businesses that offer parcel services on top of their core business. One fifth of parcel shops are kiosks and gas stations. The rest is a mix of dry cleaners, copy shops, bakeries, supermarkets, tailor shops, etc. Their benefit compared to post offices is more flexibility in terms of opening hours. In Germany, the average opening times of kiosks is 7am-1.00am, and thus, outside of standard business hours (Lessmann, 2017).

In the future consumers will use Post Offices and Courier Deposits less often (see Figure 18: -4.4 / -8.3%). The shift away from post offices is the result of new options that fit better around an individual's lifestyle, such as parcel shops and lockers (Lowe and Rigby, 2014).

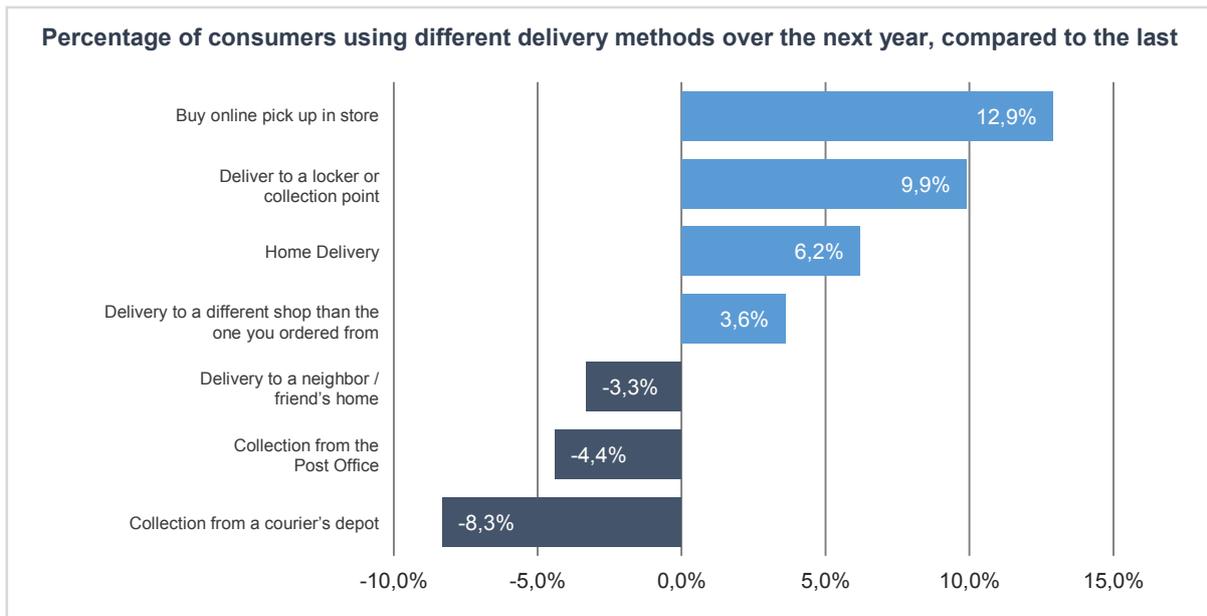


Figure 18: Own representation based on Lowe and Rigby, 2014, p. 11

Pick up in store

Buy online pick up in store (BOPUS) is another form of unattended delivery at a collection point. The collection point is an offline physical store outlet of a retailer. Many retailers, fashion retailer Zara for example, allow consumers to shop online and pick up their purchase in the Zara store closest to them. Therefore, BOPUS is sometimes also called Click & Collect.

A study from Temando in 2016 reveals an interesting fact about Click&Collect. They find that around 82% of consumers want the option to collect their purchase from a store and only 36% of consumers want to collect their shipment from lockers or other collection points. It is surprising that consumers appear to prefer Click&Collect over Parcel Lockers, given that the offering in itself is more beneficial for parcel lockers, i.e. wider network of lockers than a retailer's store outlets and accessibility 24/7. Temando has analyzed this surprising outcome and found that Click & Collect's greatest appeal, is that it's free or cheaper - not because it's more convenient than delivery. This again highlights the importance of affordability as one of the Critical Success Factors (Temando, 2016). Besides saving on the delivery costs, consumers would also consider using BOPUS because (i) they can first see the product before accepting it, and (ii) they can do 'trip-chaining' - the ability to combine collection with other shopping activity (Figure 19).

BOPUS appeals for reasons of shipping cost reduction and immediacy of product acquisition.



Figure 19: Deloitte, 2015, p. 25

While only 20% of consumers have used this service so far, the number of consumers using BOPUS in the future is going to increase significantly (Lowe and Rigby, 2014). Click & Collect is free or cheaper than home delivery, because retailers look to minimize costs associated with delivery, as well as encouraging further shopping opportunities when consumers collect in-store. Almost 30 percent of retailers would use Click & Collect as their preferred delivery option for two reasons (ibid.). First, retailers can save on shipping costs because the customer's online purchase takes the same route from their central depot/distribution center to the brick-and-mortar store that is supplied anyway. Second, retailers encourage further shopping opportunities when consumers collect their online purchases in-store. Click&Collect, thus, has the potential to increase revenue through increased foot traffic (Audi *et al.*, 2016).

To sum up, parcel delivery to post offices and collection points successfully addresses the 'not-at-home' problem of home delivery, but brings along their own limitations:

Asked for barriers for not shopping in store, customers name crowds and long lines as the top reasons. Further top ranked reasons include: too much drive time (too far away or too much traffic), lack of parking, and store hours inconvenient (Figure 20). The relevance of these results is in the parallels of a regular store and a post office. In other words, the mentioned barriers apply equally to post offices or Click&Collect. The downsides of picking up a parcel largely overlap with the arguments why consumers

did not shop in-store in the first place. Deriving from this I would formulate the next hypothesis:

Hypothesis: Post offices & Collection points as alternatives to Home Delivery bring along a new set of inconveniences.



Figure 20: Adapted from Deloitte, 2016, p. 16

Parcel Lockers

Parcel lockers are an evolution from the post offices. From a consumer perspective, parcel lockers resemble post offices in many ways, with the key point of difference being accessibility all around the clock.

The other key difference is that parcel lockers are a self-service technology which does not require the presence of staff. Until the collection of the parcel from the locker, the process for the consumer equals delivery to post offices and other types of collection points. At the online check-out before payment, the shopper chooses the parcel locker closest or most accessible to him. Upon arrival of the parcel at the locker, the shopper receives a SMS and e-mail notification with a PIN code that allows him to open the compartment with his package and retrieve it. Parcel lockers can also be used for C2C shipments. They are accessible twenty-four hours a day, seven days a week, unless they are located within another site that has varying opening hours, for instance within a shopping mall.



Figure 21: Parcel Locker (Audi et al., 2016, p. 24)

Postal companies have invested in secure parcel locker units over the last decade to meet customer expectations, especially in reference to effective and efficient parcel delivery (Audi et al., 2016). Currently, there are over twenty companies in Europe offering a network of parcel lockers (ibid.). The biggest operators are logistics companies. In Germany, for instance, DHL operates 3.000 parcel lockers, with eight million registered users, which accounts for a tenth of the German population. The percentage using these lockers is even higher, because registration is not needed to have your parcel delivered there.

Yet, also online retailer Amazon operates parcel lockers and grows its network across Europe.

In general, the success of this delivery option is measured by the volume of customer use. Amazon, for instance, measures success of this delivery option by the volume of repeat customers. Because parcel lockers are a relatively new solution to Amazon, specific measures and metrics are still being defined, according to Russell Dougherty, Business Development Officer at Amazon (Audi et al., 2016). Information gathered for measurement purposes include:

- Volume of customer use and repeat customer use
- Customer satisfaction surveys
- Customers feedback & comments on social media platforms
- Number of parcel lockers installed
- Delivery efficiencies, such as changes in (i) distance traveled of delivery truck, (ii) shipping costs, and (iii) vehicle standing time

He adds, “We are not making revenue [directly from the parcel lockers], the idea is getting the package to the end customer and get customers to re-use Amazon’s core services. [...] We aim to create increased sales conversion” (Audi et al., 2016, p. 33). His insights highlight the crucial role of Last Mile Delivery to retailers. As a retailer,

Amazon seeks increased sales opportunities (hard benefits) via an efficient and satisfactory delivery (see Chpt. 2.1.5). In fact, according to a research by InPost in Australia, 41% of parcel lockers customers showed increased frequency of online shopping after registering for parcel lockers (InPost, 2014).

Parcel lockers are of mutual benefits to consumer and postal operators:

- Primary benefit is the convenient and secure service provided to the customers.
- Accessibility is 24/7. Thus, recipients are independent from opening hours. This is proven in the fact that
 - around 35-40% of parcels are picked up at a time when post offices and couriers do not operate (Norman, 2014)
 - 30% of parcels are collected at weekends | 32% of parcels are collected between 8 PM and 9 PM (InPost, 2014)
- Lockers are secure against theft (through automatic locks and video surveillance).
- If a carrier can deliver the package at the first time, then he saves not only vehicle idling time, truck miles traveled, but also the opportunity costs to re-attempt the same delivery.
- Based on these efficiency improvements, InPost for instance, states that they have experienced 95% reduction of CO2 emissions (Audi *et al.*, 2016). It is questionable however, if the environmental impact is not offset by the individual customer picking up the parcel.
- Drop density (number of parcels dropped per stop/recipient) is significantly higher than for home delivery. Delivery vehicles are only required to make one stop to a locker location for multiple customers rather than several individual stops (Joerss *et al.*, 2016).
- The lockers are unmanned and require low maintenance (Audi *et al.*, 2016).

The downside of delivery to parcel lockers is “Splitting the last mile”. Delivery to parcel lockers (as well as post offices and parcel shops) is based on a model that essentially splits the last mile between carriers and recipients. Delivery vehicles transport the package to the locker station, the customer himself then bridges the final step, collecting the package from the locker. Depending on the nature of the parcel this may be very troublesome. Around 5% of parcels weigh between 15-30kg (Joerss *et al.*, 2016). Furthermore, parcel lockers lack human interaction with postal agents. For

some this may be a limitation to use parcel lockers, however my survey shows that little people care about human interaction in the delivery process. In fact, 98% of survey respondents state, that they do not care about “Interaction with Delivery staff”.

Overall, consumers state that they will use parcel lockers more in the future (+10%) at the expense of post offices, courier depots and delivery to friends or neighbors. This appraisal demonstrates the consumers’ need for secure and flexible solutions (Lowe and Rigby, 2014).

Weighing the benefits and restrictions of each, parcel lockers and post offices/parcel shops, I formulate the next hypothesis:

Hypothesis: Consumers value lockers over post offices and parcel shops/collection points

To sum up, in this chapter I have extensively examined the prevailing delivery methods. I have shown that each type of delivery has its practical limitations. Over the past years, the introduction of alternative delivery modes aimed to address existing problems. First, delivery to post offices addressed the problem that customers are less and less reachable at their homes. Then, parcel shops complemented post offices amplifying the network of parcel delivery stations. Finally, parcel lockers resolved the time constraint, granting accessibility 24/7 to retrieve parcels independently from opening hours.

Nonetheless, some problems persist. Among them, the trip to the collection point and need to carry home the parcel yourself. Provided the continuing deficiencies of current delivery methods, it is imperative for postal companies to develop new delivery modes that tackle the remaining inconveniences and eventually improve customer satisfaction.

2.4.2. Future Delivery Options

This chapter outlines delivery modes and means of delivery that have the potential to improve the delivery experience from a customer point of view and generate efficiencies for logistics providers. These concepts are in the piloting phase or in very low-scale commercial application still.

In the following paragraphs I will cover: Drone delivery, AGV/Droid Delivery, and In-Car Delivery.

Drone Delivery

Drones are autonomous aircrafts, vertically starting like helicopters, that carry parcels to their destination at a relatively high speed and along the most direct route. Their operation and flights needs to be supervised (Joerss *et al.*, 2016).

Drones are essentially a new means of transport. Their application does not imply new delivery methods. Parcels are still delivered to a consumer's home or dedicated delivery spots that are equipped with a suitable start and take-off platform.



Figure 22: Delivery Drone (Joerss et al., 2016, p. 20)

Drone application has two profound disadvantages. First, drones are big, especially those that can carry heavy parcels and are to fly long distances. In urban areas it will be hard to find landing sites of 2 sqm - the estimated size for secure operation. The scarcity of landing sites will make a city-wide deployment of delivery drones unlikely. Second, drones currently transport parcels up to 5kg only. Even if drones will be able to carry up to 15kg, there still needs to be a full-service operator for the remaining packages to be delivered via traditionally vans (Joerss *et al.*, 2016).

On the flipside, the disadvantages can be overcome if drone service is restricted to smaller parcels and rural areas. Long distance coverage to remote locations is very expensive today. Drones turn out to be quite cost-competitive in rural areas, at only 10% above the cost of today's delivery model. At the same time, drones are the only solution to offer specified time slots and same-day delivery in rural areas. The additional charge for such options can make up for the slight cost increase (Joerss *et al.*, 2016).

Further benefits of drones include operating in difficult terrain, possibly taking shorter routes, and reduced environmental impact as there will be less trucks required (Lee *et al.*, 2016).

The public opinion regarding autonomous vehicles including drones is open-minded. 60% of consumers indicate they are in favor or at least indifferent to drone delivery (Joeress *et al.*, 2016). 51% of consumers are willing to accept drone delivery in the future (Temando, 2016).

The fundamentals for drone delivery are a solid legal framework and regulation of safety and liability aspects, powerful IT capabilities, trained supervisors and technicians as well as starting and take-off bases. It is estimated that one supervisor can remotely observe eight drones.

These requirements make it necessary for traditional parcel companies to build the capabilities and invest into the assets. But before committing to large scale capital investments, the companies are experimenting with delivery drones. Among the companies testing deliveries with drones are: UPS, Amazon Prime Air, Google and Hermes. Since 2014, DHL, for instance, uses drones commercially in a low-scale setting where it delivers medicines to the remote island Juist in Germany. The market potential is high. Even considering the above mentioned limitations of drones, around 1 out of 5 Amazon orders meet the criteria in light of size and distance, to be in scope for drone delivery. Amazon CEO, Jeff Bezos, claims: "One day seeing Amazon drones will be as common as seeing a mail truck" (Lee *et al.*, 2016, p. 11).

AGVs

Autonomous ground vehicles (AGV) are self-driving vehicles that use the streets, alongside regular cars. When equipped with parcel lockers, AGVs are essentially a substitute for current delivery vans (see Figure 23). They can deliver parcels without any human intervention. In case such vehicles need to be supervised, one operator could centrally manage around ten AGVs. Customers are notified in advance about the exact arrival time. Once the AVG arrives at their home, the recipients are asked to collect the parcel from the locker.



Figure 23: AGV (Joeress *et al.*, 2016, p. 20)

Joeress *et al.* (2016) predict that AGVs with parcel lockers will replace current forms of standard parcel delivery due to cost advantages compared to today's conventional last-mile delivery. They calculate cost savings of over 40 percent, assuming labor costs of approx. EUR 20 per hour. Especially in rural areas, the deployment of such driverless vehicles pays off. They can operate for longer hours, hence, provide greater flexibility in delivery times and increase operations efficiency (Lee *et al.*, 2016).

The technology requires a recipient to be present at the time of delivery, to unlock the compartment and retrieve his parcel. From the consumer's standpoint, parcel delivery via AGVs is not hugely different than traditional home delivery. AGVs are only a different means of transport, a driverless one. The not-at-home problem persists. On the other side, AGVs could provide Sunday delivery, even in countries with tight labor laws where work on Sundays is forbidden in most professions, for instance Germany (Joeress *et al.*, 2016). Customers highly value flexibility. 70 percent of consumers believe that couriers should deliver on a Sunday, which is not surprising considering people do value the convenience of shipment right to their doorstep but are not at home during the regular work days (Lowe and Rigby, 2014). During night times the vehicles can serve as regular parcel lockers. This would even allow the parcel companies to save on the real estate cost of classic parcel lockers.

AGVs are largely accepted in public, with 40% of consumers claiming that they would definitely or likely use AGVs with parcel lockers (Joeress *et al.*, 2016).

Droids

Droids are small autonomous vehicles that deliver parcels right to the doorstep (see Figure 24). Their size is only slightly larger than the parcel itself. They travel at low

speeds of 5-10 km/h and use sidewalks and bike lanes to reach their destination. They are programmed to travel amongst pedestrians, bicyclists, and cars. Droids are not meant to cover long distances, for example delivery to rural areas. Current models have a range of 5 km. Their field of application could be sub-/urban areas, campuses, or gated communities. The droid would travel short distances from the distribution hub or retail store to the customer, within 5-30 min. Upon arrival, the customer is notified via his smartphone and can open the robot's locker using the app. The robots are protected against theft, and only the recipient has the one-time access code to retrieve the parcel. The droids need to be supervised. But given their size and low speed, a single operator could centrally handle 50-100 of them (Joeress *et al.*, 2016).



Figure 24: Delivery Droid (Joeress *et al.*, 2016, p. 20)

Among others, Hermes and DHL run pilots with droids. DHL pursues a program called SideWalk. Hermes partnered with the technology startup Starship. Since 2016 they run trials in Hamburg, Germany. The trials show that droids are very well perceived by parcel recipients as well as the pedestrians who share the sidewalks with the robots (Bertram, 2016).

To recap, autonomous vehicles - that includes the droids, AGVs, and drones - will deliver nearly 100% of X2C (= B2C & C2C) parcels in the future. Developed countries will be the early adopters of these new autonomous delivery models, because labor costs are high enough for the investments to have a positive return. Autonomous delivery models will make the last-mile much more asset-intensive. In developing countries, labor costs probably remain low enough to prevent big technological change impacting the last mile over the next 5-10 years (Joeress *et al.*, 2016).

In-Car Delivery

In-Car Delivery, or Trunk Delivery, is a concept that allows customers to receive parcels and other deliveries into the trunk of their car (see Figure 25). DHL currently runs pilots and describes In-Car Delivery as “a new and attractive service for a young online savvy target group that seeks to enhance the quality of urban life” (smart, 2016). Consumers need to register for the service at the carrier.

The concept is fairly simple. Online shoppers select their vehicle as the delivery location for their purchase. The carrier locates the car using geo-location, opens the trunk using a temporary and digital access key and delivers the package. Upon successful drop-off, the customer receives a notification and the one-time key of the delivery person automatically expires.



Figure 25: In-Car Delivery (DHL, 2015)

In-Car Delivery (ICD) combines the advantages of home delivery and unattended delivery. It is the only form of unattended delivery so far, that does not split the last-mile between carrier and company. In other words, the parcel is delivered right to the consumer (assuming of course his car is close by), but he does not need to be present when the parcel is dropped off. Thus, it appears that ICD has the potential to meet all five identified Critical Success Factors (see also Chapter 2.3.2):

1. **Choice.** ICD will not replace existing delivery options. Instead, it serves as an additional delivery option, expanding the variety of options offered to consumers.

2. **Convenience.** Despite the practical limitations of home delivery, the concept of home delivery is still preferred by the majority of shoppers. This is due to the high degree of convenience when a parcel is delivered right to your home, i.e. to you. In-Car Delivery offers the same level of convenience because the parcel is delivered to you no matter if you are at home or elsewhere. This assumes that your car is in your proximity because you use it to travel to work, go shopping, etc. If this was untrue, the shopper would have likely chosen among the other delivery possibilities. Trunk delivery can therefore spare the shopper lengthy and time-consuming trips to collection points or post-offices, and the need to carry the parcel back to his home.
3. **Cost.** There is no pricing scheme available yet, because trunk delivery is still in the pilot phase. During the pilot phase at least, delivery to your car is free of charge. It can be assumed that ICD will be line-priced with home delivery. The one-time cost, installing a connectivity box in your car, is currently born by the parcel companies. The box transmits the geo-location of the car to the delivery driver and allows him to remotely access the trunk via an app. In the long run, automobiles will be equipped with the necessary technology by default, since it is needed for autonomous driving and other 'connected-car' enabled services.
4. **Flexibility.** Needless to say, the parcel recipient has unlimited access to his own car 24/7. In terms of flexibility and safety, ICD is at one level with parcel lockers.
5. **Speed.** ICD is not inherently faster than other delivery options. Implicitly, however, the consumer could gain time because delivery to post offices, parcel shops, or parcel lockers always takes time to collect the parcel. With delivery to the recipient's car, he can retrieve the parcel in no time.
6. (Returns). The ease of returning parcel is none of the CSF. Nevertheless, it is very important to online shoppers. Users of ICD cannot only receive parcels in their car, but they can as easily place returns in the trunk for the delivery person to collect them the next time.

In-Car Delivery can reduce the risk of a failed delivery. The carriers not only save vehicle idling time, truck miles traveled, but also the opportunity costs to re-attempt the same delivery. The trial runs carried out in various German cities have shown that the carriers can also save fuel and avoid the parking problem when delivering parcels overnight, as is feasible with ICD. Another problem that can be avoided is the need for

“long-distance walking” which is a significant inefficiency in last-mile delivery (DHL Trend Research, 2014, p. 31). This occurs every time when the delivery person is not able to find a parking spot close to the recipient’s front door. Then they have to cover the distance on foot which takes extra time and can be hard work if the parcels are heavy.

A limitation of ICD is the size of the trunk. Large items, such as TVs or furniture, are not suited for this type of delivery. Furthermore, the consumer needs to have a car. This appears obvious but is not negligible as especially the target group of younger people tends to have less cars as they value other types of mobility, for instance car sharing.

Using In-Car Delivery comes at a cost. Not necessarily a monetary one, but the usage of this service is only possible when the consumer provides the GPS-location of his car to the delivery company, at least for the duration of the shipping process. Consumers may worry about misuse of their data or selling of their data to third-parties. A second potential concern is the perceived privacy intrusion when the delivery person opens the car. Many consumers consider their car a very private space. Even though, it is technically only feasible to open the trunk once, and only the trunk, consumer may be concerned about theft of belongings in the car or even car theft. The service providers ensure that there are no reasons to be concerned about safety because insurance is covered via the delivery company in case something happens. However, the firms must not underestimate the consumer’s sensitivity when it comes to data privacy and GPS tracking.

Deriving from above paragraphs, I formulate the next hypotheses:

Hypothesis: ICD successfully mitigates the remaining problems of established delivery services.

Hypothesis: People would be willing to accept In-Car Delivery. But people also feel strongly about the potential data and privacy concerns.

Several postal companies are experimenting with In-Car Delivery. For this purpose, delivery firms create partnerships with car manufacturers. The OEMs have a legitimate interest in pursuing such partnerships. As the CEO of SMART, Dr. Annette Winkler, nicely phrases it: “What is it that makes cars attractive nowadays? It is software,

software that enables services. [Having more applications than mere driving] will increase the willingness to purchase a SMART” (ntv, 2016).

In one trial, DHL has joined forces with Amazon and Audi and VW to enable In-Car Delivery. In another trial, DHL collaborates with Smart/Daimler. Chinese car manufacturer Volvo partners with Hermes. In 2017, the trial between DHL and Smart was expanded from originally 2 German cities, Berlin and Munich, to 7 German cities. While little is revealed from these pilots, DHL reports to deliver 30-50 parcels per night via In-Car Delivery (Schweitzer, 2016).

In the B2B environment, the concept of In-Car Delivery is not entirely new. Especially in time-critical and cost-intensive scenarios In-Car Delivery finds application for a number of years already. Logistics companies, like Night Star Express, deliver spare parts in the trunks of service vehicles. Deliveries include, for instance, medical devices for hospitals, or machine parts needed on construction sites (Nicolai, 2017).

2.5. Summary

Before heading into the analysis part of this paper, this section summarizes two cornerstones of the literature review.

- a) What drives development of new delivery modes?
- b) What criteria must new delivery methods meet?

The multitude of reasons making innovation necessary is summarized from four different perspectives.

Consumer.

- a. Imbalance. On the one side, consumers order more and more online. On the other side, they are less home to receive parcels. This is due to people spending more time at work, shrinking household sizes, and less married couples/more single households.
- b. Evolving consumption patterns. Consumers increasingly look for convenience in everyday activities. There is a focus on shopping as experience. They develop round-the-clock purchasing habits and still demand delivery the next day or the day after.

- c. Profusion of new demands. Consumers' level of expectation is rising steadily. They increasingly demand for flexibility, personalization, and customization. Also, the mega trend urbanization is relevant for innovations (35% of German population are urbanites already), because urban dwellers have different demands, among others they are more inclined to sameday delivery.

Company.

- a. Companies experience increasing cost pressure.
- b. Offered delivery options are gradual improvements only. For instance, from Home delivery to delivery to Post Offices to delivery to collection points to delivery to Parcel Lockers. All have their deficiencies and limitations in practice.
- c. Existent delivery modes are not suited to deliver specific types of services or goods (e.g. for food or crates of beer which could easily be delivered into a car's trunk).
- d. Companies are more dependent on the parcel business, as mail volume is declining. They must find new ways to win.

Industry.

- a. The problem that consumers are not at home/not reachable and therefore deliveries fail, is not new to the industry. Yet, the problem is significantly amplified by (i) higher parcel volumes and (ii) consumers being even less at home. This leads to higher cost per parcel/per delivery.
- b. In addition, labor and commodity costs are rising.
- c. Next to the cost pressure, there is also competitive pressure. New players, such as technology firms, e-commerce players, or startups, are entering the market and pose a threat to incumbents.
- d. Postal firms need to differentiate, one way of doing so is innovation and development of new delivery models.

Technology.

- a. Technology serves as enabler for innovation.
- b. The necessary infrastructure is ready and parcel companies need to leverage it, as other industries already do.
- c. The increasing adoptability and dispersion of smartphones can be utilized.
- d. In addition, ubiquitous connectivity (4G / 5G) allows for entirely new solutions.

- e. Smart cars, connected to the Internet and built-in GPS capabilities, enable remote services (e.g In-Car Delivery).
- f. Cloud computing and real-time dynamic route optimization create new possibilities for innovation (e.g again In-Car Delivery).

The need to drive last-mile innovation and develop new modes of delivery is understood by leading industry players. Innovation and service enhancements must be at the core of their strategy. To put these ambitions into action, it requires support from the C-suite.

The below table (Table 2) contains statements from executives and leading managers in the parcel and automotive industry who place projects - like In-Car Delivery - at the top of their agenda, thus, demonstrating the sense of urgency it takes to win in the parcel industry.

 Statements from Parcel Industry	
Dieter Bambauer, Swiss Post, Head of PostLogistics ¹	“Customers increasingly want to choose where and when they receive their deliveries. Swiss Post has therefore introduced a wide range of services for convenience, such as evening and weekend deliveries, individual management of consignments, and parcel terminals. In-car delivery supplements these services perfectly.”
Frank Rausch, CEO, Hermes Germany ²	„Logistics people needs a mind change: They must place the consumer at the center, not their processes“ „We need to further digitalise the last-mile, [...] make delivery an experience.“
Jürgen Gerdes, CEO eCommerce - Parcel at Deutsche Post DHL Group ^{3,4,5}	“As a leader of innovation in the parcel sector, with DHL Parcel we are pursuing the goal of developing new ideas to supplement our diverse range of solutions to make it easier to send and receive a parcel, and to personalize the process to meet customers’ needs“ “After successfully completing the in-car delivery pilot project last year in Germany, we are now using the know-how we gained with SMART to develop yet another attractive service for a young, internet-minded target group.” “It is not the job of the customer to be present when we arrive [to deliver the parcel].“
 Statements from Automotive Industry	
Dr. Dieter Zetsche, CEO Daimler AG and Mercedes- Benz Cars ⁶	“We are working intensively on the question of how cars can help make people's lives easier. If the car receives parcels customers have more time to do things they really enjoy.”
Dr. Annette Winkler, CEO Smart ⁴	“[In-Car Delivery] is the beginning of our next drive to further enhance the quality of urban life. This is our way of staying true to our pioneering role in urban mobility. A lot of other services that make city life easier are also in the works.” “Security is, of course, our highest priority” (speaking about privacy of ICD)
Natalie Robyn, Managing director of Volvo Car Switzerland ¹	“At Volvo, we are committed to making people’s lives easier and saving them time. Our networked vehicle technology, In-car Delivery, fully meets these requirements and makes online shopping even easier and more convenient.”

Ulrich Hackenberg,
Audi, Board
member Technical
Development⁷

“The security of the car and of customer data has top priority for Audi”



Statements from E-Commerce

Dominique Locher,
CEO LePost
Switzerland¹

„With deliveries to car boots, we are coming very close to our vision of seamless shopping. Working mothers or fathers have everything they need when they get into their cars in the evening, without having to make extra trips to the shops or carry parcels.”

Michael Pasch,
Amazon, Director
Prime & Delivery
Experience⁷

“We are working to offer Prime members a delivery location that is always available and convenient.” (speaking about in-car delivery)

¹ Swiss Post, 2017

² Tönnemann, 2016

³ DHL, 2016b

⁴ smart, 2016

⁵ Preuß, 2016

⁶ Daimler, 2017

⁷ Bryant, 2015

Table 2: Own representation - Statements In-Car Delivery

3. Analysis

3.1. Research Methodology

In this part, the research design and its methods are introduced. In general, the research design can be developed on the basis of the research objectives. It outlines the overall structure for conducting the research and thus for collecting and analyzing the data. Data collection and analysis techniques can be either of qualitative or quantitative nature. Saunders *et al.* (2009) refer to qualitative data if they rely primarily on non-numerical data, while quantitative data suggests the generation or use of predominantly numerical data. This study follows a quantitative approach. Quantitative research aims for generalizability of results to a population and, accordingly, focuses on measuring characteristics and testing hypotheses within sample groups. It is well suited for descriptive and inferential research (Zikmund, 2010).

As per Cooper and Schindler (2014), researchers can choose from three types of research based on their defined research objectives: (i) exploratory, (ii) descriptive, and (iii) causal.

- (i) Exploratory studies focus on the exploration of new, or previously rarely investigated, situations or concepts with the aim to develop research questions, hypotheses and theories. Such studies are often conducted through non-/ or little structured qualitative methods of data collection. Instead of providing conclusive evidence, it rather forms the basis for future and more detailed research (Döring and Bortz, 2016).
- (ii) The purpose of descriptive research is to describe certain phenomena or characteristics of a population or to detect associations among variables – for instance by using questions that emphasize the *who*, *what*, *when*, *where* or *how* of a specific topic or situation. Therefore, it tends to be more formalized than exploratory research. Usually, it relies on clearly stated hypotheses or investigative questions. Consequently, the researcher is required to have a good understanding of the research topic (Cooper and Schindler, 2014; Saunders *et al.*, 2009).
- (iii) Causal or inferential studies aim to find causal relationships among variables and thus might follow after exploratory or descriptive studies. For example, by applying inferential statistics, this type of research may be used to

determine whether a correlation between variables is in fact a cause-and-effect relationship (Saunders *et al.*, 2009; Zikmund, 2010).

The concept of In-Car Delivery has only recently gained in awareness and has not yet reached a substantial amount of people. Considering that there is no publically available research yet, it is not expedient to test hypotheses or form detailed causal relationships at this point. Furthermore, it would be misleading to create regressions, for instance on the factors impacting the adoptability/proliferation of In-Car Delivery, as there are no real-life cases. Models would rely on respondents' self-declared and hypothetical statements, rather than observations. To avoid biased inferences, the research questions in this paper focus on the general success drivers in delivery and the willingness to accept ICD in two separate steps. As the purpose of descriptive research was to describe the phenomena and characteristics in relation to consumer perceptions and attitudes, it is best suited in this case. On top, it can establish a solid foundation for future research and more importantly, generates actionable insights for the improvement of parcel delivery.

This study can be described as cross-sectional research, because it looks at a phenomenon at a particular point in time, rather than over time (Greener, 2008). This is reasonable due to the rapid evolution of the consumer landscape and the delivery sector described in the literature review.

In line with the quantitative approach, the instrument chosen is a web-based survey with mainly scaled questions.

In the next sections, the survey design, sample data, and statistical analyses used to adequately address the central research questions are discussed in greater detail.

3.2. Survey Design

Survey research can be described as all activity directed to collect information about opinions, attitudes or trends in a methodical way from a sample of a population of interest. Although questionnaires have their limitations (Johnson and Harris, 2002), they are good at collecting descriptive data and for explanatory research which suits the nature of this study (Saunders *et al.*, 2009). As for this paper the data was collected at one point in time (cross-sectional) (Odoh and Chinedum E., 2014). Surveys with

standardized closed questions work best because respondents usually interpret them the same way and therefore the results can be systematically compared (Given, 2008). Fully structured surveys are made up of concrete and pre-determined questions which are presented to all respondents with the same wording and in the same order. As regards wording, the questions should use simple and direct language to avoid bias (Taylor-Powell, 1998). Because the questions are typically less complex than in an interview, as well as answer choices are already provided, respondents can express their opinion even if less familiar with the topic at hand (Wilkinson and Birmingham, 2003). According to Kothari (2004), sequencing also has an impact on the overall survey performance. For researchers, surveys present a popular scientific instrument since they allow the collection of large amount of data from a sizable population in a highly economical way (Saunders *et al.*, 2009). For this study, a web-based survey presented the most cost-effective method because geographical barriers could be neglected, while extensive data could be gathered quickly (Creswell, 2012).

The questions in this survey are derived from theory and literature review. The survey consisted of one nominal and 15 rating questions, more specifically Likert scale items. With such items, the respondents can indicate their level of agreement with a given statement, from which the researcher can obtain the participants' preferences with a set of statements (Bertram, 2007). From literature, there are arguments in favor of scales with five response categories adding more granularity (Jamieson, 2004). Furthermore, questions should encourage to use all points of the scale, which should lead to a normal distribution of response (Field, 2003). For this survey, each Likert item had five pre-defined response categories (*either*, from strongly disagree to strongly agree, *or* from extremely important to not important at all). The survey was designed to be self-administered, that is it could be completed without the help of the researcher. The questionnaire was setup on the web platform Qualtrics. Respondents would follow a distributed hyperlink and complete the online form directly on Qualtrics. The benefits of such web based platforms include instant recording of results, affordability and cost effectiveness. Nevertheless, one of the downside is the low response rate, estimated around 30-35% (De Leeuw and Hox, 2011), yet better than postal mailings with estimates between 5% (Gratton and Jones, 2004). Ways to increase the response rate include incentives/benefits for respondents, reminders, as well as an overall easy-to-navigate, short and effective survey setup that preempts respondent's fatigue (Odoh and Chinedum E., 2014).

3.3. Subjects

Sampling can be described as the statistical process of selecting a subgroup of a population of interest in order to derive statistical inferences about this population (Bhattacharjee, 2012).

In general, one distinguishes two types of sampling, namely probability sampling and non-probability sampling (Saunders *et al.*, 2009). With probability sampling, the researcher aims to answer research questions in a quantitative manner by drawing conclusions about the overall target population by studying a sample that has been determined using probability sampling techniques such as the random selection of participants, in which each unit in the target population has a known chance of selection (Greener, 2008; Cooper and Schindler, 2014). The population is comprised of all people (unit of analysis) with the characteristics that the researcher wishes to study.

As potentially anybody can be a recipient of parcel deliveries, the target population could be the general population of all countries around the world. With the scope of this work being the regions mostly impacted by increasing parcel volumes and the changes to the consumer landscape in the way described in the literature review, the distribution of the survey focused on those regions, namely the Western countries.

The questionnaire was distributed using social networks, like Facebook. In addition, it was sent out to individuals using e-mail and messaging services. A sample size of 50 respondents is usually agreed as a reasonable absolute minimum amount to draw further references onto the larger overall population (Winter *et al.*, 2009). The smaller the sample size (of around 50 or below), the more questionable it is to follow through with such generalization (Hof, 2012). For this reason, this research collected data from around 240 respondents, which should ultimately lead to a more robust design (Saunders *et al.*, 2009).

3.4. Statistical Analysis

The following paragraphs describe how the data was structured and analyzed to make purpose of the research and gain further insight. Data in its raw form is not particularly useful. Meaningful insights can only be obtained after the data is analyzed more

thoroughly (Saunders *et al.*, 2009). The software SPSS was used for statistical analysis of the survey.

Due to the descriptive nature of the research, the analysis focuses on descriptive analytics. Such analytics concentrate on characteristics as the spread or shape of a data array. The purpose is to understand a group of people, problems, or events by identifying and summarizing overall tendencies of a dataset and the distributions or variability of the corresponding scores (Zikmund, 2010).

In order to explain the used methods in greater detail, it is important to differentiate between different types of variables. First, there are the nominal/categorical variables, which are categorized without an intrinsic ordering (Kothari, 2004). Gender (male and female) represent an example for categorical data. Second, ordinal variables can be ranked with a clear ordering, yet, without specifying the size of the intervals in-between them (Simon and Goes, 2013). An example here is level of education. Third, interval variables are both ordered and show as well equal and determinable intervals between the points on the scale (Brown, 2011). The fourth type, the ratio variable, is only different from the interval variables, in the fact that it possesses a true zero point (Simon and Goes, 2013). A good example for ratio variables are weight or height, since they combine all the properties of nominal, ordinal, and interval variables, and also feature a true zero point.

For descriptive statistics a distinction between ordinal and interval data is necessary, as there is some controversy around Likert scales. Some authors claim that Likert items fall within the ordinal level of measurement, others believe they should be seen and can be treated as interval data (Murray, 2013). This discussion is avoided in this work as it follows the conservative approach that Likert item types (single question) in fact generate ordinal data. For ordinal data (single Likert items) central tendency, which is an estimate of the center of distribution of values, can be summarized by median and/or mode. Dispersion or variability in a Likert scale can be described by percentiles and (Inter-Quartile) range, but not standard deviation. In addition, frequency tables and bar charts complement a better overview of the dataset and help analyze the frequency with which respondents answered a question with a specific answer (Zikmund, 2010). For deeper insight cross-tabulation was used to evaluate the responses and compare for instance total values as well as properties. Cross-tabulation or contingency tables are, according to Cooper and Schindler (2014), a “technique for comparing data from

two or more categorical variables” (p. 419). They were used in this work to see if there is a different attitude towards In-Car Delivery between age groups, time spend at work, and individuals with different shopping behaviors. With interval data it is possible to calculate the mean as measure of central tendency and the standard deviation as measure of dispersion, i.e. the average amount of variation around the mean.

Furthermore, it is important to note that ordinal data is subject to non-parametric tests, whereas interval data can be examined with parametric tests, including for example regression analysis (Jamieson, 2004). Unlike parametric tests, non-parametric tests do not make the assumption that the underlying population is normally distributed (bell-shaped curve) (Bhattacharjee, 2012). Common tests, such as t-test, Pearson correlation, or multiple regressions, are not applicable with data from single Likert items. Nonetheless, there are non-parametric tests that serve a similar purpose if one were to investigate differences between (the medians of) comparable groups, such as Mann-Whitney U test or Wilcoxon signed-rank test.

In this study, a mix of ordinal data measurement techniques, including frequency tables, medians, as well as contingency tables were applied to better understand the underlying dataset. Next to SPSS for statistical analysis, Microsoft Excel was used to create diagrams like bar charts.

3.5. Results

In this chapter, the research findings from the web survey described before are presented in detail. After providing a sample profile overview, the four research questions are addressed.

A total of 240 responses were collected via Qualtrics. Thereof, 230 responses are used for the analyses. A few responses were sorted out in the process of editing, which describes the "process of checking and adjusting data for omissions, consistency and legibility" (Zikmund, 2010, p. 463). The data was edited and coded with SPSS. Respondents range across age groups, with the vast majority being younger than 34 years. The sample consists of a good mixture between male and female respondents. The collected responses represent opinions from inhabitants of mostly European descent. Figure 26 outlines the main characteristics of the sample population.

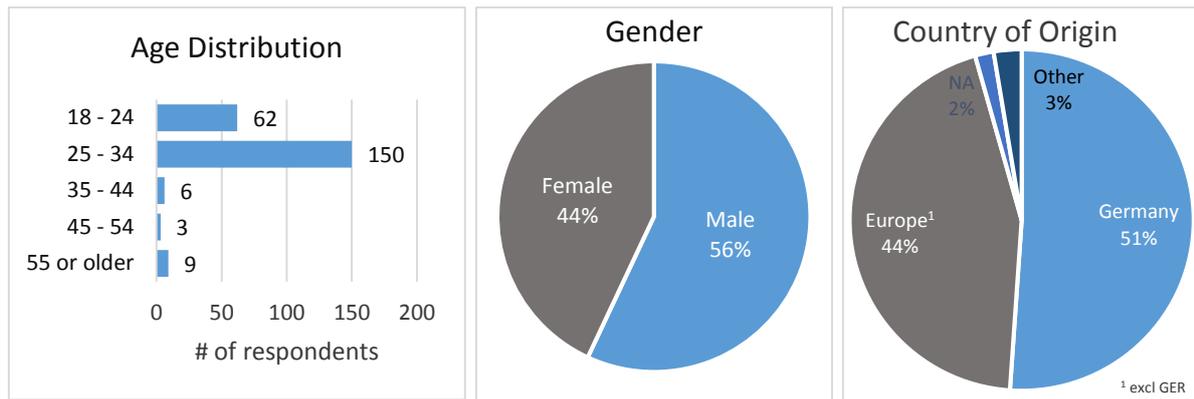


Figure 26: Overview of Respondents

With a total of 212 respondents being between 18 and 34 years old, these two age groups account for over 90% of registered responses. As the populations in North America and Europe feature a lower percentage in that age group, this sample is not representative for the general populations of those countries. As, however, the proposed target group for In-Car Delivery is “young and online-savvy” (smart, 2016), the insights gained from the collected data are nonetheless very important. With roughly 50% of responses coming from people living in Germany, and another 46% living in the remaining European countries and North America, the sample is perfectly in line with the scope of the work, the Western nations.

Research Question #1

Ensuing, the first research question is addressed:

RQ1: What are the drivers of customer satisfaction in Last Mile Delivery?

In the literature review the critical success factors (CSF) were identified and it was hypothesized that:

- Consumers care about the Cost of parcel shipment
- Consumers value Choice in Delivery services
- Consumers value Fast Deliveries in Delivery services
- Consumers value Convenience in Delivery services
- Consumers value Flexibility in Delivery services

Besides the five CSF, it was also hypothesized that consumers care about parcel tracking and the parcel condition when it arrives.

As the Likert items individually present ordinal data, frequency tables are calculated to give an overview of the given responses. All frequency tables and a corresponding graphical representation can be found in the appendix (Appendix Tables 1-2 & Figure 1). The top-box (bottom-box) score represents the percentage of responses within the top (bottom) two scores of the five-point Likert scale.

It can be noted that four out of five CSF are perceived to be “Extremely important” or “Very important” by the majority of respondents (i.e. speed, cost, convenience, flexibility). The fifth CSF, choice, appears to be moderately important with 42% of answers at a score of 3.

For central tendency observations, the sample median and mode is calculated, and the inter-quartile range (IQR) for dispersion:

Variable	Median	Mode	[Mean]	IQR
Variety of delivery options	3,00	3	3,13	1
Delivered at the time/day as promised	5,00	5	4,38	1
I don't have to be there at moment of delivery	5,00	5	4,35	1
Duration of the delivery	4,00	4	3,83	2
Ability to track current status of parcel online	4,00	4	3,57	1
Price	4,00	4	4,07	1
Condition of parcel when it arrives (no damages, etc)	5,00	5	4,44	1
Interaction with delivery person	1,00	1	1,73	1

Table 3: Statistics - CSF

It confirms the first estimate after looking at the frequency table as one can see the generally high medians of 4 or 5 for the proxies of choice, cost, convenience and flexibility, while choice has a median of 3, yet slightly tilted towards higher scores when looking at frequency table. Coming back to RQ1, it can be stated that the 5 CSF identified in the literature review are of high relevance to the consumer. However, a distinction between the various aspects of delivery can be made.

Unattended delivery stands out to be among the most valued factors with a median and mode of 5. Hence, the desire for convenience appears to be high.

Furthermore, it is critical to consumers that their parcels arrive on the date or time that was promised (median = 5 /top-box score = 87%). Therefore, it seems that consumers value reliability over speed in itself. In fact, it makes sense that reliability is more important than the absolute duration of the delivery, as it increases predictability and

the ability to plan ahead. At last, satisfaction in this case is a result of the gap between promised and actual parcel arrival.

Not surprisingly, consumers place no importance on the interaction with the delivery person. It reveals the lowest median of 1 with 79% of respondents scoring in the bottom-box ('Slightly important' or 'Not important at all').

It can be noticed that respondents also gave high importance to the condition of the parcel at arrival, meaning it arrives undamaged. As the criteria 'condition' was not mentioned in literature, it was tested in this survey to show that 'hygiene factors' must not be neglected by postal companies because they are still of high relevance to consumers even though they have become to represent basic requirements and consumers are not willing to pay (extra) for them.

Research Question #2

After answering the question what is most important to consumers in parcel delivery, the next section turns to research question 2:

RQ2: What do consumers perceive to be problems with established delivery methods?

To answer this question, three types of established methods are investigated: Home delivery service, delivery to Post Office/Collection point, and delivery to Parcel Locker. In the literature review the following hypotheses have been setup:

1. Home Delivery has a number of inconveniences linked to it, foremost the not-at-home problem.
2. Post office/ Collection points as alternatives to Home Delivery bring along a new set of inconveniences.
3. Consumers value parcel lockers over post offices and parcel shops/collection points.

Again, the medians as measure of central tendency are calculated and show to what extent consumers are affected by the shortcomings of home delivery (Table 4). The frequency tables and graphical representations can be found in the appendix (Appendix Table 3 + Figure 2).

Home Delivery	Median	Mode	[Mean]	IQR
I was not at home when the parcel is delivered.	4,00	5	4,07	1
I had to collect a failed home delivery from a post office.	4,00	4	3,49	2
I had to take a day off to receive a delivery.	1,00	1	1,70	1
I had to re-organize my day to stay home for a delivery.	2,00	2	2,57	3
I reveal too much privacy when parcel is delivered to my neighbors.	1,00	1	1,83	1
I waited at home but the delivery did not arrive.	3,00	1	2,63	2
A wrong package or something I did not order arrived.	1,00	1	1,54	1

Table 4: Statistics - Home Delivery

First, it can be stated that there are observations for each of the seven stated scenarios for Home delivery. Next, a distinction is made in regard to the frequency with which people experience these problems.

Not surprisingly, the not-at-home problem prevails. Around 99% of respondents have experienced in the past that a parcel arrived while they were not at home to receive it. This issue is by far the most prevalent among the seven tested, as it shows the highest mode possible (mode = 5) and a median of 4. As a consequence, consumers frequently have to go to a post office to collect a missed parcel (median/mode = 4).

When it comes to re-organizing a day in order to stay home for a delivery, the responses were quite dispersed, yet equally distributed on the scores 1 through 4 which is reflected in the high inter-quartile range (IQR=3). Linked to this: The statement “I waited at home but the parcel did not arrive” has a very similar distribution of answers. Its mode is 1, yet its median is 3. This is unsatisfying because one would expect that a person who makes the effort to re-organize his or her day, stays home and waits, would be able to reduce failed deliveries to a minimum.

Taking this into account, it is good thing that ‘Taking a day off to receive a parcel’ is a rare phenomenon. Over 60% of respondents have never taken a day off to receive a parcel. Nowadays, this need is probably negated by alternative and more efficient delivery methods.

Also, receiving a wrong package is not a concern. Two out of three respondents have never experienced it.

Privacy concerns, when a parcel is delivered to a friend or neighbor, are not top of mind of the recipients as the data indicates (median/mode = 1). Postal firms, like DHL which has introduced a ‘no-neighbor’ option in 2016, may consider charging a surplus to either the consumer or its customers, the e-tailers, for this option as it appears not to be a staple requirement, but rather a premium option relevant to only a few.

Overall, it appears that consumers today invest less effort into receiving a parcel at home, as indicated by the fact that few people re-organize their day or take a day off, which is reasonable given alternative ways of delivery. Yet, this does not change the fact that people continue to regularly miss their parcel because they are not at home. One needs to bear in mind that this issue is inherent to HDS and cannot be mitigated, unless moving to alternative delivery modes, as addressed in the next part.

Following, the survey results regarding consumers' perception towards post offices, collection points, and parcel lockers are presented. In line with the goal to take away the need for recipients to be there when the parcel arrives, these methods have successfully eliminated the greatest pain point of HDS. Yet, they come with a different set of inconveniences.

For post offices and collection points, the responses draw a consistent picture across all six variables (Table 5), with respondents mostly *somewhat* and *strongly* agreeing with the proposed downsides (median/mode of 5 or 4). Thus, the sample confirms insufficiencies of this type of delivery. Respondents most strongly agreed to the fact, that they are dependent on opening hours of the respective pick-up location (87% of respondents) as well as the need to walk or drive there to collect the parcel (90% of responses) (see Appendix Table 4 + Figure 3). In one regard, the sample shows slightly less affirmation, which is the need to potentially carry home a heavy parcel (only 63% agreement). This might be, for example, due to the young sample composition or because predominantly light and mid-weight items are purchased online.

Post Office & Collection points	Median	Mode	[Mean]	IQR
I lose some of my free time in order to collect the parcel.	4,00	4	4,14	1
I am dependent on their opening hours.	5,00	5	4,44	1
I receive the parcel later compared to other delivery options.	4,00	4	3,77	2
I have to walk or drive there to pick up the parcel.	5,00	5	4,33	1
I have to wait in line.	4,00	4	3,91	2
I might have to carry a heavy parcel home myself.	4,00	4	3,87	2

Table 5: Statistics - Post Offices

For parcel lockers, the same set of variables was tested, except for the dependency on opening hours, as lockers are open 24/7. In two aspects the responses differ. First, respondents believe with parcel lockers they neither receive a parcel earlier or later than compared to other delivery options (median/mode = 3) (see Table 6). Second, respondents tend to disagree that they have to wait in line in front of parcel lockers to retrieve a parcel (median=2/mode=1). This is reasonable because (i) parcel lockers

are accessible round-the-clock so that demand spreads more broadly across the day/night, and (ii) lockers are still less frequently chosen as delivery destination, even though its popularity is increasing.

Parcel lockers	Median	Mode	[Mean]	IQR
I lose some of my free time in order to collect the parcel.	4,00	4	3,76	1
I receive the parcel later compared to other delivery options.	3,00	3	3,23	1
I have to walk or drive there to pick up the parcel.	4,00	4	4,10	1
I have to wait in line.	2,00	1	1,93	2
I might have to carry a heavy parcel home myself.	4,00	4	3,78	2

Table 6: Statistics - Parcel Lockers

Overall, respondents expressed softer attitude towards parcel lockers' inconveniences. Yet, on three dimensions, the median score is still high and equal in value as for delivery to post offices. These three dimensions span around, losing free time to collect parcels, the need to go someplace other than your doorstep to collect the parcel, and lastly the need to carry the parcel yourself.

Coming back to RQ2, it can be stated that a number of key problems with established methods still persists. In Home Delivery, the prime concern is that people are not home when the parcel arrives with the subsequent efforts involved until finally holding the parcel in their hands. Furthermore, also the alternative delivery to post offices and parcel lockers shows some major practical limitations, primarily that the parcel does not come right to the recipient, and he has to invest time and effort to collect the parcel.

Research Question #3

After discussing the results connected to the problems of existing delivery options, the next research question is rather focused on solutions:

RQ3: Does In-Car Delivery achieve to mitigate the identified problems?

For this purpose, participants to the survey were briefly familiarized with the theoretical concept of In-Car Delivery, which would allow them to receive online purchases right into their car without the need to be present. Then, they were asked to express their opinion to what extent they believe In-Car Delivery could address and improve each of the four aspects listed in Figure 27.

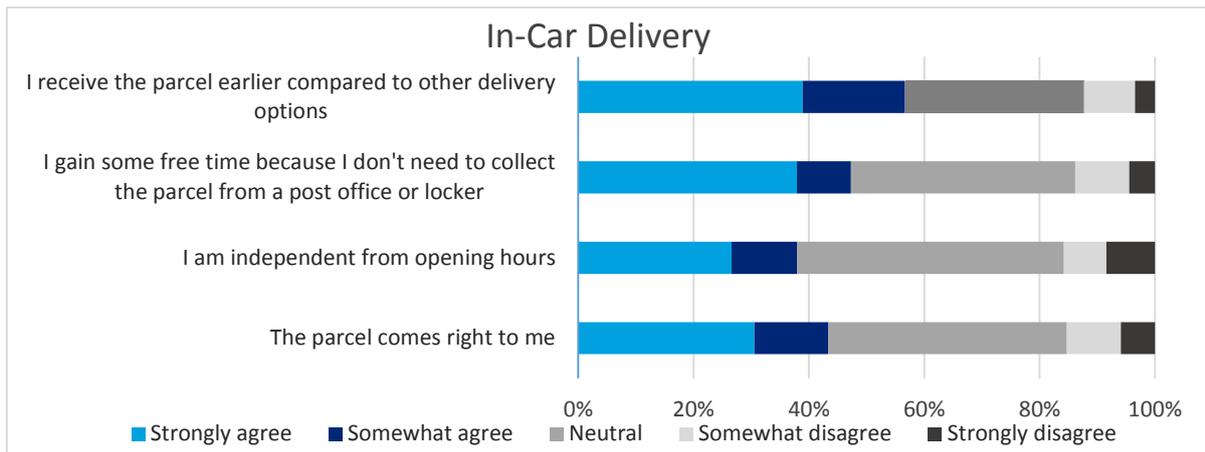


Figure 27: Frequency chart - In-Car Delivery

The first observation to be made from the frequency overview is the extremely low level of disagreement with the four statements (Figure 27 and Appendix Figures 5-8). The second observation is the separation of responses in essentially two classes. The vast majority of responses fall into either “Strongly agree” or “Neutral”. Given this particular distribution, the measures of central tendency for ordinal data fall short in their meaningfulness. In this case, median and mode alone have limited ability to describe the data set, as they do not explain patterns in the distribution of responses. The variables show medians of 3 or 4 (Table 7). The inter-quartile range (=2) reflects the allocation of most responses onto scores 5 and 3.

In-Car Delivery	Median	Mode	[Mean]	IQR
ICD_1 I receive the parcel earlier compared to other delivery options	4,00	5	3,80	2
ICD_2 I gain some free time because I don't need to collect the parcel from a post office or locker	3,00	3	3,67	2
ICD_3 I am independent from opening hours	3,00	3	3,40	2
ICD_4 The parcel comes right to me	3,00	3	3,53	2

Table 7: Statistics - In-Car Delivery

The relatively high number of neutral responses might be driven by two factors. First, the default option for this particular set of questions was set to three (“Neither agree/disagree”) due a technical restriction of Qualtrics for this type of answer mechanism. As ‘cognitive misers’, respondents may have been biased to maintain the status quo option, rather than actively deviate from it. Second, respondents may have chosen the ‘safe’ (neutral) option because the scenario of trunk delivery was too hypothetical for them. This could be supported by the fact that trunk delivery is not self-explanatory in nature and that over 76% of respondents have never heard about this way of parcel delivery before. These aspects combined may result in an overstated

tendency towards the mid-score. Hence, placing less weight on the neutral scores, even more clearly draws a picture of strong agreement. In other words, respondents believe through the use of trunk delivery they would gain back some free time, would receive their purchases earlier, would be independent from opening hours, and finally, would enjoy the benefits of a delivery right to them as they value so much in Home Delivery.

Research Question #4

Having found that consumers do see the benefits of a delivery into their car, the question regarding potential downsides and their willingness to adopt this delivery method remains. They will be addressed through research question 4:

RQ4: Are consumers willing to use in-car delivery? What kind of new issues/concerns are involved? Are consumers willing to share personal/vehicle data?

The corresponding hypothesis developed in the literature review as follows:

- People would be willing to accept In-Car Delivery. But people also feel strongly about the potential data and privacy concerns.

In fact, 61% of respondents indicate they would be willing to use In-Car Delivery, while 27% state they would not. The detailed statistics for this statement (median = 4) can be found in the appendix along with the frequency table (Appendix Table 7-8 + Figure 9). A cross-tabulation has been calculated to present the willingness to use ICD across different groups (Figure 28). Younger people, in the age range 18 to 34 years, have shown more willingness to use this novel service (62%), than respondents over 34 years' age (50%). Furthermore, persons working seven or more hours per day demonstrated willingness to use ICD more often than those working only up to 6h per day.

A prerequisite for the concept of in-car delivery is, that the delivery company needs to know the location of the recipient's car, for the time of the delivery. The percentage of respondents that would be willing to temporarily share their location data is 50% (median/mode = 4). Thus, it is roughly 10% lower than the percentage of those that demonstrated willingness to use ICD. Even though this is not rationale because the geographic location of the car is a fundamental enabler of this service, this may indicate that consumers are somewhat reluctant when it comes to their personal data.

Question: Would you consider using trunk delivery when buying something online?

Percent of respondents selecting “Strongly agree” or “Somewhat agree”, N = 230

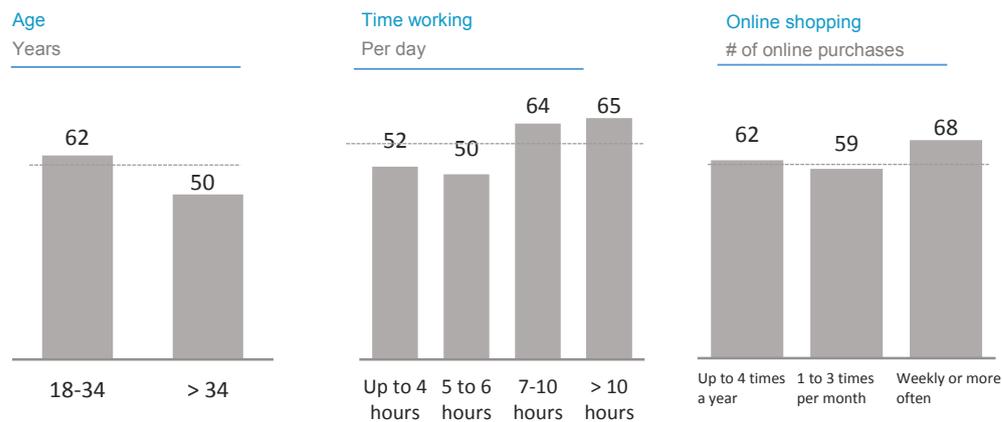


Figure 28: Willingness to use Trunk Delivery across different groups

Before moving on to the next results related to consumers' concerns with trunk delivery, I would like to briefly elaborate on the last finding, as this is crucial for understanding why consumers would be willing to share data and when concerns may arise. Eventually, the willingness to accept trunk delivery hinges on, besides of course the need to own a car in the first place, on the proposed value proposition, which is often a trade-off between the benefits and concerns.

A study from McKinsey about monetization of car data shows that customers are generally willing to share data when they receive benefits in return around: safety, time saving, convenience, cost reduction. According to the study, the “exchange of data for benefits lies at the very heart of the value creation process related to car data” (Bertoncello *et al.*, 2016, p. 13). The willingness to share data tends to be especially high in time- and convenience-related use cases, for instance networked parking, in which the consumer saves valuable time in the city looking for a parking spot. While In-Car Delivery was not covered by their research, the results are still applicable. ICD is one of dozens of possible use cases of the so-called ‘Connected Car’, i.e. cars that allow for data-enabled features through real-time exchange of car-generated data over the Internet. As the findings of RQ3 show, the perceived advantages overlap largely with the four dimension stated above for which customers would be willing to share data: Trunk delivery could save the consumers the trip into the city to collect a parcel from a post office (time saving / cost reduction), he would not need to carry the parcel long distances (convenience), and the parcel is sitting safely in the trunk protected from weather conditions or thieves (safety). Nonetheless, a more granular look reveals that

consumer openness to data sharing also depends on the type of data. Depending on the type, consumers show different degrees of sensitivity in terms of data sharing. They are more cautious with data that is perceived as privacy critical (e.g. driver's identity, calendar, e-mail, preferred radio station) compared to more 'objective' data (e.g. external road conditions, temperature, oil status). For non-personal data types in which consumers are most willing to share data, they expect a fair level of benefit in exchange. For personal data the expectations for the benefit received in return are even higher as well as sensitivity to data misuse (Bertoncello *et al.*, 2016).

In regard to the potential concerns that customer may have using In-Car Delivery, a division in two broader categories can be made. The first type of concerns comprises (physical) privacy issues and property related concerns. For instance, car ownership in many countries has a high value to people. Depending on the relationship to their car, it may be perceived as entering personal space when the delivery person remotely opens the trunk of the car to put in the parcel. Also, fear about theft and physical damage belong to the first type. The second type of potential concerns relates to data privacy and misuse of that data, for instance improper storage or lack of anonymity.

In reference to the first type, the larger portion of respondents (60%) stated they would have reservations about a delivery person opening the car, in the absence of the car owner himself (Appendix Table 7-8 + Figure 9). For example, respondents perceive it an "intrusion into their privacy" when the mail man opens the trunk (median/mode=4). In addition to that, they also express a high level of agreement with the statement "I am worried that my car will be hacked and can be opened by thieves" (median=4/mode=5).

Respondents felt strongly also about the second set of potential concerns: Only 34% of respondents believe their navigation data is safe with the delivery company. Specifically, the respondents fear (i) that their location data could be sold without their consent to third-parties for further monetization purposes (median/mode = 4), and (ii) that their GPS data will be stored, exceeding the period of time that is actually needed to complete the delivery (median/mode = 4) (*ibid.*).

Coming back to RQ4, it can be stated that trunk delivery is mostly accepted with respondents, yet it is not free from flaws, as many show concerns with respect to data privacy and security.

4. Conclusion

4.1. Conclusion

The aim of the study was to examine whether consumers would accept In-Car Delivery as a novel way to receive parcels. In order to provide perspective relevant to *any* form of consumer-facing innovation in the parcel industry, the study also identified the general characteristics which are most important to consumers when receiving parcels. The demand for new solutions of parcel delivery is immediate given the consumers' profusion of new demands and surge in parcel volume driven through e-commerce. Current forms of delivery are not equipped to meet today's challenges. My research shows that consumers still face multiple pain points - most notably around the time, location and method of delivery (RQ2). Considering that other industries use technology to better serve their customers, parcel receivers are becoming less willing to tolerate these pain points. They seek for the same seamless experience they are used to from other services, like banking or taxis. In-Car Delivery has the potential to become such a service for the parcel industry, as its concept has shown to solve or at least mitigate these pain points to a certain degree (RQ3). Therefore, it is not surprising that this research finds overall willingness to use trunk delivery. On the flipside, In-Car Delivery brings along an unprecedented set of concerns in parcel delivery, namely customer data and privacy concerns (RQ4).

To conclude on the topic at hand, the concept of In-Car Delivery appears to be a superior solution in parcel delivery. In practice, In-Car Delivery is not going to be the one solution that will do away with the industry's problems. While this form of parcel delivery may be a superior and viable solution to some, there are too many contingencies preventing it to become the default option of choice for the broader population. The determinates limiting the scope of application comprise among others, (i) the need to possess or have access to a car, (ii) cost barrier of installing the technical enablers within the car, (iii) agile and uncertain real life environment, for instance car parked inaccessible in garage or private parking lots, (iv) data and security concerns, or (v) the barely self-explanatory nature of trunk delivery compared to other methods.

Yet, it does have a justified place in the line-up of delivery modes as it promises to be one element in a series of efforts undertaken to comprehensively address today's problems of increasing parcel volume and decreasing chances to meet the customer

at home. The demand for a variety of delivery options will likely continue, with no specific one being overwhelmingly dominant. Beyond ICD, the likelihood for even more novel developments is high. From a managerial point of view, the identified critical success drivers (CSF) in this work can serve as a type of first 'readiness check' when postal organizations ideate new ways of delivery. The findings highlight the importance of flexibility, convenience, cost, speed, and variety in parcel delivery (RQ1).

One of such new offerings has been recently introduced by Amazon and can be described as "In-Home Delivery" (Ralph, 2017). Smart locks enable access to private homes to anyone that has been granted a 'digital' key to the front door. The concept of a delivery person remotely opening the door of a consumer's home via an app, fundamentally resembles trunk delivery. Yet, for obvious reasons in-home delivery even more strongly raises questions of privacy and security concerns. In fact, 68% of US adults say they are not comfortable letting delivery drivers have access to their homes (Piacenza, 2017), compared to 57% with the delivery person having access to their car, as found in this study. Matt Poll, founder of a smart lock company, says market research suggests customers are not keen: "There's a barrier. Customers have a fear of being hacked. That's why smart lock penetration is low" (Ralph, 2017).

In-Car Delivery offered by various postal companies and In-Home Delivery offered by Amazon are the first foray into alternative parcel delivery. If the industry incumbents do not want to leave the playing field to Amazon, they must equally persuade innovation in Last Mile Delivery. For In-Car Delivery not to fail in the market place, the postal firms need to offer a truly compelling value proposition to their customers. From a managerial perspective, the first challenge on the path to acceptance of novel delivery modes is communicating to the consumer what is in it for them. It begins with an environment in which customers believe that there is something of value for them by using the new service and that the cost is worth the benefit. This research revealed that, in general, consumers do understand and value the benefits of ICD which makes parcel delivery more convenient, flexible, and save them time and nerves. Yet, what this study also reveals is that this alone is not enough for consumers to overcome the barriers that are inflicted by cultural shifts like this. The second challenge therefore needs to begin with the cost side, until made sure the proposed value exceeds their discomfort. As for In-Car Delivery, this means soothing your customer's concerns. To accomplish that, the following proposes a three-step guide aimed at postal organizations:

Educate. In-Car Delivery is not self-explanatory. Other than traditional delivery, such as home delivery, firms need to explain the process and functioning of trunk delivery. An emphasis should be on the safety mechanisms in place, for example expressing clearly that the technology does not allow the delivery driver do open any other door besides the trunk. Furthermore, it should be highlighted that the digital key grants the driver access to the car once only, and automatically expires after he places the parcel inside and closes the trunk again. In the case that actually the car gets damaged or a parcel lost, the delivery firm is liable. Ulrich Hackenberg, head of Technical Development at Audi, states: “The security of the car and of customer data has top priority to Audi” (Bryant, 2015). Addressing damage, a spokeswoman of Deutsche Post assures: “If our mailman has made a mistake, of course DHL is liable” (Focus, 2015). Assurances of such sort should be repeated as they have shown to significantly diminish the reluctance to sharing data (Bertoncello *et al.*, 2016).

Commit. In order to keep those assurances, post and parcel organizations need to put the required technical enablers in place. They need to commit into building the capabilities and resources to develop reliable, secure technology. As these companies eventually store greater quantities of sensitive data, their security capabilities must mature. According to Accenture (2016b, p. 42), “76% of enterprise security professionals believe they need to improve their ability in threat and vulnerability assessments”. Building partnerships is key on the road towards becoming more data-driven businesses.

Build trust. Not only must organizations nurture trust, they must also defend it. On the one side, it would appear that consumers have no factual experience that would explain their skepticism, because In-Car Delivery is not even marketed yet. On the other side, recent years have seen multiple cases of cyber-attacks, misuse of customer data, and data leaks in other industries that have entered the data sphere. As traditional logistics firms fairly new to the digital environment, they are well-advised to follow some fundamental rules of data-related trust. Firstly, they must never use data against their customers, but rather in their favor, offering enhanced and more customized services to them. Secondly, providing transparency and giving the customer choice is imperative in building and maintaining trust. They ought to communicate clearly what data will be used (e.g. GPS location), for what purpose (locate the car) and in what form (e.g. personalized vs anonymized). Customers must

have the chance to choose what data to share, what not. Finally, they must adhere to their own assurances, not misuse data, and also prevent third-parties from doing so, keeping the data secure from leakage or cyber-attacks (Andersen *et al.*, 2015; Bertocello *et al.*, 2016). Ultimately, traditional delivery providers, such as UPS, FedEx, or DHL, are not in a bad position to start with. Many customers value their reliability and place more trust in them versus new entrants to the market (Lee *et al.*, 2016).

4.2. Further Research and Limitations

Generally, this dissertation also showed some limitations that need to be addressed. First of all, the survey sample did not show great diversity of age groups. It could be interesting to assess the attitudes of various generations, therefore including a higher portion of participants over 35 years.

Different generations have different lifestyles, habits and familiarity with technology, all of which may influence to acceptance of In-Car Delivery.

The second limitation concerns the CSF model. The factors most important to customer in parcel delivery have been identified through the study of literature. Before testing their relevance in the survey with quantitative data, expert interviews could have been carried out to assess the validity of the items and create new insights. An alternative therefore would be to make use of a sequential mixed design, which combines the quantitative data with qualitative data that is collected for explanatory purposes.

Thirdly, it needs to be considered that this study is restricted to the consumer point of view (demand side). While it is necessary to understand if consumers would engage in a new service offering that a company plans to build, it is also essential to assess the service from a company perspective (supply side). The success of In-Car Delivery is not only contingent on the customers' willingness to adopt, but also on the ability of service providers to build the underlying technology, create a positive financial business case around it, and avoid adding to much complexity with yet another form of delivery. Overall, this study contributes one element needed for a holistic evaluation of trunk delivery.

A fourth limitation is represented by the strategic implications drawn from the survey. Changing lifestyles and habits as well as evolving demands of consumers belong to

the key drivers that make new ways of parcel delivery a necessity. Among those changes in the society is the increasing demand for flexibility. While consumers perceive In-Car Delivery to deliver the highest degree of flexibility when compared to the existing delivery modes, flexibility also means that consumers are more likely to avoid possession and more heavily utilize shared means of transportation. Among the fifty percent of respondents not owning a car today, only one in four projects to purchase one in the next two years.

For further research, it is recommended to complement the online survey with extensive with field studies and pilots before making a huge commitment into this endeavor. Responses so far can only be based on consumers' hypothetical statements because trunk delivery is not yet available. Samples should be chosen to represent the demographics, geographic market and lifestyles of the target group. Once In-Car Delivery is open to the broader market, it would be interesting to determine the driving forces that lead to adoption of trunk delivery (dependent variable) and could be based on actual observations. In order to apply parametric tests, such as proposed regression analysis, it is recommended to design the questionnaire in a way generating interval data. While Likert items (single questions) suited the nature of this study, they generate ordinal data. Likert scales, which can be seen as the sum or average of a set of Likert items types (questions with identical scale), generate interval data. The combination of ideally seven items to an overall Likert scale (also: summative scale) makes the scale more reliable than a single item (Simon and Goes, 2013).

Finally, it is recommended to test various price points in future research. As cost was identified to be one of five critical success factors in parcel delivery, willingness to pay for In-Car Delivery can have a strong impact on its popularity. As for this study, the assumption was that ICD is priced equally with home delivery, based on statements from carriers that are currently running pilots. Taking into account, that a number of parcel providers have announced possible upcharges for deliveries made to a consumer's home versus delivery to parcel lockers and other collection points already as of 2018, the pricing of trunk delivery may also be affected.

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Appendix

For Research Question 1:

	Extremely important		Very important		Moderately important		Slightly important		Not at all important		Total #
	Row %	Count	%	#	%	#	%	#	%	#	
Variety of delivery options	9%	20	25%	58	42%	97	19%	43	5%	12	230
Delivered at the time/day as promised	55%	126	33%	75	10%	22	2%	4	1%	3	230
I don't have to be there at moment of delivery	53%	123	33%	75	11%	25	2%	4	1%	3	230
Duration of the delivery	29%	67	36%	83	27%	61	5%	11	3%	8	230
Ability to track current status of parcel online	23%	52	33%	75	29%	66	12%	27	4%	10	230
Price	30%	69	50%	114	18%	42	2%	4	0%	1	230
Condition of parcel when it arrives (no damages, etc)	60%	137	29%	66	9%	21	1%	3	1%	3	230
Interaction with delivery person	0%	1	2%	4	19%	44	28%	64	51%	117	230

Table 1: Frequency Table Importance of CSF

		Variety of delivery options	Delivered at the time/day as promised	I don't have to be there at moment of delivery	Duration of the delivery	Ability to track current status of parcel online	Price	Condition of parcel when it arrives (no damages, etc)	Interaction with delivery person
N	Valid	230	230	230	230	230	230	230	230
	Missing	0	0	0	0	0	0	0	0
Mean		3,13	4,38	4,35	3,83	3,57	4,07	4,44	1,73
Median		3,00	5,00	5,00	4,00	4,00	4,00	5,00	1,00
Mode		3	5	5	4	4	4	5	1
IQR		1	1	1	2	1	1	1	1
Range		4	4	4	4	4	4	4	4

Table 2: Median, Mode, IQR and Range for RQ1

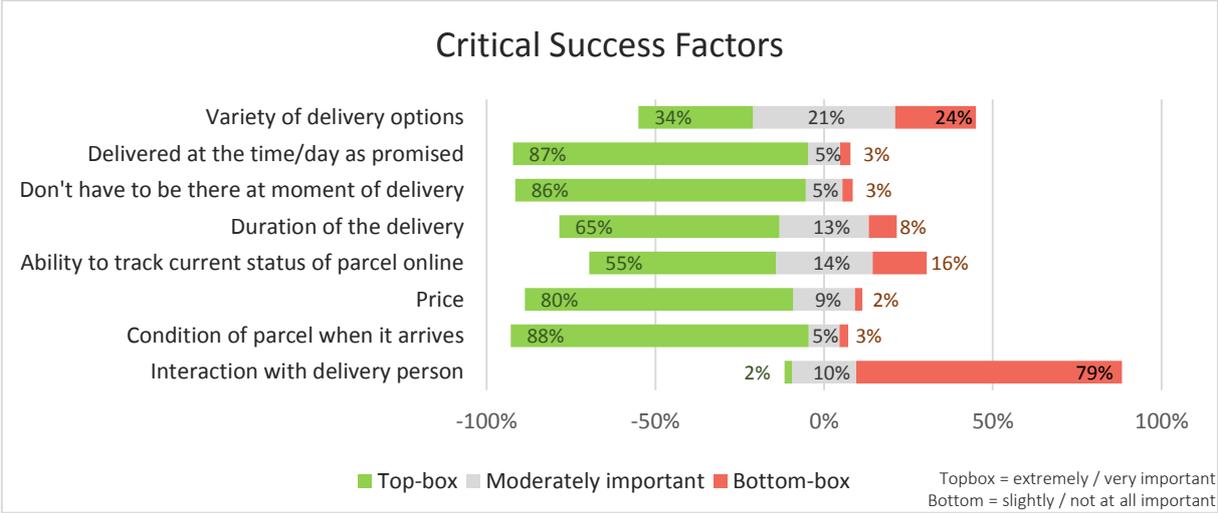


Figure 1: Bar chart - Importance of CSF

For Research Question 2:

	A great deal		Much		Somewhat		A little		Never		Total #
	#	Row %	#	%	#	%	#	%	Count	%	
I was not at home when the parcel is delivered.	91	40%	87	38%	32	14%	17	7%	3	1%	230
I had to collect a failed home delivery from a post office.	58	25%	74	32%	44	19%	31	13%	23	10%	230
I had to take a day off to receive a delivery.	2	1%	19	8%	30	13%	35	15%	144	63%	230
I had to re-organize my day to stay home for a delivery.	19	8%	43	19%	47	20%	63	27%	58	25%	230
I reveal too much privacy when parcel is delivered to my neighbors.	5	2%	17	7%	29	13%	62	27%	117	51%	230
I waited at home but the delivery did not arrive.	20	9%	43	19%	55	24%	55	24%	57	25%	230
A wrong package or something I did not order arrived.	4	2%	4	2%	24	10%	49	21%	149	65%	230

Table 3: Frequency Table - Home Delivery

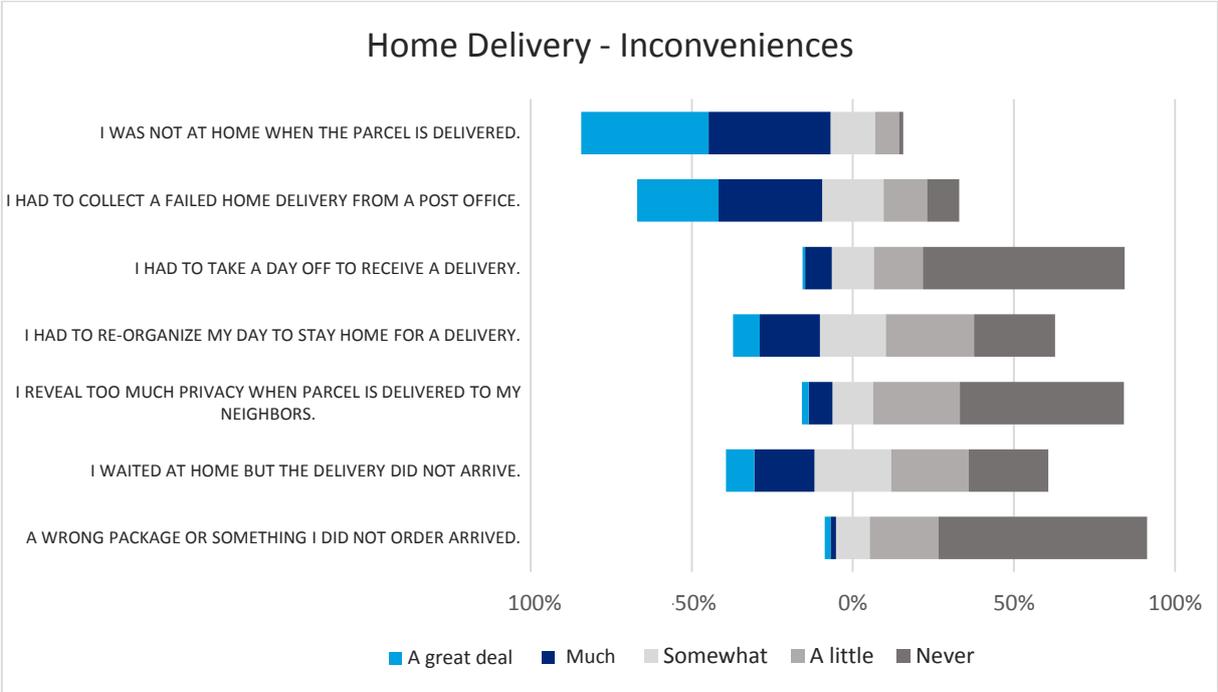


Figure 2: Bar chart - Home Delivery

	Strongly agree		Somewhat agree		Neither agree / disagree		Somewhat disagree		Strongly disagree		Total #
	#	Row %	#	%	#	%	#	%	Count	%	
I lose some of my free time in order to collect the parcel.	96	42%	96	42%	17	7%	17	7%	4	2%	230
I am dependent on their opening hours.	137	60%	69	30%	15	7%	6	3%	3	1%	230
I receive the parcel later compared to other delivery options.	65	28%	79	34%	60	26%	21	9%	5	2%	230
I have to walk or drive there to pick up the parcel.	121	53%	79	34%	16	7%	13	6%	1	0%	230
I have to wait in line.	80	35%	84	37%	38	17%	21	9%	7	3%	230
I might have to carry a heavy parcel home myself.	74	32%	89	39%	38	17%	22	10%	7	3%	230

Table 4: Frequency table - Post offices / collection points

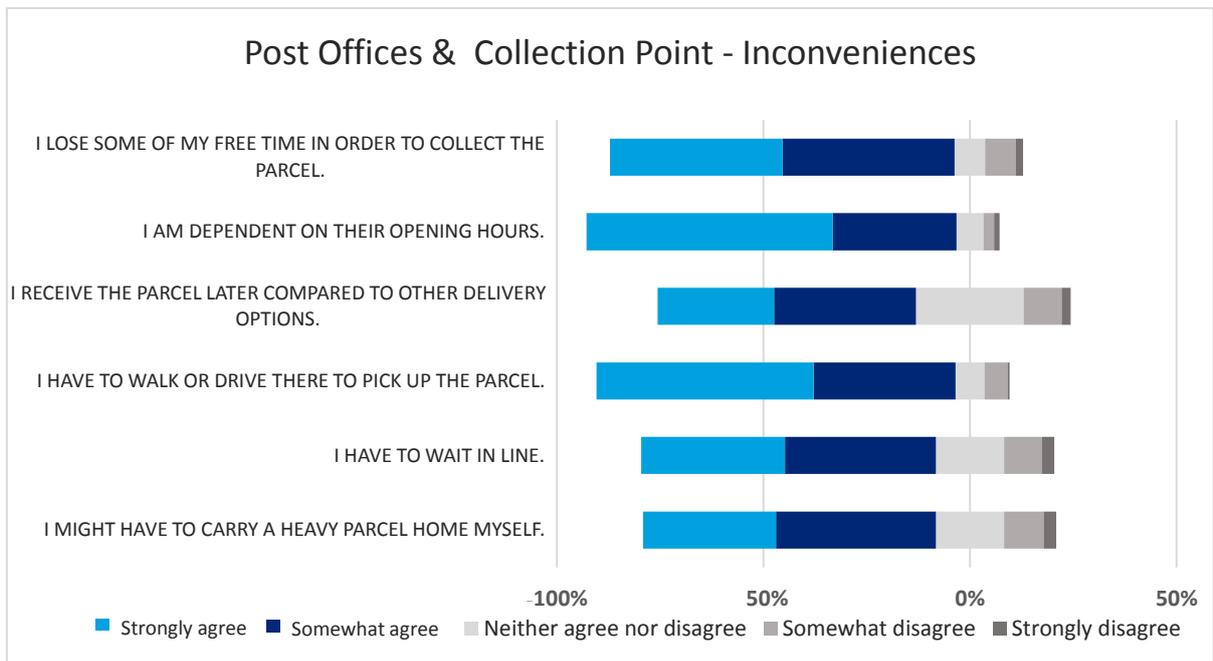


Figure 3: Bar chart - Post offices

	Strongly agree		Somewhat agree		Neither agree / disagree		Somewhat disagree		Strongly disagree		Total #
	#	Row %	#	%	#	%	#	%	Count	%	
I lose some of my free time in order to collect the parcel.	56	24%	101	44%	42	18%	24	10%	7	3%	230
I receive the parcel later compared to other delivery options.	22	10%	75	33%	82	36%	36	16%	15	7%	230
I have to walk or drive there to pick up the parcel.	84	37%	98	43%	38	17%	7	3%	3	1%	230
I have to wait in line.	3	1%	18	8%	47	20%	54	23%	108	47%	230
I might have to carry a heavy parcel home myself.	67	29%	86	37%	44	19%	25	11%	8	3%	230

Table 5: Frequency table - Parcel locker

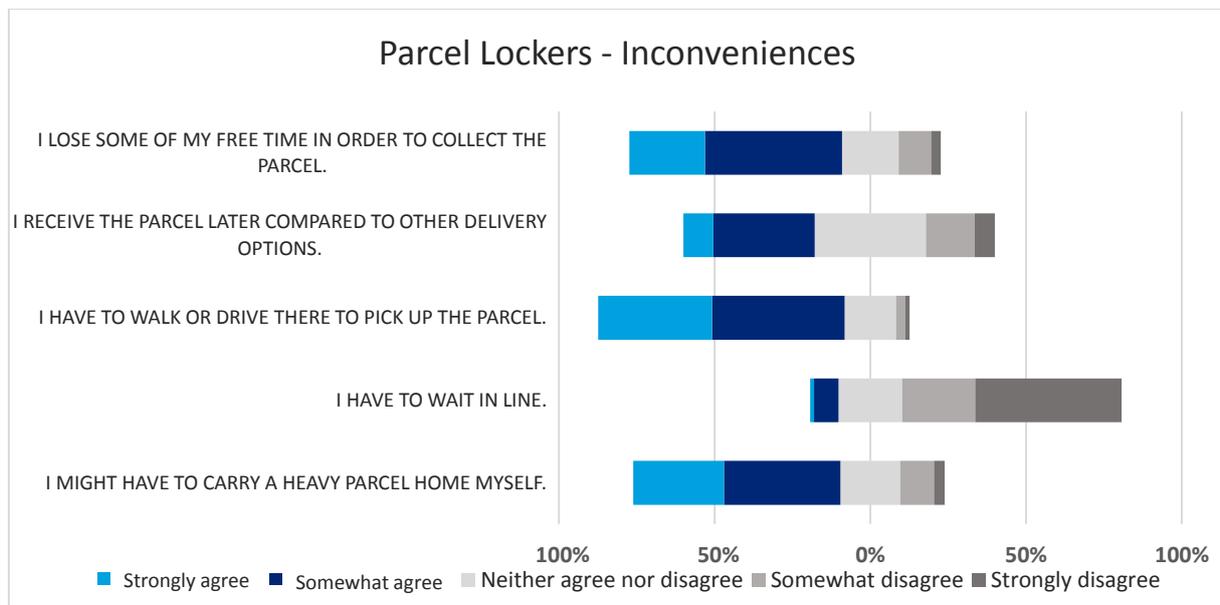


Figure 4: Bar chart - Parcel locker

For Research Question 3:

In-Car Delivery		Median	Mode	[Mean]	IQR
ICD_1	I receive the parcel earlier compared to other delivery options.	4,00	5	3,80	2
ICD_2	I gain some free time because I don't need to collect the parcel from a post office or locker.	3,00	3	3,67	2
ICD_3	I am independent from opening hours.	3,00	3	3,40	2
ICD_4	The parcel comes right to me.	3,00	3	3,53	2

Table 6: Statistics - In-Car Delivery

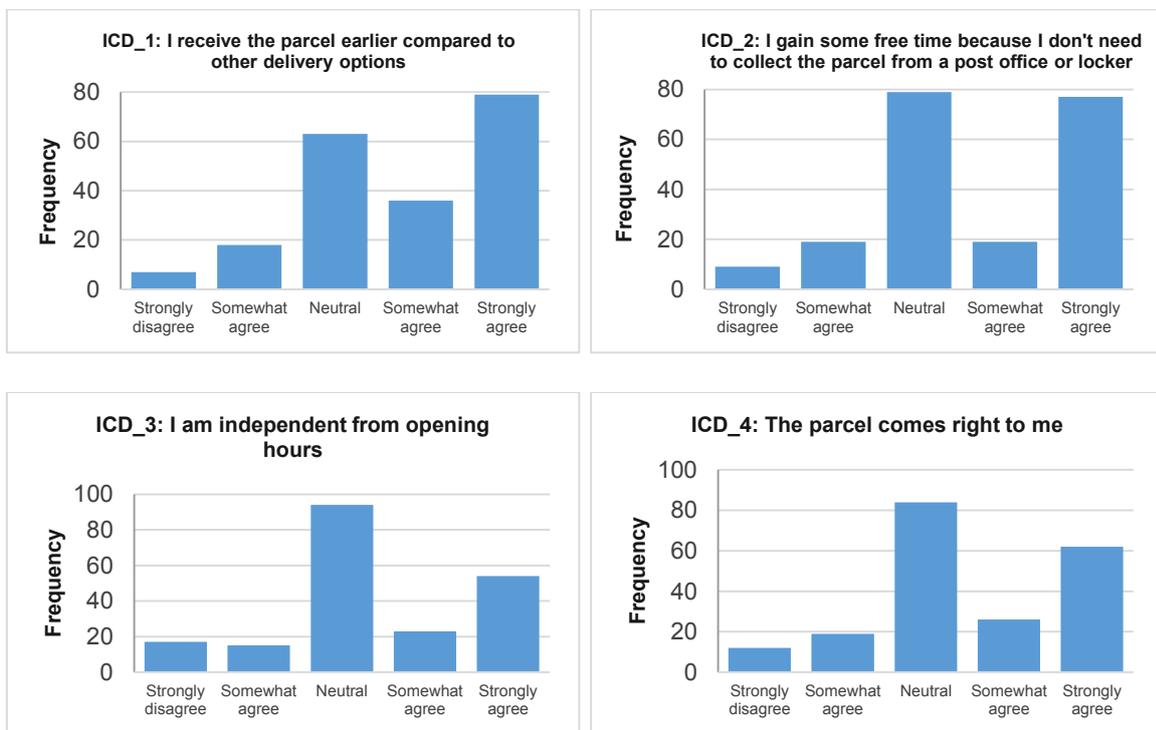


Figure 5-8: Bar charts - In-Car Delivery

For Research Question 4:

In-Car Delivery		Median	Mode	[Mean]	IQR
ICD_5	I would consider using trunk delivery	4,00	4	3,44	2
ICD_6	I would be willing to temporarily share the location of my car in order to use this service	4,00	4	3,10	2
ICD_7	I don't mind that the delivery person has to open the trunk of my car to put in the parcel.	2,00	1	2,60	3
ICD_8	It is an intrusion into my privacy when the mail man opens the trunk.	4,00	4	3,45	2
ICE_9	I am worried that my car will be hacked and can be opened by thieves.	4,00	5	3,87	2
ICD_10	My navigation data (location data) is safe.	3,00	4	2,77	2
ICD_11	I am concerned that my navigation data will be sold.	4,00	4	3,48	2
ICD_12	I am worried that my location data will be stored.	4,00	4	3,63	2

Table 7: Statistics - In-Car Delivery 2

	Strongly agree		Somewhat agree		Neither agree / disagree		Somewhat disagree		Strongly disagree		Total #
	#	Row %	#	%	#	%	#	%	Count	%	
ICD_5	54	23%	86	37%	28	12%	31	13%	31	13%	230
ICD_6	35	15%	81	35%	28	12%	45	20%	41	18%	230
ICD_7	25	11%	55	24%	19	8%	64	28%	67	29%	230
ICD_8	48	21%	87	38%	33	14%	45	20%	17	7%	230
ICE_9	82	36%	80	35%	34	15%	25	11%	9	4%	230
ICD_10	15	7%	63	27%	53	23%	52	23%	47	20%	230
ICD_11	58	25%	66	29%	53	23%	34	15%	19	8%	230
ICD_12	66	29%	75	33%	43	19%	31	13%	15	7%	230

Table 8: Frequency table - In-Car Delivery 2

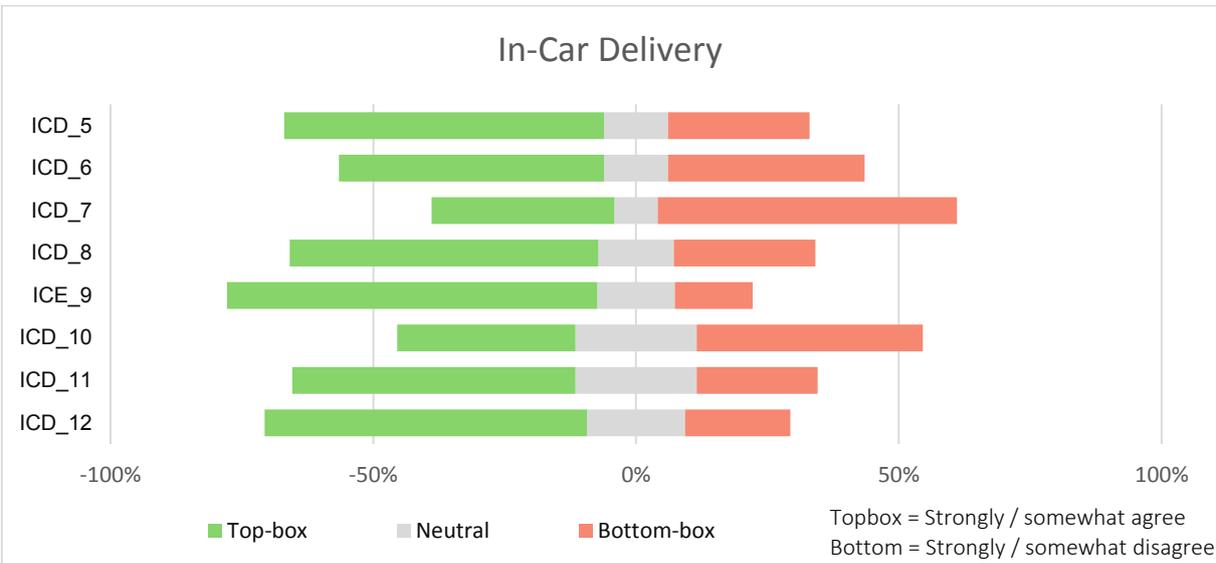


Figure 9: Bar chart - In-Car Delivery 2